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Technological Innovation as a Driver of Healthcare Expenditure: Measuring Technology Directly

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Abstract:

Spending on healthcare in industrialized countries has grown substantially over the last few decades (OECD 2016). Over the years, many researchers have analyzed the main determinants of aggregate healthcare expenditure. In this paper we determine the main factors that have contributed to the increase in healthcare spending over time, focusing especially on the impact of technological innovation on the healthcare sector.

This paper differentiates itself by using multiple imputation to construct a large, complete panel dataset and through the construction of a technological composite index able to directly measure the role of new technologies on healthcare costs. The results suggest that the introduction of new technologies contribute to the increase in healthcare expenditures verified in the last years, where technology has a differential impact on costs depending on a country's stage of the development of technology. Moreover, by analyzing the non-linear effects of technology, we can also conclude that this increase in healthcare expenditure per capita driven by technological innovation illustrates diminishing returns, fading away with volume. Many of our conclusions, such as those regarding GDP per capita, percentage of private expenditure on health, and health expenditure financed by General Government reinforced findings from other studies.

Keywords: determinants of health expenditure; technological innovation; technological composite index; OECD countries.

JEL Classification: C87; C33; I10; O33.

1. Introduction

Over time, rampant growth in healthcare spending has attracted the attention of several leading health economists, organizations, and policymakers, whose chief concerns have been to address issues related to the cost-containment and cost-effectiveness of healthcare expenditure. In particular, many researchers and policy analysts have questioned the role of technological innovation and its impact on health care spending.

Past research has measured the impact of technology on healthcare spending in two different ways: through the theory of economic growth; or through the use of proxies for technological innovation in health.

In this study, we adopt a different approach by measuring technological innovation more directly, through the construction of a technological composite index, and by performing a panel data analysis. As far as we are aware, only Gerdtham *et al.* (1998) and McGuire *et al.* (1993) have used a panel analysis to address these questions. Our results, consistent with prior studies, suggest that technological innovation has yielded a positive impact on total healthcare expenditures *per capita*. By analyzing the non-linear effects of cost increases, we can also conclude that this rise in healthcare expenditure *per capita* that is driven by technological innovation exhibits diminishing returns, eroding with volume. In addition, most developed countries in our sample have passed a key

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inflection point, allowing them to efficiently save resources with technological innovation. This is a new result in the existing literature.

2. Literature review

Despite the verified slowdown in the share of healthcare spending on GDP in the 1980s, the growth of healthcare spending continues to be a recurring problem in the developed world to this day. Explaining the steady upward spiral of healthcare expenditures has been a popular and pressing theme on government researchers' agendas for several decades.

The first studies of the different factors driving the growth of health spending were conducted in the 1960s and 1970s. These include evaluations by Abel-Smith (1967), Feldstein (1971), Freeland and Schendler (1983), Fuchs (1972), and by Klarman *et al.* (1970), whose goals were to understand and restrict the growth of health spending. They primarily analyzed the influence exerted by certain measurable variables, i.e. inflation, ageing, medical visits, and number of beds on healthcare spending, but did not consider the observed effects of behavioral variables, which have been examined in more recent papers by Barros (1998), Cutler (1995), Newhouse (1992), and Okunade and Murthy (2002). These studies disaggregate healthcare spending growth, by directly measuring its components and other factors such as technological innovation that effect demand for healthcare. In this way, they estimate some variables representative of important behavioral factors.

Despite the differences in approaches used in analyzing health care spending growth, these studies do share some conclusions. The following factors are consistently deemed the most important drivers of health care spending growth:

▪ *Aging*: as healthcare spending generally increases with age and people live longer, healthcare spending grows with the aging of the population. Even though some econometric studies have found jointly positive and significant influences of aging on healthcare costs (Blomqvist and Carter 1997, Breyer and Felder 2006, Hitiris and Possnett 1992, Jönsson and Eckerlund 2003, Lubitz *et al.* 1995, Roos *et al.* 1987, Seshamini and Gray 2004a, 2004b), there are still others that find insignificant results (Barros 1998, Gerdtham and Jönsson 2000, Gerdtham *et al.* 1992a and 1992b, Gerdtham *et al.* 1998, Hogan *et al.* 2001, Hoover *et al.* 2002, Leu 1986, Lubitz and Riley 1993, Oxley and MacFarlan 1994, Spillmann and Lubitz 2000, Stearns and Norton 2004, and Zweifel *et al.* 1999. Some studies suggest that it is not age but proximity to death that increase health care spending (Brockman 2002, Felder *et al*. 2000, Hogan *et al*. 2001, Levinsky *et al*. 2001, Lubitz and Riley 1993, Lubitz *et al*. 1995, McGrail *et al*. 2000, Moïse and Jacobzone 2003, Roos *et al*. 1987, Schulz *et al*. 2004, Serup-Hansen *et al*. 2002, Seshamani and Gray 2004a and 2004b, Spillmann and Lubitz 2000, and Stearn and Norton 2004.

▪ GDP *per capita*: the effect of income on expenditure is positive and significant: Andersen and Benham (1970), Barros (1998), Blomqvist and Carter (1997), Culyer (1988 and 1989), Di Matteo (2003), Freeman (2003), Getzen (2000), Gerdtham *et al.* (1992b and 1998), Getzen (2000), Ginsburg (2008), Grossman (1972), Kleiman (1974), Leu (1986), Manning *et al.* (1987), Muurinen (1982); Newhouse and Phelps (1974), Newhouse (1977), Okunade *et al.* (2004), Okunade (1985); Tosetti and Moscone (2007), and Wagstaff (1986).

▪ *Insurance expansions*: the expansion of insurance coverage leads to spending growth. Studies have attributed jumps in health care spending growth from 5-10% due to insurance expansions from 1950 to 1984 (Aaron 1991, Manning *et al.* 1987, Newhouse 1993) and to increases of 10-13% to insurance expansions from 1940 to 1990 (CBO 2008).

▪ *Defensive Medicine*: in some cases, studies find proxies for defensive medicine to exhibit a negative effect on healthcare expenditure growth, but others observe a positive effect on spending. These studies have differing results depending on how they try to capture this phenomenon, using measures which relate the number of physicians to the number of hospital beds, population, *etc*. (Christiansen *et al.* 2006, Gerdtham *et al.* 1998, and Okunade *et al.* 2004).

▪ *Prescription Drugs and the Pharmaceutical Industry*: despite the fact that prescription drugs contribute to the reduction of health expenditure through the replacement of certain medical procedures such as surgeries (for example the case of anti-ulcer drugs), the weight of the pharmaceutical sector relative to total healthcare spending and total pharmaceutical sales *per capita* has increased over time, representing an important and growing share of health expenditures in most countries (Huber and Orosz 2003).

▪ *Technological Change:* Although many studies have measured the effects of technological change, their results are diverse (Baker and Wheeler 1998, Cutler and McClellan 1996, Gerdtham and Lothgren 2000, Matteo 2005, Newhouse 1992, Okunade and Murthy 2002, Peden and Freeland 1998, You and Okunade 2017, and Weil 1995). This is in part due to the fact that technological change includes a vast number and type of factors, from

improving equipment and techniques across a range of medical areas to adopting new processes. This makes evaluating the effects of technological progress on healthcare costs a very complicated task.

In this study we account for socio-demographic, lifestyle, institutional, and technological factors. However, we focus most closely on the role of technology in increasing health care spending.

Health technology involves the introduction or improvement of medical devices (*e.g.:* magnetic resonance imaging, computed tomography scanners, coronary artery bypass grafts, etc.), and advanced equipment used in medicine, such as, new procedures, processes and techniques, and more specifically, electronic medical records and transmission of information, telemedicine. As such, technological changes involve not only new equipment and procedures but also improvements in existing equipment. Many studies include pharmaceutical goods in this category, but we separate the two.

New technologies lead to an increase in healthcare costs given that new technologies are typically more expensive, and their introduction expands the availability and number of procedures performed. Even if new procedures are less expensive than traditional ones, the increase in the intensity of their use can override the possible cost savings. For example, cataract surgery and the treatment for depression with selective serotonin reuptake inhibitors have cut costs but, at the same time, expanded the number of treated patients (Ginsburg 2008).

Furthermore, since these technologies are often rapidly and broadly widespread, it can reduce the utilization rate of such technologies, increasing in this way the cost per treated patient, and in some cases can even be used on people for whom the benefits are smaller. Even in circumstances when technological innovation allows the use of cheaper medical technologies, the increase in the range of possible treatments promotes the increase in demand and supply (Weisbrod 1991). For example, new procedures that have emerged for the treatment of heart attacks and breast cancer are two kinds of technological changes that have increased spending via a treatment substitution effect (Ginsburg 2008).

Moreover, technological progress makes it possible to extend the lives of some patients by curing certain pathologies that were previously fatal, adding also to the financial burden they place on health care spending. In this way, technological innovation indirectly contributed to the growth of healthcare spending by increasing the survival rate, which also increases the number of chronically ill people. Indeed, these individuals can induce more costs to the health system because, as it is expected, they will need more healthcare services than the rest of the population or they will have more severe diseases, something that would have not occurred if they had died (Moïse 2003). In this way, some technological advances in healthcare did not arise as a means to preventing or curing diseases, but rather to keep people alive, albeit at huge costs, which is the case of organ transplantation, radiotherapy, and chemotherapy (Kumar and Ozdamar 2004).

While some types of technological innovation increase costs, we cannot neglect possible cost savings through the improvement in the overall quality, timeliness, safety and efficiency of healthcare service provided. For example, according Hillestad *et al.* (2005) the use of electronic health records (a record in digital format that contains current and historical patient information) could produce efficiency and safety savings of $142 billion in U.S. physician offices and $371 billion in U.S. hospitals over the next fifteen years.

As such, evaluating the impact of technological progress on healthcare costs is a necessary and complicated task due to the difficulties that arise from the direct measurement of aggregate technological change in the sector and the difficulty in obtaining a measurable proxy for technology, without even measuring the impact of technological change on mortality and morbidity. Despite these difficulties, recently several studies have emerged trying to measure the role of technological innovation on healthcare expenditure growth (including Barros 1998, Cutler 1995, Newhouse 1992, Okunade and Murthy 2002, revealing a common conclusion – technological innovation is one of the most important determinants of health expenditure growth.

Newhouse (1992) uses the Solow model to analyze the determinants of health expenditures in the United States of America (USA) in the post-war period – 1950 to 1980. Using a regression approach to represent factors that increase health spending such as aging, the spread of insurance, income growth, supplier-induced demand (number of physician), and the productivity growth in medical care, he concludes that technological change explains roughly half of the increase in healthcare expenditures. Peden and Freeland (1998) utilized a similar approach and found that approximately 70% (76%) of the health spending growth in the USA from 1960-1993 (1983-1993) was due to cost-increasing advances in medical technology. However, the methodology used by Newhouse (1992) and Peden and Freeland (1998) – the residual approach – risks confounding technological innovation with other factors (for example education, lifestyle and environment questions), demanding some care in the final interpretation of the results. Despite this methodological limitation, Newhouse's work (1992) gained significance and importance in the area, not only for being the first to assign a central role to new technologies in determining the growth of healthcare spending, but also for being the first to use the theory of growth to explain this phenomenon.

Other approaches have since been adopted for measuring the cost consequences of technological progress. Cutler and McClellan (1996 and 2001) directly analyzed procedures subject to constant technological improvements as a proxy for technological innovation. They found that cost growth from treatments for heart attack, low-birth weight babies, depression, cataracts, and breast cancer increased cost growth. Other studies focus on explaining cost growth from specific medical equipment (Baker and Wheeler 1998) or surgical procedures (Weil 1995).

Okunade and Murthy (2002) used total Research and Development (R&D) spending and R&D spending specific to healthcare between 1960 and 1997 as proxies for technological change in health. They estimated the elasticity of total R&D spending and R&D spending specific to healthcare as 0.3 and 0.4 respectively, confirming that technological innovation is associated with long-term growth in healthcare spending.

Another approach has been to use a time index variable (Gerdtham and Lothren 2000) or a time trend (Matteo 2005) as proxy for healthcare technology. For example, Matteo (2005) concludes that 62% of the increase in health expenditure is due to technological change in the sector. You and Okunade (2017) estimated technology effects on Australia's health expenditure using both the residual component method and technology proxies approach.

With the purpose of determining the different relationships and impacts of these factors, on overall healthcare spending over recent decades, there have emerged different econometric papers and methods devoted to understanding this relationship. This paper approaches the problem by constructing a composite technological index that is analyzed using a panel database and multiple imputation techniques.

3. Methodology

3.1. Technological Composite Index

In order to directly measure the effects of technological innovation on healthcare spending we developed a composite technological index. The use of a composite technological index is proposed to address two issues: the lack of quantitative data able to reflect the technological level of the countries in the healthcare sector, and the need to create a variable that could reflect such technological level.

The methodology behind the construction of this index was based on the work of Nardo *et al.* (2005), in which the weights of different variables were computed using Factor Analysis. The variables used in the construction of the technological composite index were collected from the OECD database, according to the available data. They were selected with the aim to replicate the effects of technological change presented by Cutler and McClellan (2001), this is, the treatment substitution effect and treatment expansion effect.

In Table 1, we list the variables that constitute the present index with their respective weights. This index has two main groups of variables: group one (MRI, PET, GAMMA, DSA, MAM, RTE, LITH and MRIE) corresponds to healthcare machinery available in the country, while group two (END, DIA, FUKIDNEY, BONE, HEART, LIVER, LUNG and KIDNEY) represents the most innovative medical procedures of the past few years. The selected technologies were collected considering the year in which they appeared and were used.

To measure the influence of pharmaceutical sales on total healthcare spending, two versions of the technological index were created, one version without pharmaceutical sales (INDEX) and one version with pharmaceutical sales (INDPHARM).

3.2. Data Collection

We collected data from different OECD sources and from the World Bank. The unbalanced dataset covers 27 OECD countries from 1975 to 2015 (Australia (1975-2010); Austria (1975-2011); Canada (1975-2014); Czech Republic (1991-2011); Denmark (1975-2011); Estonia (2000-2011); Finland (1975-2012); France (1976-2011); Greece (1981-2010); Hungary (1992-2014); Iceland (1975-2013); Ireland (1975-2013); Israel (1995-2011); Italy (1989-2011); Japan (1975-2010); Korea (1981-2015); Luxembourg (1996-2011); Mexico (1991-2014); Netherland (1975-2015); New Zealand (1975-2011); Portugal (1975-2013); Slovak Republic (1998-2012); Slovenia (1996-2011); Switzerland (1975-2011); Turkey (1976-2012); United Kingdom (1975-2015); and United States of America (1975-2010). In

Figure 1 we show a graph of technological innovation by healthcare spending for different years.

We collected additional variables for our regression analysis to understand the cross-country and cross-time differences in aggregate expenditure. These include some socio-demographic variables: Gross Domestic Product *per capita* in US dollars, converted at economy-wide PPP (GDP$_{pc}$), the proportion of population 14 years and under (POP14), the proportion of population over the average life expectancy (EMV), the number of infant

mortality, deaths per 1,000 live births (IM), the proportion of urban population (URB), and the unemployment rate (UNEMP).

We also included lifestyle factors that show how individual health affects spending in ways that are not directly through health care spending (McKeown 1979 and Mokyr 1997). These lifestyle factors include alcohol consumption in liters *per capita* (ALCOOL) and the proportion of population aged 15 and over who are daily smokers (SMOK). We also introduce some institutional variables such as out-of-pocket health expenditure, percentage of private expenditure on health (OUTP), the total pharmaceutical sales *per capita* in US dollars, converted at economy-wide PPP (PHARM), and health expenditure financed by the General Government, percentage of GDP (GOV). Finally, we use our technological composite index (INDEX, INDPHARM).

The model of aggregate healthcare expenditure *per capita* of the *i-th* OECD country in year *t* is:

$$\textbf{THEXpc}_{it} = \boldsymbol{\beta_0} + \sum_{n=1}^{11} \boldsymbol{\beta_n X_{nit}} + \boldsymbol{\beta_{12} INDEX_{it}} + \boldsymbol{\beta_{13} INDEX_{it}^2} + \sum_{i}^{27} \boldsymbol{\mu_i d_i} + \sum_{t}^{35} \boldsymbol{\vartheta_t d_t} + \boldsymbol{e_{it}}$$

(1)

$$X = \{GDP_{pc}, POP14, EMV, URB, ALCOOL, SMOK, OUTP, IM, PHARM, GOV, UNEMP\}$$

In the expression above, the 27 (40) d_i (d_t) are dummy variables with the value of 1 for each of the 27 (40) observations corresponding to country (year), in order to control for any factors that are fixed within each country (and time period). These include two way fixed-effects models and β_o as an overall constant as well as a "country effect" for each country and a "time effect" for each period.

The dependent and the independent variables in the regression, except the variable INDEX, are in log form, so the coefficients associated with these variables are referred to as elasticity. In addition, the regression model was estimated using STATA with robust regression as the estimation technique (35). Robust regression was used to mitigate the effects of heteroskedasticity and of possible outliers, as we found some countries had either high leverage or a large residual (Korea, Slovak Republic and Turkey). We also ran our regressions without the countries with high leverage or a large residual to check for the stability of our results (

Table 2).

4. Results

Table 1 presents our results for the estimation of healthcare expenditure *per capita* – there are certain variables that yield a significant impact on health spending across the different regressions. This is the case for GDP$_{pc}$, POP14, EMV, URB, ALCOOL, OUTP, IM, PHARM, GOV, UNEMP, INDEX, and INDEXSQ.

Table 1. Estimated coefficients for 2-Fixed Effect Models (Fixed Effects for Countries and Time)

Variables/Models	Without Multiple Imputation	With Multiple Imputation		Percentage of variable imputed
	1	2	3	
GDP per capita	1.07*	0.85**	0.83**	0%
CI (95%)	(0.92, 1.24)	(0.81, 0.89)	(0.78, 0.87)	
Proportion of population with 14 years and under	-0.29	0.13**	0.14**	0%
CI (95%)	(-0.6, 0.01)	(0.07, 0.21)	(0.07, 0.21)	
Proportion of population over the average life expectancy	0.01	0.01*	0.02*	3%
CI (95%)	(-0.01, 0.04)	(0.00, 0.03)	(0.00, 0.03)	
Urban population	-0.11	-0.35**	-0.34**	0%
CI (95%)	(-0.84, 0.62)	(-0.52, -0.19)	(-0.51, -0.17)	
Alcohol consumption	0.06	0.05*	0.04	0%
CI (95%)	(-0.02, 0.14)	(0.00, 0.01)	(-0.00, 0.08)	
Tobacco consumption	0.01	0.01	0.02	50%
CI (95%)	(-0.09, 0.11)	(-0.02, 0.04)	(-0.00, 0.05)	
Out-of-pocket health expenditure	-0.23*	-0.04**	-0.05**	48%
CI (95%)	(-0.38, -0.09)	(-0.06, -0.03)	(-0.07, -0.03)	
Infant mortality	0.06	-0.08**	-0.10**	0%
CI (95%)	(-0.03, 0.15)	(-0.12, -0.05)	(-0.13, -0.07)	
Total pharmaceutical sales per capita	-0.03	0.01	-	50%

Variables/Models	Without Multiple Imputation	With Multiple Imputation		Percentage of variable imputed
	1	2	3	
CI (95%)	(-0.09, 0.03)	(-0.01, 0.04)	-	
Health expenditure financed by Government	0.91*	0.65**	0.66**	3%
CI (95%)	(0.79, 1.02)	(0.62, 0.69)	(0.63, 0.69)	
Unemployment rate	-0.01	-0.01*	-0.02**	12%
CI (95%)	(-0.04, 0.03)	(-0.02, -0.00)	(-0.03, -0.01)	
INDEX	-	0.38**	-	67%
CI (95%)	-	(0.11, 0.66)		
INDEXSQ	-	-0.29**	-	67%
CI (95%)	-	(-0.49, -0.10)		
Constant	-3.85	-0.27	-0.04	0%
CI (95%)	(-7.29, -0.4)	(-0.95, 0.41)	(-0.69, 0.62)	
INDPHARM	-	-	0.23*	88%
CI (95%)	-	-	(0.02, 0.45)	
INDPHARMSQ	-	-	-0.29**	88%
CI (95%)	-	-	(-0.50, -0.08	
R^2	0.431	0.671	0.669	-
Adjusted R^2	0.425	0.666	0.651	
F-statistic	853.03	2296.70	2124.75	-
F-test		0.000	0.000	-
F-test against 1-FEM, (Countries)	87.12**	135.78**	132.31**	-
F-test against 1-FEM, (Time)	2.01**	3.31**	3.32**	-
F-test against 0-FEM	54.80**	79.02**	77.89**	-

Note: Here we regress the log of Healthcare Expenditure *per capita*, on different factors, including a technological composite index, using fixed effects for countries and for years (fixed effects dummies were not included in the table). In model 3, the technological composite index is enhanced to include pharmaceutical spending. ** and * represent 1% and 5% levels of significance. CI: Confidence Interval. F-tests are shown for the different fixed effect models (FEM) to justify the model with two fixed effects.

We found that the best fit for the data was a model in which fixed effects were used both for countries and years compared to when we used fixed effects for just years (F-test against 1-FEM, Time), for just countries (F-test against 1-FEM, Countries), or when we did not use fixed effects (F-test against 0-FEM). All the test results are statistically significant (

Table 1), which supports the decision of using 2-way fixed effects models, for country and time.

The existence of unit roots in the independent variables was tested using Fisher-Type Unit Root test (panel data unbalanced). The result obtained allows us to reject the null hypothesis that all series are non-stationary.

To test the validity of Multiple Imputation (MI) we also compared the main models with a model that does not use multiple imputation (Model 1). It is important to mention that when we use multiple imputation we are unable to calculate the technological composite index because the proportion of missing values for the variables that constitute the index is too high, and hence we do not have enough observations to construct the technological composite index. After running the regression without using MI and without the introduction of the technological composite index, we find that most of the explanatory variables are statistically insignificant. One likely reason for this is that the number of observations is lower than the number of observations when we use MI. A second possible reason is that we have taken out the technological index, which we believe is important for the model.

Beginning with the most important variable of the model, composite technological index (INDEX), we find that this variable has a positive impact on total healthcare expenditure *per capita*. This implies that new technologies contribute to the increase in health expenditure verified in the last years, which is in line with the results obtained by Newhouse (1992), among others.

To allow for non-linear effects of the index on health care expenditure, we included a variable for the index squared (INDEXSQ). However, based on the coefficient for this index squared, we can conclude that this increase in healthcare expenditure *per capita* has diminishing returns. More interesting, when we compare these results with the actual healthcare technological position of each country, we can see that most of the developed countries nowadays are beyond the 'turning point', whereby the weight of innovation on healthcare costs becomes increasingly lower through diminishing returns. These patterns can be seen in

Figure 1. In the first and second graphs, corresponding to the year 1976 and 1991, all the countries in the sample are in the first phase. In this scenario, an increase in technological innovation will lead to an increase in healthcare costs. In the third graph however, we can verify that, most of the countries in the sample (Australia, Austria, Canada, Denmark, France, Finland, Iceland, Italy, Japan, Korea, Luxembourg, Netherland, Portugal, Switzerland, and USA) are on the right side of the turning point. This suggests that an increase in innovation will lead to efficiency gains that allow for a reduction in the contribution of technology to total healthcare costs.

Despite the initial effort of required investment, which significantly increases healthcare spending, additional investments are offset from efficiency gains through the use of technology. This fact may lead to an increase in global divergence between countries with respect to technological level in the healthcare sector, given that countries with a lower technological levels in healthcare (Czech Republic, Estonia, Greece, Hungary, Ireland, Israel, Mexico, New Zealand, Slovak Republic, Slovenia, Turkey, and the UK) do not benefit from the resource savings that countries with a higher technological level benefit from, making them more prone to invest in technological innovation. This fact may also be aggravated by the weak capacity of the countries with a lower technological capacity to invest in more technologies due to the initial costs that it entails.

When pharmaceutical spending is integrated in the technological composite index (right graphs in Figure 1, the conclusions about the impact of technological innovation in healthcare spending remain unchanged. However, in this situation, it is verified that the number of countries on the right side of the turning point – in the third phase – are higher. In other words, we find that when we account for pharmaceutical spending, the weight of innovation on healthcare costs become increasingly lower for more countries. This may happen because access to drugs is easier than access to new medical equipment; that is, the use of drugs involves a lower investment.

From here, we can conclude that both versions of the technological index show an inverse-U shaped relationship with healthcare spending, which means that weight of technological innovation in total healthcare spending has been decreasing over time. Despite using a different methodology from other authors (Cutler and McClellan 1996, Newhouse 1992, Okunade and Murthy 2002), this conclusion is in line with their results; that is, technological innovation is important in explaining the increase in healthcare expenditure over time. However, its significance, over time, has been declining, which does not mean that its weight in total expenditure is not yet significant. However, in past years, other variables have also contributed positively to the continuous increase in health expenditure.

Figure 1. Contribution of technological innovation to healthcare costs
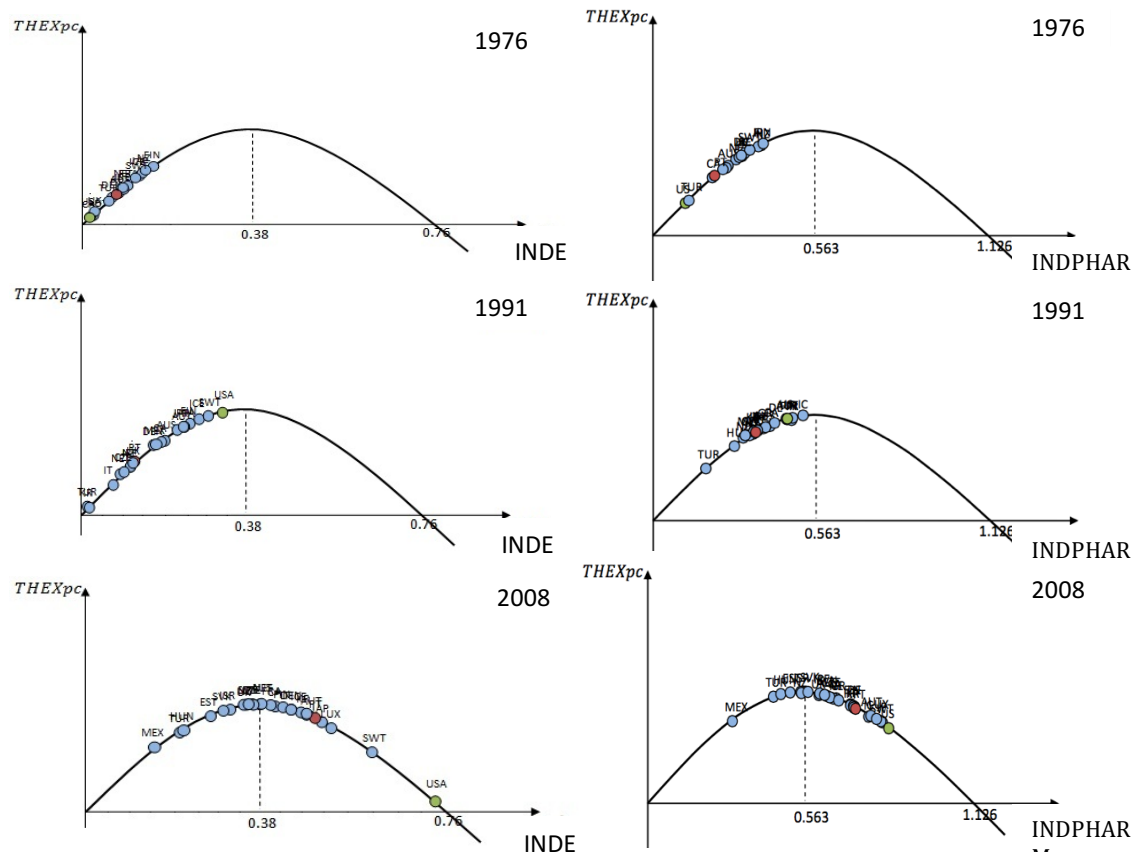
Note: These graphs were created from the database used in this paper and each of them shows the relationship between healthcare expenditure *per capita* and the variable INDEX (left graphs) and INDPHARM (right graphs) over three years (1976, 1991 and 2008), for the countries in the sample. According to these charts, the increase in healthcare expenditure *per capita* exhibits diminished returns fading away with its volume. In 2008, most of the countries were beyond the "turning point" (0.38/0.563), where the weight of innovation on healthcare costs becomes increasingly lower.

Our results on many of the other explanatory variables are also significant. We describe them below and relate them to the findings in the literature. Income elasticity is lower than 1 (0.85), whilst also highly significant in all regressions and positive as expected, reflecting the fact that healthcare is a necessity rather than a luxury. These results are consistent with other studies including Barros (1998), Di Matteo (2003), Freeman (2003) Ginsburg (2008), Tosetti and Moscone (2007). Furthermore, the variable POP14 is positive and also significant in all regressions. The sign of this coefficient is consistent with theory that assumes that children between 0 and 14 years of age need more healthcare services than the rest of population.

With the aim of measuring the impact of aging on total healthcare expenditure we created a variable that captures the ratio of people over average life expectancy for each country – EMV. According to our estimation, when the number of adults above the average life expectancy increases by 10%, we expect an increase of 0.14 percentage points in healthcare expenditure. The amount of private expenditure on health (OUTP) contributes to a decrease in health spending. This is consistent because the increase in the percentage of private expenditure on health represents an increase in the health price paid by the agents, which leads them to demand less healthcare services, contributing to the reduction of such expenditures. This result can also be associated with some adaptations to a reduction in insured people.

The results obtained ultimately support both a significant and positive relationship between GOV and health expenditure. In particular, this result is consistent with the emphasis of current governments on reducing the share of healthcare expenditures that are publicly financed because there is a contagion effect between the two variables. The higher the percentage of healthcare expenditure financed by the government, the higher the expenditure (so it will be necessary to finance an even larger amount of health expenditure, which will compromise more and more the solvency of public accounts).

According to our results, there also exists a significant and negative relationship between infant mortality and health spending *per capita*. As such, when infant mortality decreases, health care spending increases. We also estimate the impact of the pharmaceutical industry through the prescription of drugs on total health

expenditure, which has not been measured in related papers. The results suggest that the pharmaceutical sector has a positive impact on health-care costs, which supports the theoretical results of Kumar and Ozdamar (2004).

We include URB and UNEMP to estimate total health expenditure *per capita*, but we find significant results opposite to what is expected. Although unexpected, the results obtained in these variables are quite consistent with the analyses elaborated by Gerdtham *et al.* (1992a, 1992b, 1998) that find a negative effect of urbanization on healthcare expenditure, and by Christiansen *et al.* (2006) that also find a negative effect of unemployment on total healthcare expenditure *per capita*.

We find that urbanization has a negative effect on healthcare expenditure, which is difficult to explain because according to some studies (Kleiman 1974) it is expected that the increase in the urbanization rate leads to an increase in healthcare costs due to the higher risk of contagion and lower time travel costs in urban areas. Some possible explanations may arise from the fact that in urban areas there is widespread access to improved water sources and improved sanitation facilities. Improved personal hygiene and consequently the quality of urban life may decrease the emergence of certain diseases. Moreover, a larger proportion of people with high education in urban areas lead to a greater awareness of positive health behaviors, through nutrition, diet, or exercise, for example. These collectively improve the health status of the population, which can lead to a lower need for healthcare services.

The negative effect on healthcare expenditures was captured in the variable UNEMP, which was also unexpected due to the positive link that is established between unemployment and bad health (Christiansen *et al.* 2006). However, if we assume that unemployed people are exposed to less risk (work accidents/injuries, for example), while simultaneously avoiding stressful working situations, we can conclude that the increase in the unemployment rate leads to a decrease in the demand for healthcare. Apart from this, with more free time, people can apply a part of that time to take better care of themselves. This hypothesis is defended by Ruhm (2000, 2003, 2005) who argues that unemployed people have more time for leisure and healthier habits.

Other variables were tested, such as the total number of hospital beds per million population, the number of doctors' consultations *per capita*, the number of hospitals per million population, the number of professionally active physicians per million population, and the number of total health employment per million population. However, these variables were not statistically significant, which led to their exclusion from the analysis. Meanwhile, the study of possible time breaks in the period in question was also considered, however tests did not suggest the existence of any time breaks. Such conclusions might be due to the fact that the variables present in the regression already were captured endogenously, or because there are not any significant time breaks over the period considered.

Acknowledgement

Conclusion

This paper considers different factors that affect healthcare spending using panel data and multiple imputation techniques. Through the development of a composite technological index and through the use of unique panel dataset that covers 27 countries over the years from 1975 to 2015, we found several interesting results from our analyses.

Our econometric model introduces a composite technological index that has a positive impact on total healthcare expenditure *per capita*. This suggests that the introduction of new technologies contributes to the increase in healthcare expenditures verified in the last years, which is consistent with other studies in the literature (Cutler 1995, Newhouse 1992, Okunade and Murthy 2002). Our analysis of the technological index suggests that technology has a differential impact on costs depending on a country's stage of development of technology. Results from

Figure 1 further reinforce the conclusions obtained by Newhouse (1992) that technological innovation contributes positively to healthcare costs, given the fact that all countries, before 1992, were on the left side of the turning point. Moreover, by analyzing the non-linear effects of technology, we can also conclude that this increase in the healthcare expenditure *per capita* driven by technological innovation illustrates diminishing returns, fading away with its volume.

This allows us to conclude that more investment in technological innovation can efficiently save resources. Despite the initial effort of required investment, from a certain point, additional investments are offset from efficiency gains through the use of technology. This fact may lead to an increase in the global divergence between countries with respect to their level of technology adoption in the healthcare sector. This pattern may be hastened given that

countries with a lower level of healthcare technology (for example, according to our results, Mexico) do not benefit from the resource savings that countries with a higher technological level benefit from (as seen in the USA or Switzerland), making them more prone to invest in technological innovation. This fact may also be amplified by the weak capacity of countries, with a lower technological level or capacity to invest in more technologies due to the initial start-up costs necessitated.

We also had robust findings for other variables in our model. Many of our conclusions, such as those regarding variables GDP_{pc}, OUTP, and GOV reinforced findings from other studies such as Barros (1998) and Okunade *et al.* (2004).

Finally, our methodology produced robust and interesting results, suggesting that the use of panel data and multiple imputation techniques may be a viable approach to the analysis of trends in health expenditure. These conclusions remained unchanged even when we supplemented new independent variables in the regression or even when we included pharmaceutical spending in the technological composite index (Model number 2), proving in this way the robustness of the analyses performed. In future work we hope to address some of the limitations of our study, such as the inability to include ICTs in the technological composite index.

Throughout this paper we look at the amount of health expenditure as something high and problematic. Up until this point, it is important to analyze both the nature and magnitude of such concern about the amount of spending on health. We can also ask the question: from what point can we infer that such expenditures are high? Is there really an ideal amount of expenditure on health? Is this concern about health spending legitimate or exaggerated? Why are high healthcare costs bad?

 "We do not know that the current rate of medical spending growth is "too high" or that there are ways to slow it without doing more harm than good. We do know that there is more to medical care than spending, and more to medical spending than cost" (Okunade *et al.* 2004, 26).

According to Pauly (2003), if we assume that the additional resources, which flow into the healthcare sector, are used to produce some good for health and welfare, then we should not be overly worried about the amount and growth rate of this spending. However, one of the major problems is measuring in quantitative and qualitative terms the return of such value invested.

Jönsson and Eckerlund (2003) defend that technology is not the cause of the increased spending on health but rather a consequence of such an increase. In turn, Newhouse (1992) argues "I believe the bulk of the residual increase is attributable to technological change, or what might loosely be called the march of science and the increased capabilities of medicine" (Newhouse 1992, 11).

Invariably, we can ask ourselves why economies continue to invest in developing technologies that supposedly contribute to increasing spending on health. Furthermore, we need to understand if the development of new technologies implies their adoption. Before being able to answer any questions that may arise here, it is necessary to remember that there are many forces and pressures in the health market, not only from insurers, but those also exerted from patients and health professionals (Hall and Charles 2007).

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APPENDIX

Table 1. Components of the technological composite index

Variable	Min.	25%	50%	75%	Max.	Mean	N (pre-imputation)	Weight (INDEX)	Weight (INDEXPHARM)
MRI: Magnetic Resonance Imaging units, total – Per million population	0	1.65	12.64	24.65	26.6	7.03	310	0.06402	0.06232
PET scanners, total – Per million population	0	0.19	0.575	1.25	5.62	1.01	154	0.08426	0.08048
Gamma cameras, total – Per million population	1.45	7.44	10.95	13.65	21.28	10.40	166	0.03028	0.02900
DSA: Digital Subtraction Angiography units, total – Per million population	3.03	4.58	7.35	11.07	16.93	7.75	123	0.05627	0.05148
MAM: Mammography, total – Per million population	1.90	10.61	15.83	22.65	56.01	18.59	202	0.07364	0.06887
RTE: Radiation therapy equipment, total – Per million population	0.2	4.00	5.45	9.24	28.01	6.85	283	0.07441	0.07377
LITH: Lithotripters, total – Per million population	0.02	0.58	2.08	3.29	14.33	2.04	227	0.02428	0.02151
MRIE: Magnetic Resonance Imaging exams, total – Per million population	2.2	15	32.4	55.2	97.9	35.90	83	0.02805	0.02683
END: End-stage renal failure patients – Per 100.000 population	2.5	32.1	50.3	77	190.4	56.79	426	0.09165	0.08900
DIA: Patients undergoing dialysis – Per 100.000 population	3.1	19.9	34.75	51.6	125.7	39.74	535	0.0972	0.09220
FUKIDNEY: Functioning kidney transplants – Per 100.000 population	0.1	12.7	22	31.2	54.5	22.56	430	0.05794	0.05357
BONE: Bone marrow transplants – Per 100.000 population	0	0.8	2.2	4.5	9.4	2.70	455	0.05373	0.05019
HEART: Heart transplants – Per 100.000 population	0	0.1	0.4	0.6	1.4	0.36	515	0.07295	0.07040
LIVER: Liver transplants – Per 100.000 population	0	0.2	0.7	1.1	2.6	0.70	532	0.06361	0.05949
LUNG: Lung transplants – Per 100.000 population	0	0	0.1	0.3	1.5	0.20	444	0.06422	0.06171
KIDNEY: Kidney transplants - Per 100.000 population	0	1.9	2.85	3.5	5.7	2.70	641	0.06352	0.05987
PHARM: Total pharmaceutical sales per capita	31.8	161.7	251.2	365.1	968.9	259.82	379	-	0.04979

Note: This table displays the variable names, definitions and respective weights of the variables that constitute the technological composite index.

Table 2. Models of health care expenditure, without outliers

Variables/Models	1	2
GDP per capita	0.83**	0.82**
CI (95%)	(0.79, 0.88)	(0.78, 0.86)
Proportion of population with 14 years and under	0.16**	0.16**
CI (95%)	(0.09, 0.23)	(0.09, 0.22)
Proportion of population over the average life expectancy	0.01	0.01
CI (95%)	(0.00, 0.02)	(-0.00, 0.02)
Urban population	-0.15*	-0.15*
CI (95%)	(-0.28, -0.04)	(-0.27, 0.03)
Alcohol consumption	0.04*	0.03
CI (95%)	(0.01, 0.08)	(0.00, 0.06)
Tobacco consumption	0.008	0.02
CI (95%)	(-0.02, 0.04)	(-0.01, 0.05)
Out-of-pocket health expenditure	-0.04**	-0.05**
CI (95%)	(-0.06, -0.02)	(-0.07, -0.03)
Infant mortality	-0.10**	-0.12.**
CI (95%)	(-0.13, -0.06)	(-0.15, -0.09)
Total pharmaceutical sales per capita	0.002	-
CI (95%)	(-0.00, 0.04)	-
Health expenditure financed by Government	0.61**	0.62**
CI (95%)	(0.59, 0.64)	(0.60, 0.65)
Unemployment rate	-0.01*	-0.02**
CI (95%)	(-0.02, -0.00)	(-0.03, -0.01)
INDEX	0.33*	-
CI (95%)	(0.08, 0.58)	
INDEXSQ	-0.24**	-
CI (95%)	(-0.41, -0.10)	
Constant	-1.08**	-0.80**
CI (95%)	(-1.61, -0.55)	(-1.30, -0.31)
INDPHARM	-	0.21*
CI (95%)	-	(0.01, 0.42)
INDPHARMSQ	-	-0.24*
CI (95%)	-	(-0.45, -0.04)
R^2	0.545	0.521
Adjusted R^2		
F-statistic	2725.02	3189.03
F-test	0.000	0.000
F-test against 1-FEM, (Countries)	178.47**	199.52**
F-test against 1-FEM, (Time)	3.24**	4.37**
F-test against 0-FEM	89.85**	95.77**

Note: These regressions exclude outliers in the models.

Public-Private Partnership in Europe: Comparative and Sectoral Perspective

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Abstract

The global financial crisis caused additional challenges for financing infrastructure projects in European countries. While the governments have been widely faced with urgent pressure to reduce public debt and consolidated general government deficit, the requirements for public services and implementation of infrastructure projects are rising. Thus, many countries are seeking private partners for financing capital projects. The literature shows that public-private partnership is also highly sensitive to financial and real sector crises.

This paper explores attitudes towards public-private partnership and greater involvement of the private sector in provision of public services in European countries from a comparative and sectoral perspective. Although European countries are very different, in all of them co-operation between different government levels is important and the second-tier level of government can make proposals concerning infrastructure projects that are needed. The analysis is based on data from a survey conducted in 14 countries.

Keywords: public-private partnership; analysis of variance; project; public sector; private sector.

JEL Classification: H5; H7.

1. Introduction

The relationship between needs for infrastructure projects, public debt and public-private partnership (further: PPP) development is very tight. After financial crises, the local government units' fiscal position has weakened in most of the European countries (Slijepčević 2014, Levine *et al.* 2013, Cuttaree and Mandri-Perrott 2011), while their role in providing public functions to citizens stayed in most of the cases unchanged. Therefore, local authorities have been confronted with additional difficulties in financing infrastructure projects. Public infrastructure incorporates necessary facilities for the functioning of the economy and society (Yescombe 2007). It distinguishes two types of infrastructure: (i) economic infrastructure (transportation facilities, utility networks etc.) and (ii) social infrastructure (schools, hospitals, libraries, prisons…). According to OECD (2015) definition PPP are arrangements "…whereby the private sector provides infrastructure assets and services that traditionally have been provided by government, such as hospitals, schools, prisons, roads, bridges, tunnels, railways, and water and sanitation plants". Grimsey and Lewis (2002) noticed that infrastructure has a common characteristic, such as a long duration, indivisibility, capital-intensiveness and difficulties in estimation of project costs. Thus, they stress that such projects are complex and require specialized activities.

There is no legal framework for PPPs at the European level. European Commission is neutral regarding issue whether public authorities should provide some public services themselves, should they entrust it to private sector or conduct it in the form of PPP (European Commission 2005). European Commission recognized the increasing interest of public authorities in co-operation with private sector which is primarily driven by know-how transfer, limitations in public funds to cover investments needs, efforts to increase efficiency of using scarce resources and improve the quality of public services (European Commission 2003, 2005). European countries have different experience in co-operation between the public and private sector. Capacities of local government units for financing infrastructure projects are even smaller and much more restricted than those from central government. The goal of the paper is to explore attitudes towards PPP in 14 European countries from comparative and sectoral

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perspective. This paper gives insight into opinion of second-tier councillors across Europe about the most preferable form of providing different public functions to the citizens, with special focus on their opinion regarding PPP.

The paper is structured as follows. The second part describes the role of PPP in regional development in European countries and gives overview of their experiences with PPP in general. The methodology and the sample are described in third part. The fourth part analyses the results of the survey about different options for public services provision. The last section concludes.

2. Research background

The available financial resources to local government are seen to be important determinate of quantity and quality of provided services to citizens (UN-Habitat 2009). However, two issues have been recognized within literature. First is the high dependence of local government to intergovernmental transfers and second is related to the low level of fiscal autonomy of sub-national government (UN-Habitat 2009, Jurlina Alibegović *et al*. 2013). The increasing demand for public goods and services with a lack of funds in the national and local budgets lead to the change in the role of the state. State has the main role to create appropriate institutional and legal framework, while the market increasingly open to private sector. Previously protected monopoly markets become more and more liberalized and competitive market, while private sector became more and more involved in sectors where until recently dominated state. A PPP model was in 2016 and 2017 mostly related to constructions of road and railway infrastructure, telecommunication, health or education sector (EPEC 2017, 2018). There are many reasons for establishing partnerships between public and private sectors when financing public goods and services, especially infrastructural ones. In many European countries the public sector is not capable of meeting the growing demand for goods and services, and particularly high demand for modern infrastructural goods. Public authorities are not able to assure enough financial resources in their budgets for infrastructure construction and maintenance. Due to the growing development and capital market interconnectivity, access to international capital has been eased for private investors that invest in infrastructure.

In a PPP, the private sector takes over part of the risk initially borne by the public sector, thus leading to risk diversification. The private sector tends to minimize costs and maximize profits, and seeing that it is more efficient regarding planning speed, construction, and more reliable in exploitation, private capital is drawn to all investment that yields higher returns, under the condition that government regulation stimulates investment. The choice of the most suitable form of PPP depends on level of welfare state, tradition of democracy and other factors as explained by Boxmeer and Beckhoven (2005), while successfulness of PPP depends largely on macroeconomic environment, legal framework, political environment in country and previous experience with PPP (Mota and Moreira 2015).

Although it is assumed that PPP will increase quantity and quality of infrastructural projects and other public goods and services without additionally burdening the central governments' and local units' budgets due to the fact that private investors assure financial funds for infrastructural projects more easily, PPP should be considered with caution. This is due to the fact that central and local government which arrange project financing by PPP principles bear numerous risks. Risks are related to quality and quantity of essential public goods and services that need to be ensured and as noted by Buso *et al.* (2017) PPP development is very often motivated by financial difficulties. Usually, complexity of administrative procedure and risk allocation, as well as high administrative risk are weakening the motivation for conducting investments though PPP model (Rossi and Civitillo 2014).

The literature stresses a significant role of local government in conducting and fostering public investments (*e.g.* Allain-Dupré *et al.* 2012). The average increase of the share of local government in total public investment in OECD countries, despite of financial crises, could be influenced by increase in the costs of the investment projects or lagged effects of financial crises on the stance of local finances which is visible with delay. PPP is vulnerable during the crisis which can be visible in the delays in starting the new projects or in their cancelation (Burger *et al.* 2009).[2] European countries have different experiences with PPP. In the period 2008-2017, 781 PPP projects were conducted across EU-28, from which 42 in 2017 (EPEC 2018a).

PPP have an important role in regional development in majority of European countries. However, this is connected with the level of decentralization and size of the country. Allain-Dupré *et al.* (2012) noticed that decentralization process is mostly related to Eastern and Central European countries where additional responsibilities had a direct impact on their share in public investment. Local government units started to recognize

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[2] As stressed in Burger *et al.* (2009) the most of delays were caused by uncertainty regarding access to finance, demand and costs of financing, while the survey conducted regarding 316 projects in period between July 2008 and February 2009 showed that the largest delays were in the energy and transport sector.

the PPP as the way to fund public sector services with the goal to improve efficiency and effectiveness of public services delivery to citizens (UN-Habitat 2009).

Figure 1. PPP projects in EU-28, 2008-2017
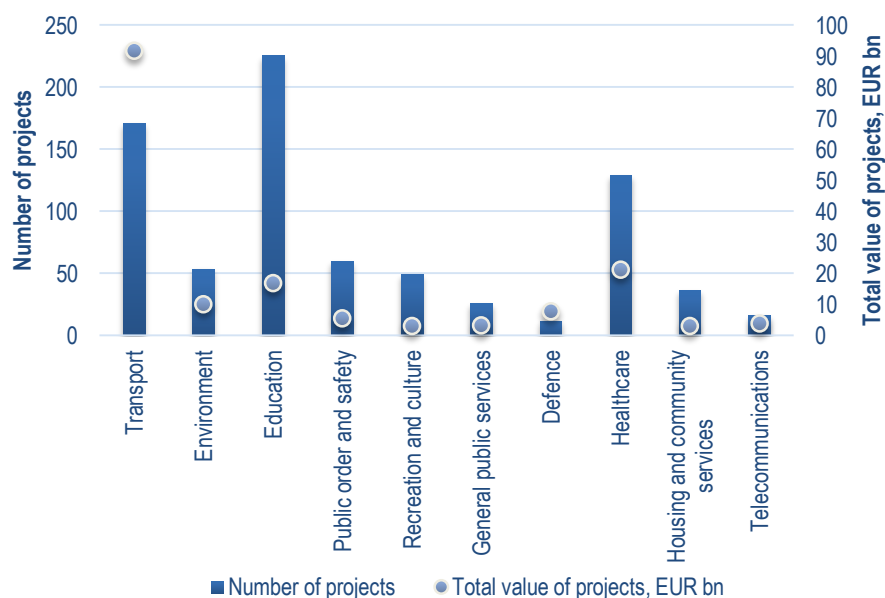
Source: EPEC (2018a).

3. Sample characteristics and methodology

Analysis is based on the result of conducted survey among second-tier councilors in 14 European countries as the part of the project Policy Making at the Second Tier of Local government in Europe conducted with the goal to organize and carry out an identical survey of councilors, political executives and leading bureaucrats at the second level of local government i.e. provinces, counties etc. in various European countries and provide a comparative data. The survey was conducted among second-tier councilors which have a different role in European countries. However, in general, in all of them they have important functions and responsibilities for achieving economies of scale and thereby increasing the efficiency of public service provision and delivering services which may not be possible for local authorities (Council of Europe 2012). The survey included large number of questions, and among them second-tier councilors were asked to determine who should, in their opinion, ensure certain public functions: public sector, private sector or should a public function be provided in the form of PPP. In Table 1 overview of experiences with PPP projects in analyzed countries are given.

Table 1. PPP overview, by countries

	Number of projects, 2008-2017	Total value of projects, EUR bn, 2008-2017
Belgium	25	5.5
Croatia	1	0.3
Czech Republic	0	0
France	148	28.7
Germany	92	8.5
Greece	15	2.8
Hungary	1	0.6
Italy	17	9.4
Norway	n.a.	n.a.
Poland	8	3.2
Romania	0	0
Spain	64	11.3
Sweden	1	1.1
United Kingdom	0	0
Total	372	71.4

Source: authors' and EPEC (2018a) data.

Largest experience with conduction of PPP project have France and Germany. The both have large experience with different PPP projects (Table 2) and almost half of the total value of conducted PPP projects in both France and Germany was used to build new infrastructure or to renovate, maintain or manage existing transport infrastructure facilities.

Table 2. PPP projects by sector, 2008-2017

	Transport	Environment	Education	Public order and safety	Recreation and culture	General public services	Defense	Healthcare	Housing and community services	Teleco-mmunications
Belgium	●●●		●	●●	●					
Croatia	●									
Czech Republic*										
France	●●●	●	●●●	●●●	●●●	●	●	●●●	●●	●●●
Germany	●●●		●●●	●●	●●	●●●	●	●●	●	
Greece	●	●	●	●						●
Hungary	●									
Italy	●●	●						●●		
Norway*										
Poland	●	●	●	●						●
Romania										
Spain	●●●	●●	●	●●	●			●●●		
Sweden								●		
United Kingdom*										

Note: ● = 1 to 5 projects, ●●= 6 to 10 projects, ●●● = more than 10 projects. * No data available.
Source: EPEC (2018a) data.

The survey covered following public functions: public transport, school building maintenance, waste management, energy supply, water supply and sewage, hospitals and care homes for elderly. 5,722 respondents answered the questions about preferable form of delivering public services. The respondents' opinions have been analyzed to explore the differences in attitudes about PPP across European countries, and whether their attitudes on whether to implement or not certain project entirely or to some extent with the private sector can be explained by their socio-demographic characteristic. Sample statistics are shown in Table 3.

Table 3. Sample characteristics, N=5,722

	%
GENDER	
Male	72.2
Female	27.8
AGE	
18-39	12.3
40-49	51.9
50+	35.7
COUNTRY	
Belgium	6.1
Croatia	5.9
Czech Republic	1.8
France	6.0
Germany	30.6
Greece	4.4
Hungary	2.3
Italy	5.1
Norway	4.2
Poland	2.4
Romania	3.4
Spain	4.0
Sweden	21.4
United Kingdom	2.4
EDUCATION	

	%
Primary	7.9
Secondary	23.3
University or equivalent	68.7

Source: Authors´ analysis.

Results of the survey has been analyzed generally and according to the second-tier councilors' country to gain insight into respondents' opinion for each of analyzed public function in each country. Also, paper analyses do respondents which choose one form of public service delivery for one public function have the same opinion for all the other public functions as well.

4. Results

With the respect of rising citizen's expectation regarding provision of public functions and the poor fiscal position of sub-national government in large number of European countries, in this part of the analysis the second-tier government attitudes regarding different forms of delivering public services has been analyzed.

Figure 2. Attitudes toward PPP in public transport
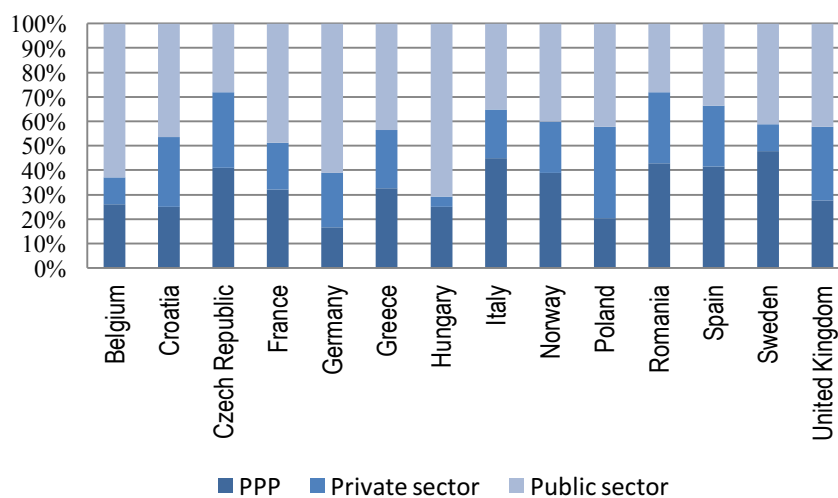
Source: authors' analysis based on survey.

Out of 4,916 respondents that reported on the way of providing a public service, 48 percent find that public sector needs to take care of public transportation, while 32 percent support that public transportation should be secured through PPP. In spite of the experiences while dealing with PPP projects related to transport sector, more than 40 percent of second-tier councilors in Czech Republic, Italy, Romania, Spain and Sweden would choose PPP as a way for investment in transportation. Mostly, these are countries with long term experience with implementation of PPP projects in the transport sector, but it has to be noted that among investment in transport sector, most of the PPP agreement are related to building roads, railways and crossings. Italy is considered a leader when accounting for the completion of the grand projects such as the BreBeMi motorway (EUR 2.3 billion) or the Milan eastern ring road (EUR 1.8 billion) (EPEC 2014). German local authorities give the smallest contribution, of 17 percent to this type of cooperation between public and private sector for financing projects of public transportation. Most of them support the continuation of financing projects through the public sector only although Germany is very active in PPP transport market. In 2016 it closed the large PPP investment worth EUR 600 million used for expansion of A6 Wiesloch/Rauenberg-Weinsberg motorway (EPEC 2017). Also, the Federal Ministry of Transport and Digital Infrastructure has established the budget which is planned to be used for new PPP road projects (Deloitte 2017).

Figure 3. Attitudes toward PPP for school building maintenance

■ PPP ☐ Private sector ■ Public sector
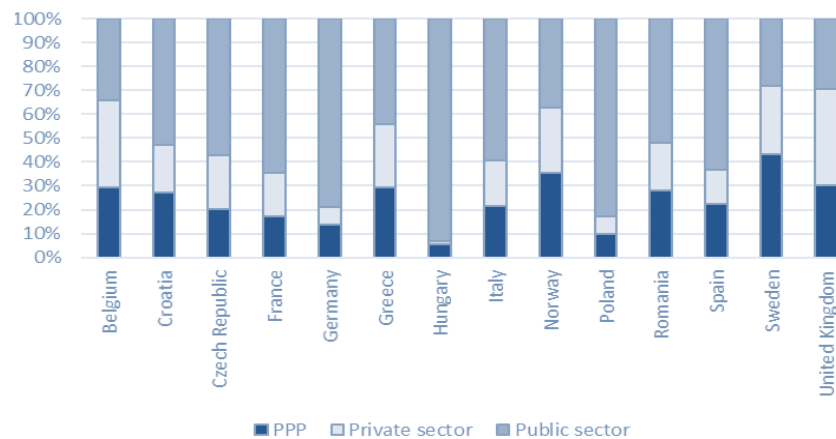
Source: authors' analysis based on survey

Out of 4,893 respondents in 14 analyzed European countries, 55% find public sector as the one that should be in charge of the projects of maintenance of school buildings. 26% of them consider that those projects should be conducted through PPP. In analyzing the results of a survey across countries it is indicated that more than 30% respondents from Norway, Sweden and United Kingdom would choose PPP for maintenance of school buildings. On the other side, respondents from Hungary and Poland give the least support for maintenance of school buildings using PPP with 6% and 10% respectively. In the majority of analyzed countries more than half of survey participants would choose public sector for the maintenance of school buildings. Most of the respondents in Belgium and United Kingdom would choose the private sector for carrying out the maintenance of school buildings.

Figure 4. Attitudes toward PPP in waste management projects

■ PPP ☐ Private sector ■ Public sector
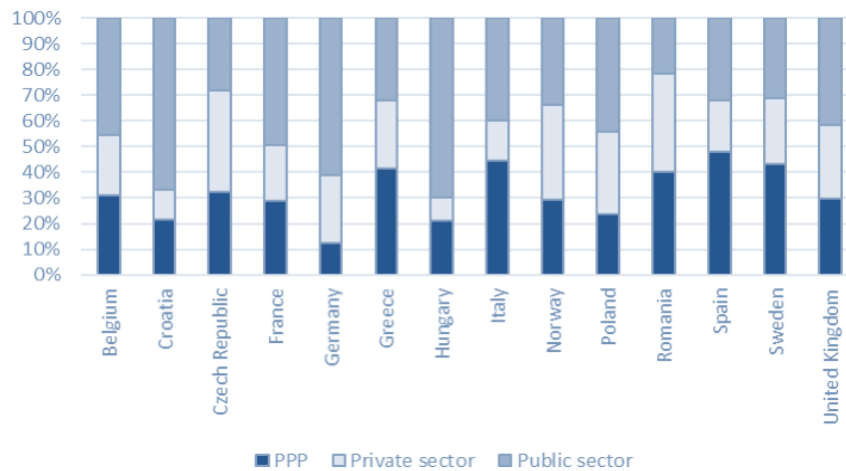
Source: authors' analysis based on survey

World bank (2015) data shows that large number of local governments are responsible for solid waste services, while the private sector has been involved in these services mostly through arrangements and informally through waste picking and sorting. In some cases, such arrangement is realized though PPP solutions.

European Commission put more and more emphasis on sustainable resource management. Great importance is given to energy efficiency projects and efficient waste management. As a consequence, an integral part of numerous European directives are regulations that prescribe to the member countries sustainable and efficient resource management. (*e.g.* Directive 2008/98/EC on waste). In the majority of countries local authorities deal with waste management, however private sector is also included in different segments of waste management.

45% of respondents find that public sector should manage waste. 25% of them consider private form as the best one for offering this service to the citizens. 30% regards PPP projects as a fitting way for waste management. Across countries, more than 40% of respondents in Greece, Italy, Romania, Spain and Sweden views PPP as a desirable way of offering the service of waste management. More than 60% of second-tier councilors in Croatia, Germany and Hungary consider waste management as a domain of the public sector.

Figure 5. Attitudes toward PPP in energy supply projects
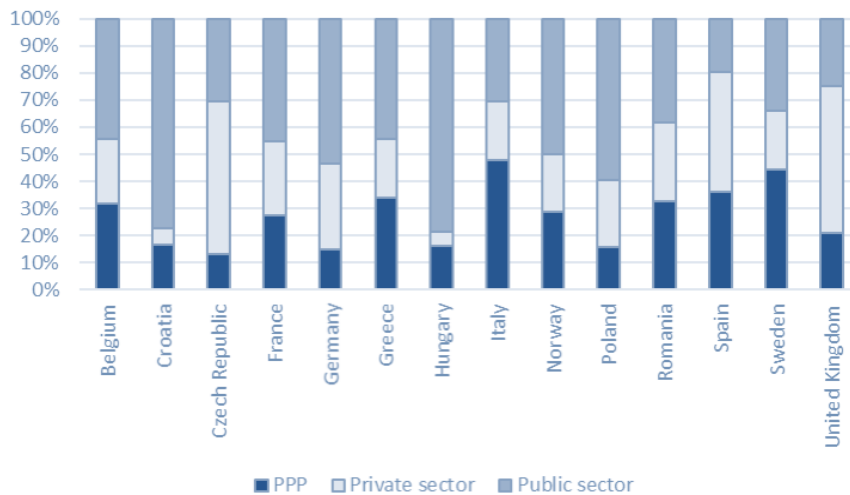
■ PPP □ Private sector ■ Public sector

Public and private sector cooperation is possible also in the energy sector. PPP investments in the energy sector are mainly used in generation and transmission (World bank 2018a). Local authorities in Germany, France and United Kingdom have also experience with conducting energy efficient public lighting projects through PPP model (World Bank 2018b). The survey of second-tier councilors included questions of involving the private sector in the sector of energy supply.

Out of 4,894 second-tier councilors, 45% find the energy sector as fully public, without the inclusion of the private sector. 29% would choose PPP financing as a suitable way for realizing projects in this sector. Across countries, more than 30% of respondents in Belgium, Greece, Italy, Romania, Spain and Sweden consider PPP as a suitable option for financing projects in the energy sector. The least number of second-tier councilors supporting PPP in this sector are the ones from Czech Republic, Germany, Poland, Hungary and Croatia.

Figure 6. Attitudes toward PPP in water supply and sewage

■ PPP □ Private sector ■ Public sector
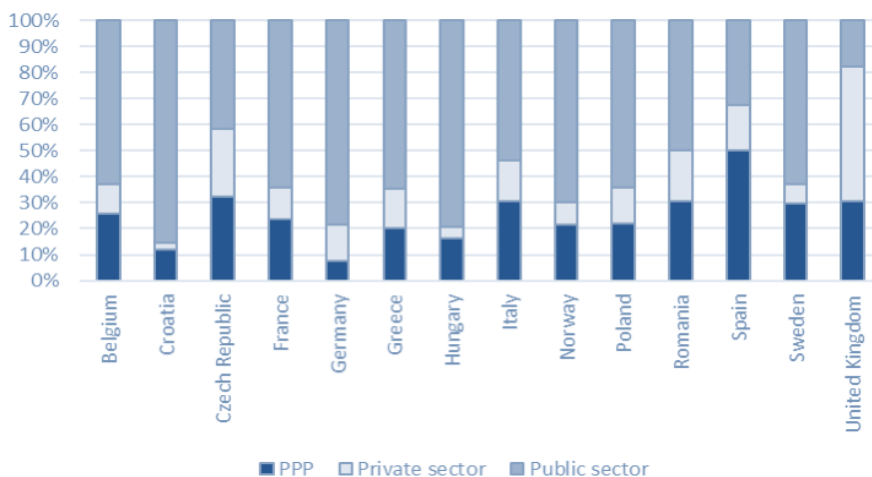
World bank (2015) stress that PPP could improve access to safe water and sanitation services by providing a number of services such as delivering service to households, building new infrastructure, improving technology or using clean technology to better meet the needs of the community.

Building a system of water supply and sewage is an integral part of an efficient natural resource management. It can be realized through PPP model. Majority of second-tier councilors, 65%, consider that water supply and sewage should be in public sector domain without large involvement of the private sector. More than 60 percent of respondents in Belgium, Croatia, France, Germany, Greece, Hungary, Norway, Poland and Sweden choose the public sector. The exception is Spain where more than 50% of second-tier councilors consider that water supply and sewage could be improved by the means of PPP model. Spain has gone through partial privatization of services of water supply and sewage.

Figure 7. Attitudes toward PPP in hospitals
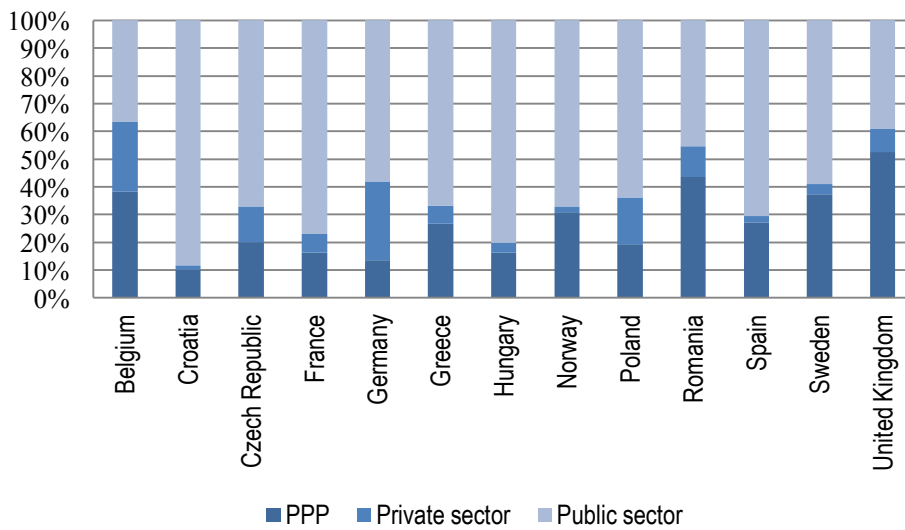
Source: authors' analysis based on survey

European Commission (2014) evaluation of the PPP in health care delivery in European countries notice the experiences of countries with building hospitals using PPP. Examples are Italy, France, Spain, Germany and UK. Spain has an experience with public financed health services which are provided by private suppliers and with PPP projects used to build and operate public hospitals.

There is a large number of European countries that have the experience of building hospitals using PPP model. In spite of that, majority of respondents (62%) consider public sector as the sole financier of hospitals. On the other side, PPP model is supported by only 25% of the second-tier councilors. Across countries, only United Kingdom recorded more than half of its second-tier councilors supporting PPP, 53%. European Commission (2014) highlights the curiosity of unsuccessful Romanian PPP project of a large renovated hospital, while the small hospital project under the jurisdiction of local authorities was a success. That situation is obviously reflected in the attitudes of respondents where Romania stands out as one with a large number of PPP model supporters.

Figure 8. Attitudes toward PPP for care homes for elderly
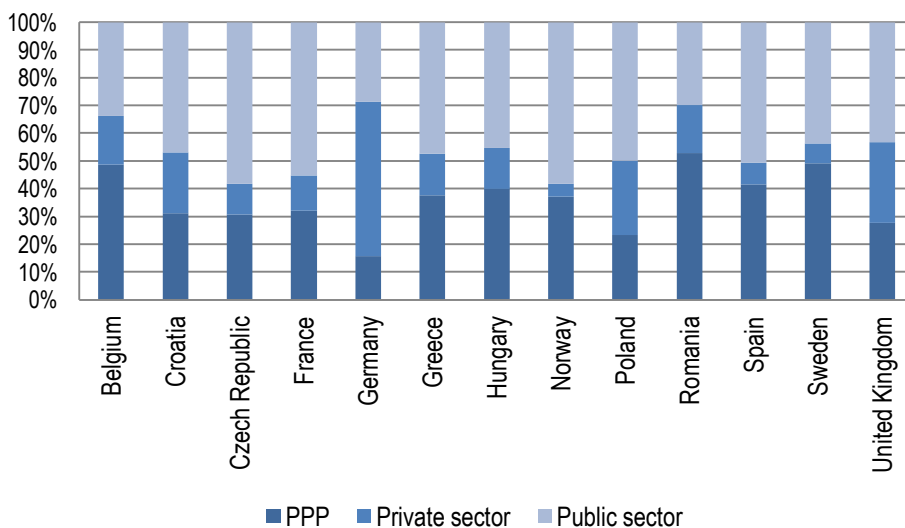
Source: authors' analysis based on survey.

The demand for health care homes for elderly is rising. It is expected that the number of people older than 79 will triple by 2060 (European Commission 2012). Growing need for care homes for elderly imposes the need of considering their construction through means of the private sector. Therefore, the survey included questions about

desirable models for their financing. Out of 4,592 respondents, 41% choose public sector, 34% PPP model, and 25% private sector as the most desirable model.

More than 40% of respondents in Belgium, Hungary, Romania, Spain and Sweden would choose the PPP model for construction and maintenance of care homes for elderly. In Germany around half of respondents supported the privatization of care homes for elderly. Less than 10% of surveyed second-tier councilors from Norway, Spain and Sweden were supporting the privatization.

Table 4 comprises summary results of the second-tier councilors support to implementation of PPP projects. Looking generally, PPP as the model for providing public services have the highest support from the second-tier councilors in following sectors: public transport, waste management and care homes for the elderly. In addition, results reveal that most of the respondents are against privatization of public services despite of the sector. On average, more than half of respondents find that maintenance of school buildings, hospitals and water supply and sewage should completely stay in the domain of public sector.

Table 4. Summary results, in %

	Public transport	Maintenance of school buildings	Waste management	Energy supply	Water supply and sewage	Hospitals	Care homes for the elderly
PPP	32	26	30	29	22	25	34
Private sector	20	19	25	26	13	13	25
Public sector	48	55	45	45	65	62	41
Total	100	100	100	100	100	100	100

Source: authors' analysis based on survey.

Finally, the paper investigates are respondents' attitudes, looking generally, towards different forms of implementation of projects related to their socio-demographic characteristics.

Table 5. ANOVA/t-statistic results

	Means	St.Dev.	N	ANOVA/t-statistics
Dependent variable: *PPP*	Independent variable: *Age*			
Less than 40 years old	1.91	2.11	632	F=2.307 p=0.100
40-49 years old	1.90	2.03	1,025	
Over 50 years old	1.77	2.01	3,478	
Dependent variable: *Private sector*	Independent variable: *Age*			
Less than 40 years old	1.35	1.75	632	F=2.307 p=0.125
40-49 years old	1.37	1.74	1,025	
Over 50 years old	1.26	1.56	3,478	
Dependent variable: *Public sector*	Independent variable: *Age*			
Less than 40 years old	3.07	2.41	632	F=9.140 p=0.000
40-49 years old	3.11	2.29	1,025	
Over 50 years old	3.39	2.31	3,478	
Dependent variable: *PPP*	Independent variable: *Education*			
Primary	1.07	1.65	407	F=31.614 p=0.000
Secondary	1.79	2.02	1,195	
University or equivalent	1.91	2.05	3,521	
Dependent variable: *Private sector*	Independent variable: *Education*			
Primary	1.66	1.84	407	F=16.080 p=0,000
Secondary	1.12	1.55	1,195	
University or equivalent	1.31	1.69	3,521	
Dependent variable: *Public sector*	Independent variable: *Education*			
Primary	3.93	2.27	407	F=21.565 p=0,000
Secondary	3.46	2.37	1,195	
University or equivalent	3.19	2.30	3,521	
Dependent variable: *PPP*	Independent variable: *Gender*			
Male	1.71	1.95	3,741	t=-6.062 p=0,000
Female	2.09	2.18	1,441	
Dependent variable: *Private sector*	Independent variable: *Gender*			
Dependent variable:				
Male	1.43	1.72	3,741	t=9.767 p=0,000
Female	0.93	1.49	1,441	

	Means	St.Dev.	N	ANOVA/t-statistics
Dependent variable: *Public sector*	Independent variable: *Gender*			
Male	3.29	2.28	3,741	t=-0.659
Female	3.33	2.42	1,441	p=0,000

Source: author.

The results of the ANOVA indicate that there are significant differences in respondents' views regarding implementation of projects. Younger respondents are more prone to PPP projects. Respondents older than 50 years are less prone to privatization of public services or to conducting project though PPP model. Overall proneness of respondents to implementation of PPP projects depends also on the level of their education. Looking generally, respondents with highest level of education are more prone to implementation of PPP projects. Results of the analysis also reveal that there are differences in attitudes with respect to respondents' gender. Female respondents' have more positive opinion about PPP than male respondents, while male respondents' are more prone to privatization of public services.

Conclusions

The main goal of this paper was to analyze whether local authorities support the idea of implementation of PPP projects for providing some public functions. Survey result shows that, depending on the sector, every third to fifth second-tier councilors support co-operation with the private sector when ensuring the provision of an infrastructure or a service. This is important since second-tier level is in most of the European countries involved in number of activities relating to the environment, economic development, transport and education. Although they should have for fulfilling its responsibilities their own resources, the weak fiscal stance for financing capital projects is large barrier for providing public services and for new investments. The research results have shown that second-tier representatives are open to greater private involvement in public services' provision in some sectors.

The main potential benefit from PPP projects, respondents see in transport sector, waste management projects and proving care homes for the elderly. Specially, strong positive position of second-tier representatives towards PPP could be find Spain for water supply and sewage, United Kingdom for hospitals, Romania for care homes for the elderly, where over 50 percent of respondents have positive opinion about such projects. Slightly lower amount, but still strong (above 40 percent of total respondents) can be found in: Czech Republic, Italy, Romania, Spain and Sweden for public transport; Sweden for maintenance of school buildings; Greece, Italy, Romania, Spain and Sweden for waste management; Italy and Sweden for energy supply; Spain for water supply and sewage; Romania and United Kingdom for hospitals; and Belgium, Hungary, Romania, Spain, Sweden for care homes for the elderly.

Although there are noticeable differences in the attitudes of respondents and real practice in conducting PPP projects between European countries, the results show that the attitudes of respondents are related, apart from the sector, to the socio-demographic characteristics of respondents. Thus, gender, age and level of education influence general respondents' attitudes about PPP. Younger people, female and those with higher level of education are more open to greater private involvement in provision of public services though PPP projects.

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APPENDIX

Overview of institutional and legal conditions	PPP unit	Location	PPP law
Belgium	2002	Ministry of finance	+
Croatia	2006	Independent	+
Czech Republic	2004	Independent	+
France	2005	Ministry of finance	+
Germany	2009	Independent	+
Greece	2006	Ministry of finance	+
Hungary	2003	Ministry of finance	+
Italy	1999	Ministry of finance	+
Poland	2001	Line ministry	+
Romania		Ministry of Public Finances	+
Spain		Ministry of development	+
Sweden			+
United Kingdom	1997	Ministry of finance	+

Source: According to Medda *et al.* (2013), World bank (2015) and World Bank (2018).

Labor Market Performance and the Beveridge Curve: The Case of Visegrad Group Countries

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Abstract:

The paper deals with labour market performance in the Visegrad Group countries between 2010 and 2018. The paper also employed the Beveridge curve as an alternative indicator of labour market performance. The curve basically shows the development of the labour market – it is a graphical demonstration of the relationship of two variables – unemployment rate and the job vacancy rate. According to previous theoretical and empirical studies, labour market performance is largely dependent on the business cycle. In other words, if a negative output gap exists rising unemployment appears and vice versa. The Eurostat data were applied in the paper. Based on the analysis it can be stated shifts in the Beveridge curve in Visegrad Group countries proved theoretical concept of this curve. Empirical results showed shifts of the Beveridge curve to the left and upward (the job vacancy rate was increasing, while the unemployment rate was declining), which is peculiar to the prosperity phase from 2014Q1 to 2018Q3.

Keywords: Beveridge curve; job vacancy rate; labour market; unemployment rate; Visegrad Group

JEL Classification: J1

1. Introduction

In the literature, we can see many approaches how to analyse labour market performance and the Beveridge curve (BC) is one of them, although it is not often used. The curve basically shows the development of the labour market over time. Labour markets in the Visegrad group countries (V-4) have undergone the turbulent developments during the past twenty years and the aim of this paper is, based on available data, to compare the development of the Beveridge curves within the Visegrad group countries in the period 2010 - 2018. Theoretically, the Beveridge curve is a relationship of two variables: job openings (vacancies) representing by the job vacancy rate and unemployment expressed by the unemployment rate over the course of a business cycle (Diamond and Sahin 2015). It is therefore used as a graphical representation of labour market performance over time, or in other words, the BC captures matching unemployed labour force and available vacancies. More in general, the outward movement of the Beveridge curve can be interpreted as a decrease in the efficiency of the matching process (Cardullo and Guerci 2018). According to Elsby, Michaels and Ratner (2015) the Beveridge curve has played a pivotal role in debates over functioning of labour markets and has shaped the canonical modern approach to understanding the coexistence and volatility of unemployment and vacancies. The basic knowledge is that if the Beveridge curve is shifted downward, which will mean a higher rate of unemployment at the same level of vacancy rate than we can suggest a deterioration in the matching/hiring process in the economy. Pater (2017) proved negative as well as positive (inducing BC shifts) co-movement between vacancies and unemployment on an example of US economy. Our research focused on the V-4 countries recorded different phases of the business cycle during observed period. In this paper, we try to analyse not only the unemployment rate but also the Beveridge curve shifts in this period of years 2010 and 2018.

The paper is organised in these parts: (i) the first part is based on literature review which contains the theoretical background associated with the Beveridge curve; (ii) the second part focused on empirical results – it

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consists of the unemployment rate development in the Visegrad Group countries and construction of the Beveridge curve based on the quarterly data from the Eurostat database; (iii) and the last part recapitulates findings.

2. Literature review

The most commonly used approach is an analysis of the unemployment rate. However, this indicator cannot itself provide an accurate picture of labour market performance. It is important to note that in cases where the unemployment rate does not develop dynamically and rather stagnates, it is necessary to use alternative indicators for proper identification of the labour market situation. One of these unconventional indicators could be decomposition of unemployment or in other words identification of cyclical, structural and seasonal component (most often authors applied Hodrick-Prescott filter, for more detailed info see Tvrdon 2016). Another approach how to determine the condition of the labour market is employment of the Beveridge curve. As written above, the Beveridge curve is a relationship of two variables: job openings (vacancies) representing by the job vacancy rate and unemployment expressed by the unemployment rate. It is therefore used as a graphical representation of labour market performance over time.

For appropriate understanding of the Beveridge curve, we have to go back to the study of Dow and Dicks-Mireaux (1958), where we can find some relationships important for the construction of the Beveridge curve. These authors pointed out the long-period 'divergence' between the unemployment and the vacancy statistics. This could be probably best interpreted as evidence that one, other or both series were being affected not only by the labour demand but also by other factors. Theoretical Beveridge curve could be derived from UV curve, which has a convex shape and which was mentioned in this study (see Figure 1). Points J, K, L, M, N on the diagram represent observed values of unemployment (u) and vacancies (v). A line of 45 degrees, that intersects the UV curve, divides the area into a part in which excessive labour supply exists and a part in which the excessive labour demand occurs. Zero net excess demand is then to be defined as all points where unemployment equals true vacancies (45º degree line through the origin). Successive points on the 45-degree line (e.g. points J, K) correspond to different degrees of maladjustment that may conveniently be measured as the amount of unemployment, which would exist at any time if there were zero net excess demand. There also exist points that lying on this convex curve and that represents different degrees of demand (low at one end and high at the other) for any given degree of instability (points L, J and M).

Figure 1. Shifts of UV and VS curves
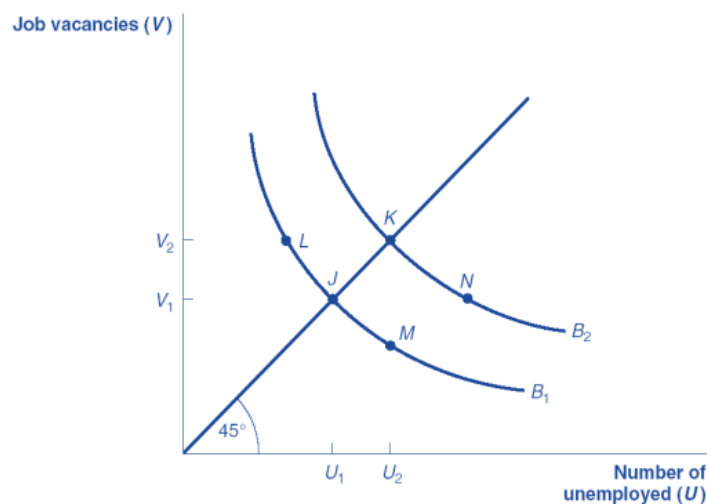
Source: Galuščák (2014)

During economic growth, there is an increase in the number of new job vacancies, while in the recession the number decreases. Each enterprise has a job that can be of two states - (i) occupied and producing or (ii) vacant and seeking candidate. Moreover, jobs that do not produce revenue or not actively searching are disturbed. According to Mortensen and Pissarides (1994), the process of creating a job means that an enterprise offering job vacancy and an unemployed job-seeker meet (just opening a new job is not taken as a job creation). On the contrary, job destruction occurs when the occupied job separates and leaves the market. Similarly, we can also explain workers´ status - they may be either unemployed and looking for a job, or employed and doing work (see Figure 2).

Figure 2. Balance between job vacancy rate and unemployment rate
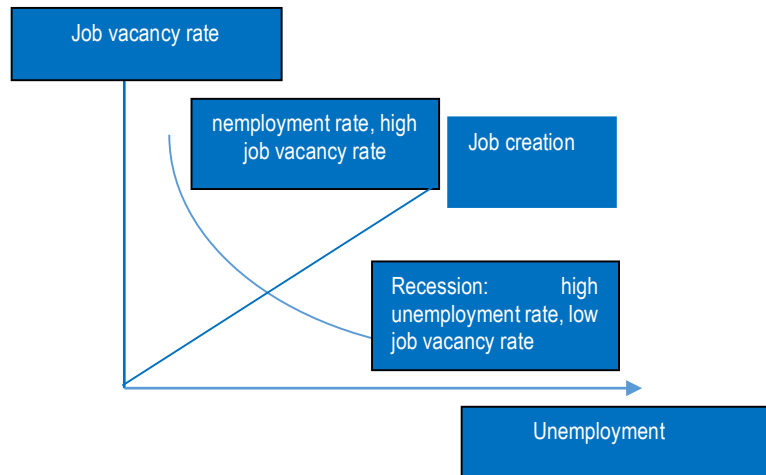
Source: Mortensen and Pissarides (1994)

Bleakley and Fuhrer (1997) presented a schematic of the simple model (see Figure 3). The Beveridge curve is represented by the grey box outlined at the centre of this figure; it is determined by the flows of workers and jobs into and out of unemployment and vacancies, as indicated by the arrows. As the figure shows, unemployment arises as the result of flows of job losers, job leavers ("quits" or voluntary job separations), and flows into the labor force. Vacancies arise from the expansion of firms ("job creation") and from quits. The outflows from the Beveridge variables are new hires: Workers leave unemployment upon finding a job and jobs are no longer vacant once a worker is hired. The flows fall into three broad categories: labor market reallocation or "churning," labour force growth, and the search and matching process.

Figure 3. A simple schematic capture relationship between unemployment and vacancies underlying the Beveridge curve
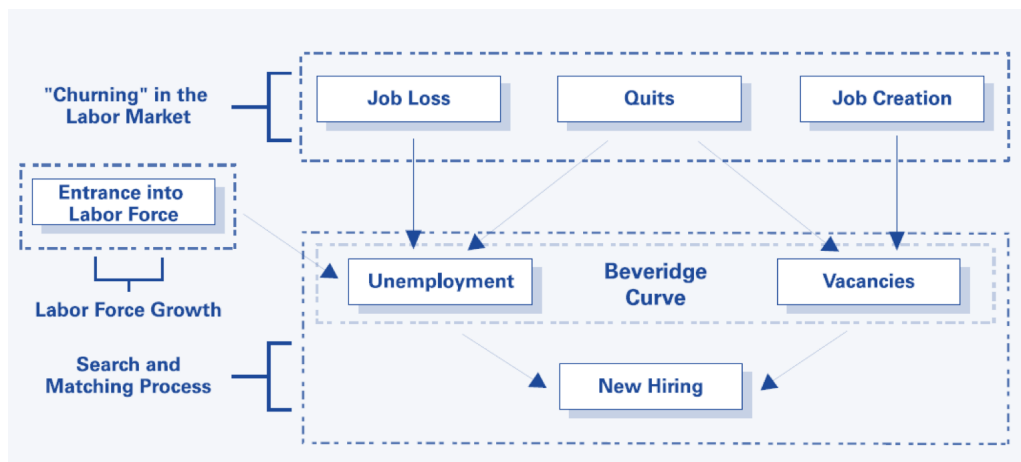
Source: Bleakley and Fuhrer (1997)

The question is how different shocks can influence Beveridge curve. Galuščák (2014) distinguishes three groups of shocks: (i) in aggregate demand (fiscal and monetary policy), (ii) change in wage pressures and (iii) change in non-labour income. These three types of shocks entail temporary or permanent shift in the VS curve, corresponds to movement from A to B (see figure 3). On the other hand, there exist also structural shocks (e.g. lower demand in a specific industry) that may cause right shifts of the UV curve. UV curves shifts to the right due to higher regional or occupational mismatch between u and v. Structural shocks lead to temporary or permanent shifts from A to C due to the UV curve shift (see figure 4). In addition, hysteresis causes shift from B to D (if the demand is permanently lower) or from B to C (temporary drop in demand).

Figure 4. Shifts of UV and VS curves
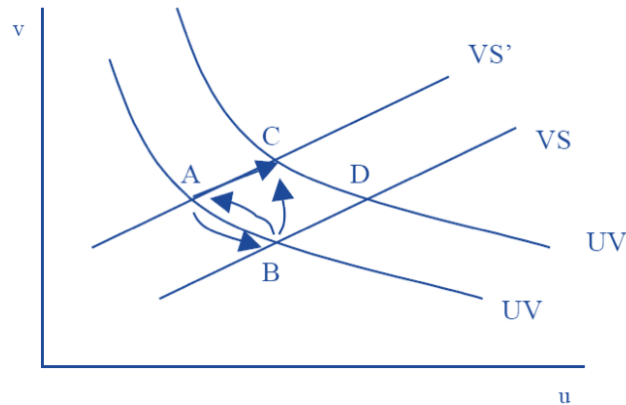
Source: Galuščák (2014)

3. Empirical results

Visegrad Group economies (V-4) recorded relatively decent economic growth during last years in comparison with the rest of the EU countries. Hungary recorded the slowest GDP growth - average growth rate was 1.1% in the observed period. The Czech economy´s average economic growth amounted to 1.9% per year. Slovak economy grew on average by 3.2% per year and the most successful country in terms of real GDP growth posed Poland with the average growth rate of 3.7%. Although these countries grew faster than the euro area countries, their level of real GDP per capita in purchase parity standards (PPS) still lagged behind. If we look at the volume index of GDP per capita in PPS expressed in relation to the European Union (EU28) than Czech index reached 89%, Slovakia 76%, Poland 70% and Hungary 68%. There is still some room for convergence.

The question is if these economies could reach higher pace of economic growth or in other words if the real GDP development was in accordance with potential output - we try to estimate output gap using Eurostat quarterly and seasonally adjusted data. We have applied the Hodrick-Prescott filter (HP filter) as a frequently used method. Our approach was inspired by studies of Tasci (2012), Tvrdon, Tuleja and Verner (2012), da Silvia Filho (2010) or Zimkova and Barochovsky (2007). An appropriate smoothing constant λ for quarterly data was 1600.

Figure 5. Output gap in Visegrad group countries between 2010 and 2018 (quarterly seasonally adjusted data)
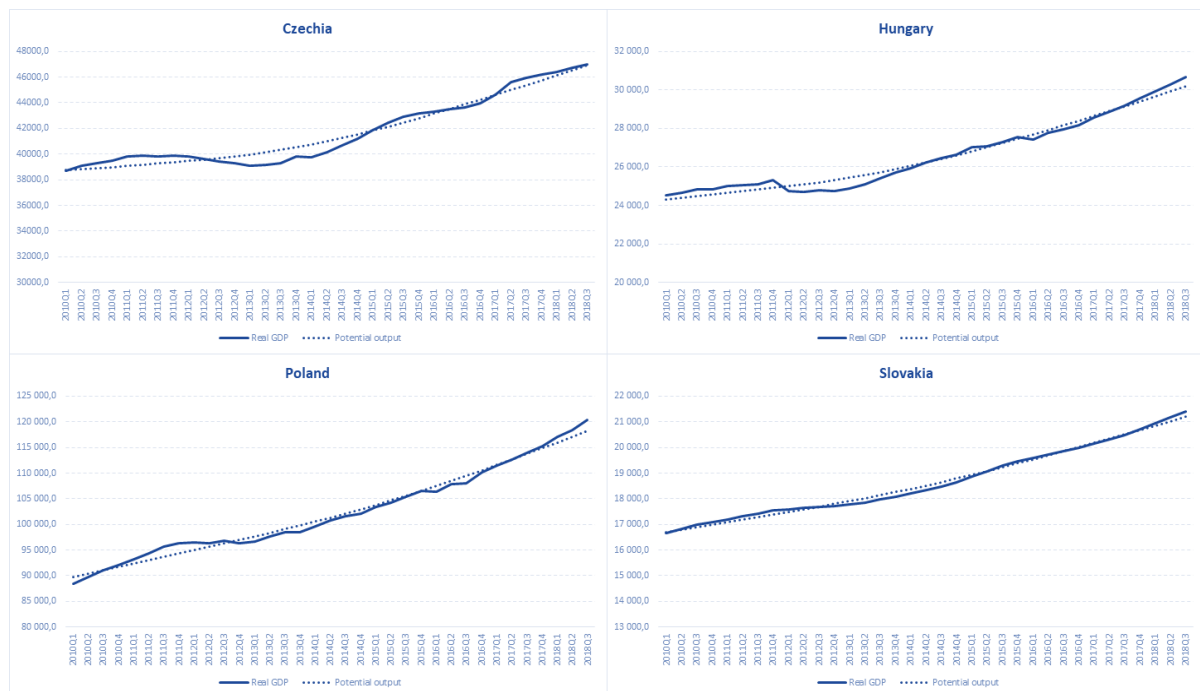
Source: Eurostat; own calculation

As seen from Figure 5, Czech and Hungarian economies experienced typical business cycle; these countries recorded short recovery of the economy after 2008 – 2009 deep recession at the beginning of the

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observed period; however negative output gap was monitored from 2012 to 2014. On contrary, Slovakia and Poland recorded continual economic growth from 2010. Significant growth has been achieved in all countries in recent years and this growth contributed to reducing a gap between the original EU countries and the new member countries.

The labor market is generally considered a mirror of economic performance. In other words, it means that labor market performance (expressed by the unemployment rate) is strongly associated with economic performance (expressed by real GDP growth). Figure 6 shows the evolution of the unemployment rate from 2010 to 2018 (we applied Eurostat quarterly data). This period was marked by several events that had an impact on unemployment, whether positive or negative. In terms of the business cycle, Visegrad group countries grew slightly, and then there was a two-year stagnation in Czech and Hungary, while in the period from the year 2015 real GDP growth rate reached high values. Remarkable economic growth had positive impact on job creation and reducing unemployment (including its long-term component) in all observed countries. If we look at the development of the unemployment rate, we can conclude that the positive trend of reducing unemployment was recorded in these countries; the unemployment rate dropped significantly. In some countries, the unemployment rate even reached its historical minimum. This is the case of Czech where the unemployment rate declined to just 2.2% in 2018. The unemployment rate has also decreased dramatically in Slovakia and Poland, where it was historically significantly higher than the EU28 average (see Figure 6). Reducing level of unemployment was recorded even in the case of Slovakia with traditionally high unemployment rate. It felt from 15.8% in 2010 to 6.3% in the third quarter 2018 and was even the EU-28 average.

Figure 6. Unemployment rate in the Visegrad Group countries between 2010 and 2018 (quarterly data)
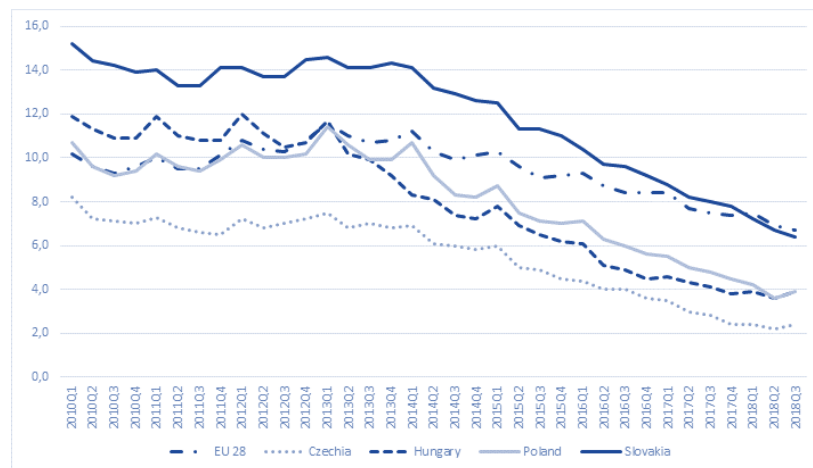
Source: Eurostat

Eurostat defines a job vacancy as a remunerated position that is newly generated, this position is vacant, or is going to be occupied. Moreover, the employer undertakes is taking active measures and is ready to apply further measures to obtain an appropriate candidate from outside the company concerned. In addition, the employer intends to fill the post immediately or within a reasonable period of time. An occupied job is defined as a remunerated position within the enterprise.

The job vacancy rate is calculated as follows:

$$job\ vacancy\ rate = \left(\frac{number\ of\ job\ vacancies}{number\ of\ occupied\ posts + number\ of\ job\ vacancies} \right) \times 100 \qquad (1)$$

As written above, the unemployment rate fell significantly in the Czech and it was even the lowest in the EU-28. Figure 7 shows developments in the Czechia´s Beveridge curve since the first quarter of 2010 on the basic of Eurostat job vacancy rate. The left side covers a period from 2010 to 2013 and the right side a period from 2014 to 2018 (third quarter). The counter-clockwise movements that are typical for the business cycle´s phase of economic growth occurs from the first quarter 2010. During the first period (left side of the figure 7) we can see different degrees of labor market performance. The Czech economy struggled with short growth and recession periods, which had a major impact on the Beveridge curve shifts that are relatively difficult to trace. This is in accordance with a study of Bonthuis, Jarvis and Vanhala (2016). One of the main findings is that job vacancy rates have improved in many countries, but unemployment rates have remained relatively high or surprisingly have kept rising. That means outward shifts in the Beveridge curves. These shifts in the Beveridge curve are often typical for the

periods of an economic crisis during which structural changes occurs in the labor market. On contrary, we can see remarkable drop in unemployment (from 6.9 in 2010Q1 to 2.4 in 2018Q3) accompanied by rise in the job vacancy rate (from 1.0 in 2010Q1 to 6.0 in 2018Q3). This significant shift is characteristic for pre-crisis period and it was also recorded before the 2009 - 2010 crisis. From a macroeconomic point of view, this development is generally understood to be positive (lower unemployment means higher consumption expenditure by households that have positive effects on other components of GDP); however, so remarkable shift in BC can also have its negative consequences. There might be a lack of labor force in the labor market, which limits the production capacities of companies, which in addition have to raise wages considerably in order to keep employees. In the Czech, the average wage has risen sharply since 2016 and we can state that this increase was higher than labor productivity growth.

Hungarian economy experienced similar development as Czech. According to OECD (2019b), economic growth has been driven by private consumption, which is underpinned by expanding real incomes, reflecting strong real-wage and employment growth, high consumer confidence and supportive macroeconomic policy stances. In the past, the Hungarian labor market was perceived as rigid especially before the 2008-2009 economic crisis. Figure 8 shows shifts in the Hungarian Beveridge curve. The Beveridge curve´s development was volatile at the beginning of the first period because of macroeconomic fluctuations. The last year of this period the unemployment rate dropped significantly but the job vacancy rate also felt. The counter-clockwise movements expressing improvement of labor market performance occurs in the second period (2014 -2018). The unemployment rate has fallen to a record 3.9% and the job vacancy rate has reached 2.8%.

Figure 7. Beveridge curve Czech Republic, years 2010-2013 (left side) and years 2014-2018 (right part)
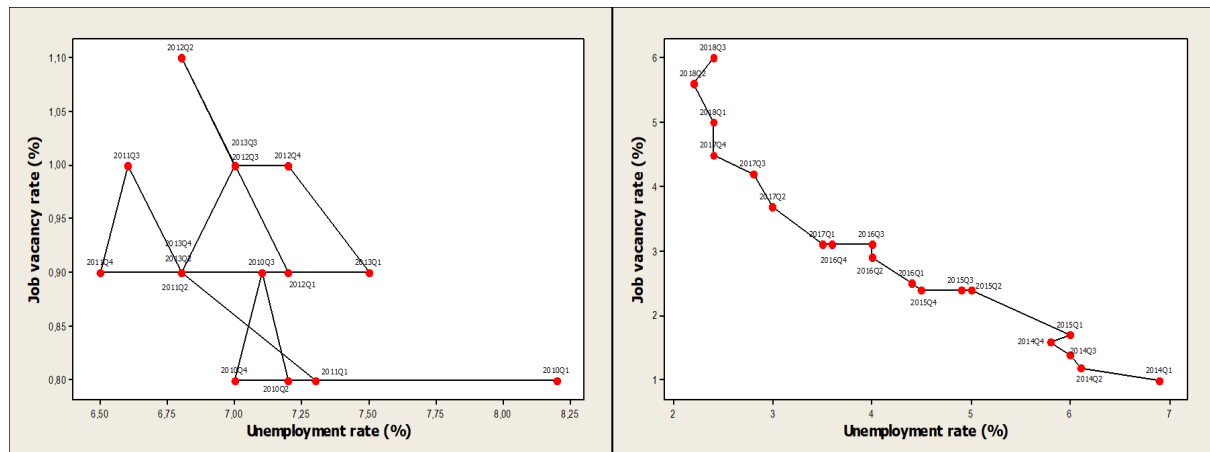
Source: Eurostat

Figure 8. Beveridge curve- Hungary, years 2010-2013 (left side) and years 2014-2018 (right part)
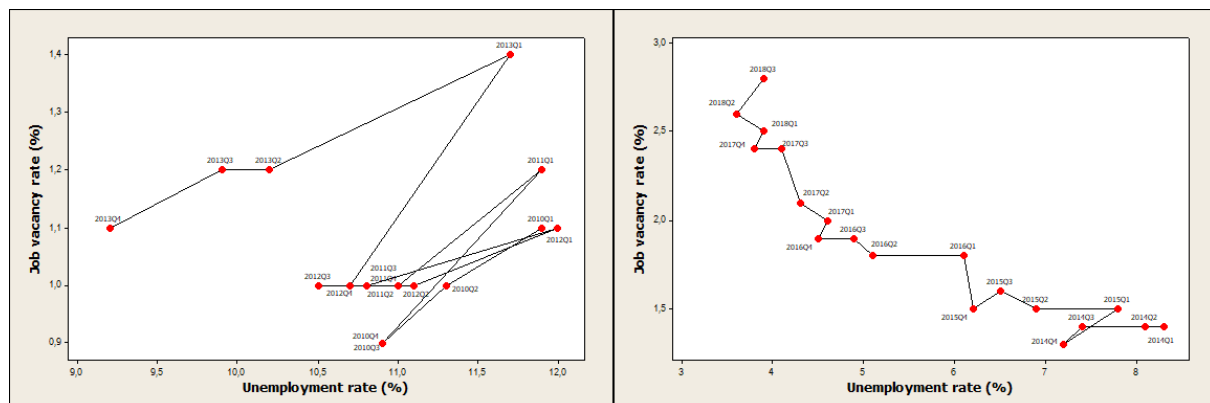
Source: Eurostat

The Polish economy was among the least affected between 2008 and 2009; however, the unemployment rate was relatively high compared to EU-28 average and reached 10.8% at the beginning of the observed period. The positive development in terms of reducing the unemployment rate was abruptly interrupted, and the increases with decreases alternated until the end of 2013. As seen from figure 9 the unemployment rate has been steadily declining since 2014, reaching a record low of 3.9% in third quarter 2018. According to OECD (2018), this

development was a result of rising employment but also a shrinking labor force. Like in other countries, shifts in the BC curve showed significant improvements in labor market performance.

The Slovak economy also recorded growth at a robust pace after the 2008-2009 recession. The start of production in the automotive industry has significantly contributed to the growth of production potential and the increase in the share of exports in GDP. The unemployment rate was highest among all V-4 countries reaching a level of 15% at the beginning of the reference period. According to OECD (2019a) employment growth has been strong and unemployment has been falling fast since 2014, though, there remain pockets of widespread joblessness in some regions and long-term unemployment has remained stubbornly high. Even in the case of the Slovak Republic, the shifts of BC curve show the volatile labor market developments in the first period, whereas in the second period the classical counter-clockwise movements were recorded (see Figure 10). The unemployment rate has dropped from 14.1% in 2014Q1 to 6.4% in 2018Q3. Moreover, the job vacancy rate has increased since 2014Q1 and reached 1.2%.

Figure 9. Beveridge curve - Poland, years 2010-2013 (left side) and years 2014-2018 (right part)
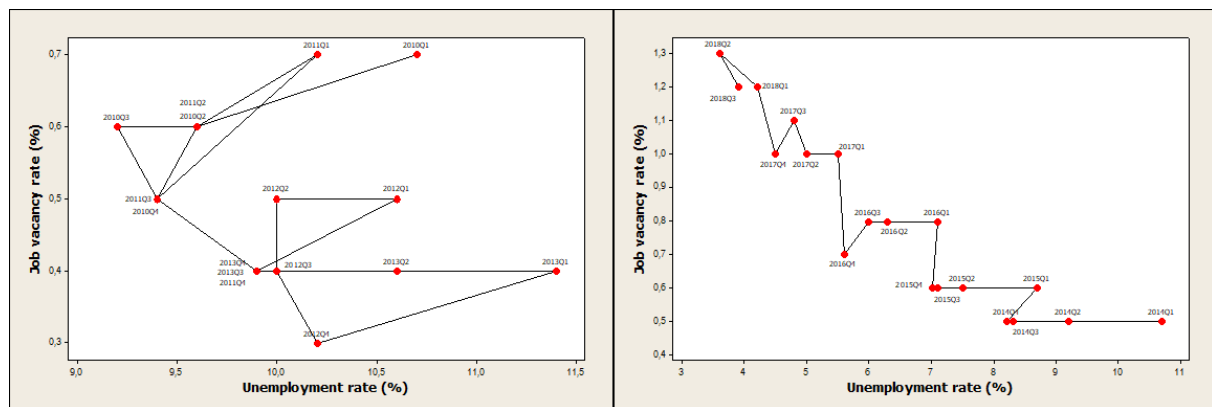
Source: Eurostat

Figure 10. Beveridge curve - Slovakia, years 2010-2013 (left side) and years 2014-2018 (right part)
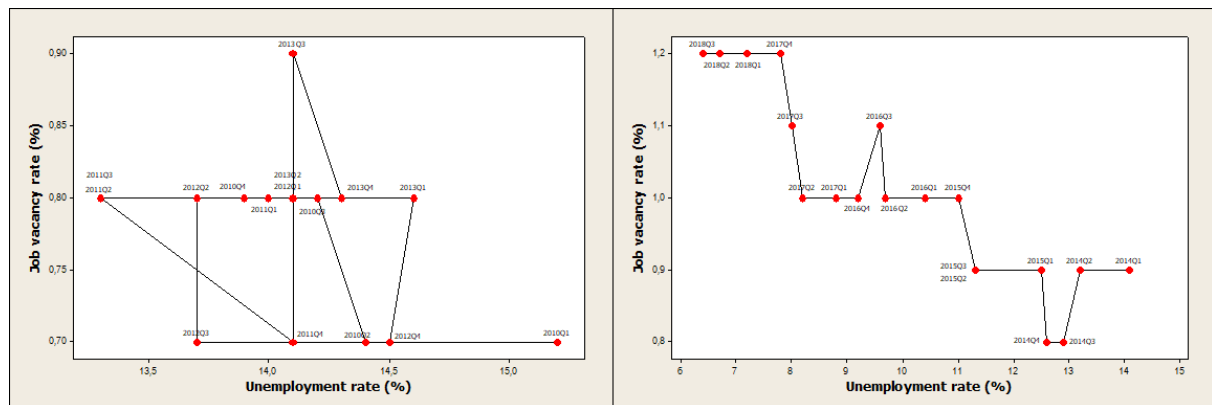
Source: Eurostat

Conclusion

This paper focused on an analysis of labor market development and the Beveridge curve shifts in the years 2010 to 2018. When evaluating Beveridge curve shifts, it is necessary to take into account these two basic facts: (i) shifts to the right and downwards at the same time are considered negative (a rising level of unemployment and a declining job vacancy rate); (ii) the evaluation must take into account the scale of the axes or ranges of values of the axes. Moreover, changes in the unemployment rate and job vacancy rate are consistent with cyclical changes, while outward shifts signal increasing mismatch. In other words, it means that there is increase in the level of structural unemployment. For all V-4 countries, we can see relatively high sensitivity of Beveridge curve shifts to a phase of the business cycle. Firstly, Beveridge curve movements were volatile in the period 2010-2013, which was due to fluctuations in economic performance. Secondly, shifts of the Beveridge curve to the left and upward (the job vacancy rate was increasing, while the unemployment rate was declining), which is peculiar to the prosperity phase. Our previous research shows same shifts before the 2008-2009 crisis.

The performed analysis leads to these conclusions: (i) after a short recession, all V-4s have experienced significant economic growth accompanied by remarkable improvement in labor market performance; (ii) development in the last quarters, however, indicates signs of overheating when a positive output gap is reached; (iii) the Beveridge curve quite reliably shows the development of the labor market and can therefore be recommended as an alternative indicator for an analysis of labor market performance.

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Inclusion of an International Financial Asset to Diversify the Investment Portfolio in Colombia

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Abstract:

The international diversification of investment portfolios is obtained by including a foreign financial asset and the benefit is the reduction of the market risk of the portfolio. This paper forms a portfolio with five shares of the Colombian market and diversifies it internationally with the Exchange Traded Fund (ETF) of the US market. To demonstrate the benefit of international diversification, the VaR (Value at Risk) of the two portfolios is quantified by two parametric methods: variance-covariance method and Monte Carlo simulation method. Volatilities are calculated by the GARCH (1,1) method and the EWMA method. For the Monte Carlo simulation method, the prices of the financial assets are modeled with the Geometric Brownian Motion and for the simulation of correlated values, the Cholesky decomposition is used. The results show that the ETF has lower risk than the local shares and has lower correlations with the shares generating lower VaR. In other words, the internationally diversified investment portfolio has lower risk than the locally diversified portfolio.

Keywords: international diversification of portfolios; Value at Risk; geometrical Brownian motion.

JEL Classification: E22; B17; C15; G32.

1. Introduction

The liberalization of markets and technological progress allow investors to invest in financial assets of any country. With this, it is possible to create investment portfolios with assets from different countries and in some cases reduce the risk due to international diversification (Switzer and Tahaoglu 2014). In addition, financial deregulation in countries generates opportunities to take advantage of international investments that reduce the risk in local investment portfolios (Dimson, Marsh and Staunton 2002).

The risk of an investment portfolio is quantified by the Value at Risk or VaR and is defined as the maximum loss with a probability and a time horizon. With international diversification the VaR of the investment portfolio is reduced (Jorion 1985; Xu 2003). With local financial assets, the portfolio diversifies, but with international assets, the diversification benefit is greater. For this reason, it is necessary to demonstrate with financial assets for investors of the Colombian market the benefit of diversifying internationally and thus take advantage of the investment options.

The objective of this paper is to demonstrate the benefits of international diversification for investors in the Colombian stock market by including the ETF (Exchange Traded Fund) SPY. This ETF replicates the S & P 500 index. The VaR of the local portfolio is calculated with five shares and the VaR of the internationally diversified portfolio. Parametric methods are implemented to calculate the VaR as the variance-covariances and Monte Carlo simulation.

2. Research background

The first research work on international diversification of portfolios dates back to 1968 and 1970. Grubel (1968) determined the international diversification of portfolios for investors in the United States using government bonds. Levy and Sarnat (1970) calculated the efficient Markowitz frontier with 28 stock indices for investors in the United States, finding that the greatest benefits of international diversification are obtained with assets from emerging markets. Lessard (1973) found that to reduce the risk in local investment portfolios, international assets should be included with small correlations among local assets. Years later they appear Errunza, Hogan, and Hung (1999) where they used financial assets that replicate stock market indices to form internationally diversified portfolios. They concluded that despite finding high correlations with foreign markets, the risk of the portfolio decreases significantly. For his part, Driessen (2007) showed that emerging market investment portfolios have better benefits when investing in foreign assets. Like this research, Estrada (2008) and Miralles *et al.* (2015) demonstrated the benefits of international diversification of portfolios with ETFs that replicate stock indexes.

3. Methodology

The benefit for international diversification was determined by measuring the VaR by the variance-covariance methods and by Monte Carlo simulation. The recommendation of the Basel Accord is to determine the VaR with a time horizon of 10 days and a confidence level of 99%. Two investment portfolios were formed: the first with five shares of different sectors of the Colombian market and the second diversified internationally with the SPY ETF. In each of the two portfolios, equal weight was considered for financial assets. In this way, two types of VaR were calculated for each investment portfolio. Thus, it was determined if the VaR decreases with the inclusion of the international asset.

The five local actions were the action of Ecopetrol (ECO), preferred stock of Bancolombia (PFBCOLOM), Isa (ISA), group Éxito (EXITO) and ETB. The locally diversified portfolio was made up of 20% pesos for each share and 16.67% for the internationally diversified portfolio. Daily prices were used from January 11, 2008 to March 8, 2019, for 2,935 data. Figure 1 shows the evolution of the prices of the five shares, the ECO and ETB shares are on the secondary axis.

Figure 1. Evolution of local share prices
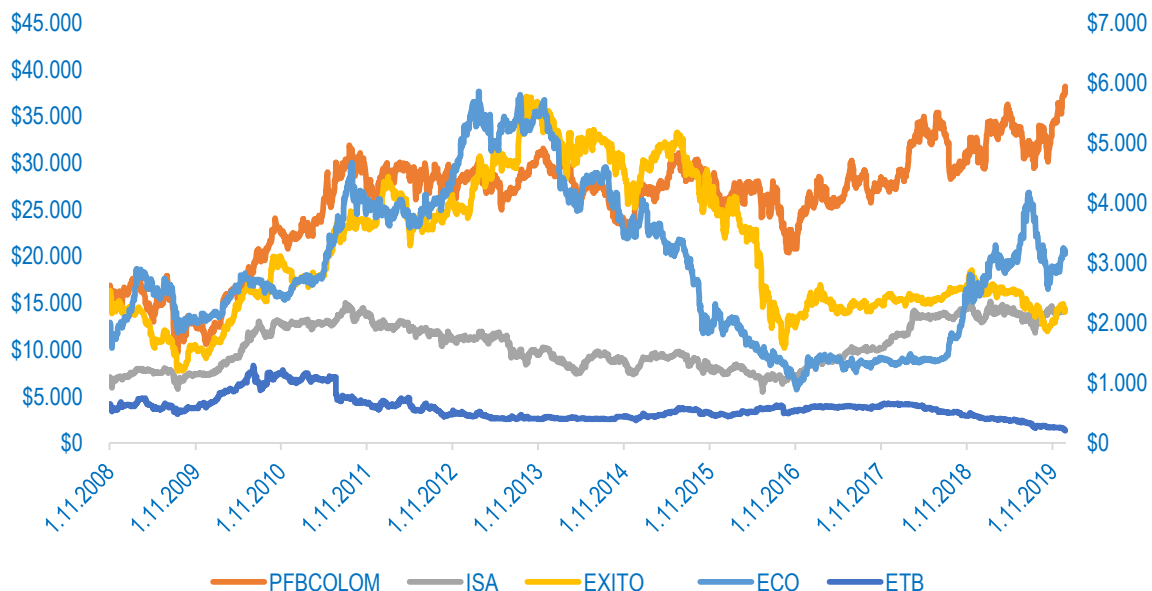
Logarithmic returns (r_t) were calculated for each action, as shown in Equation 1, where *S* corresponds to the price of the share.

$$r_t = ln\left(\frac{S_t}{S_{t-1}}\right) \tag{1}$$

The behavior of the logarithmic returns of the shares and the ETF can be seen in Figure 2 where the variability of returns is not constant over time; this is shown because there is a volatility cluster. This indicates that

dynamic volatility models such as EWMA (Exponentially Weighted Moving Average) or GARCH (1,1) (Generalized Autoregressive Conditional Heteroscedasticity) models should be used to calculate volatility.

Figure 2. Yields logarithmic behavior
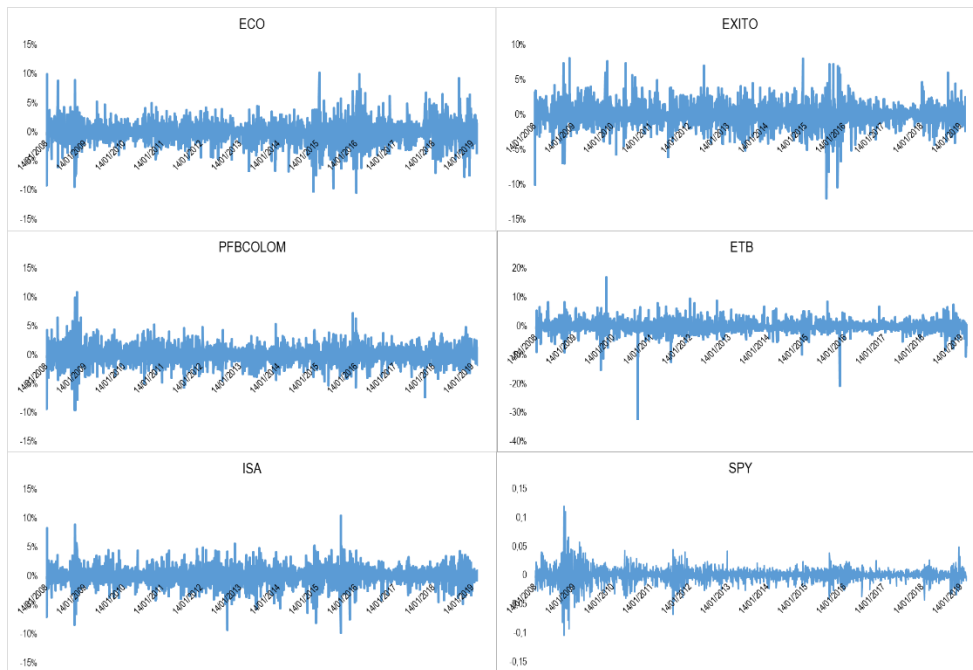
EWMA volatility is an exponential smoothing model where the most recent returns outweigh the returns that are furthest away in time. Unlike the historical volatility where all the returns have the same weight for the current volatility. In the EWMA model as it moves away in time the weight of each data decreases by a factor of lambda (λ) times. The Greek letter lambda is the decay factor that causes weights to decrease exponentially. Equation 2 presents the calculation of EWMA volatility.

$$\sigma_t = \sqrt{\lambda \sigma_{t-1}^2 + (1-\lambda) r_{t-1}^2} \tag{2}$$

Equation 2 is recursive because the volatility of the period t depends on the variance in the period t – 1, σ_{t-1}^2 and the yield of the period t – 1, , r_{t-1}^2. Lambda is the weight given to the variance in the period t – 1 and $(1-\lambda)$ is the weight for the period performance t – 1. The sum between λ and $(1-\lambda)$ must be equal to the unit.

To estimate the lambda value, the values recommended by J.P. Morgan in the methodology Riskmetrics where he uses lambda equal to 0.94 for daily yields and 0.97 for monthly yields, but in this paper the lambda value is estimated by the RMSE method (Root Mean Squared Error) that allows to determine an optimum lambda that minimizes the predicted error of the variance. The RMSE method is shown in Equation 3 where the objective is to find the lambda value that minimizes the RMSE conditioned to $0 \le \lambda \ge 1$.

$$RMSE = \sqrt{\frac{1}{T} \sum_{t=1}^{T} [r_{t+1}^2 - \sigma_{t+1}^2(\lambda)]^2} \tag{3}$$

The volatility GARCH (1,1) is similar to the EWMA model with the difference that a long term variance term is added that corresponds to the unconditional variance. The (1,1) in the GARCH indicates that the variance of period t depends on the first lag of the variance and the yield squared. Equation 4 presents the way to calculate the volatility by the GARCH (1,1) method.

$$\sigma_t = \sqrt{\omega + \alpha r_{t-1}^2 + \beta \sigma_{t-1}^2} \tag{4}$$

Where β is the weight given to the variance of the period t – 1, σ_{t-1}^2, α the weight to the yield squared of the period t – 1, r_{t-1}^2. Long-term volatility is denoted as V$_L$ and the weight assigned is γ, where $\omega = \gamma V_L$. In this way, the GARCH volatility can be rewritten in the following way (Equation 5).

$$\sigma_t = \sqrt{\gamma V_L + \alpha r_{t-1}^2 + \beta \sigma_{t-1}^2} \tag{5}$$

where: $\alpha + \beta \leq 1$ and $\gamma + \alpha + \beta = 1$. The GARCH model is equal to the EWMA model when $\gamma = 0$, where $\beta = \lambda$ and $\alpha = 1 - \lambda$.

The estimation of the parameters (β, α and β) is carried out using the maximum likelihood method, which seeks to maximize the function of Equation 6. For the estimation of the parameters, the discrete yields are used and then to find the volatility GARCH is performed with logarithmic yields.

$$\sum_{t=1}^{T} \left[-ln(v_t) - \frac{u_t^2}{v_t} \right]$$

(6)

where: v_t is the GARCH variance of the period *t* found with the discrete yields, u_t^2 corresponds to the discrete yield squared of period *t*.

After estimating the parameters the long term volatility is equal to ω/γ and $\gamma = 1 - \alpha - \beta$, then the long term volatility can also be calculated with $\omega/(1 - \alpha - \beta)$. Therefore, GARCH volatility can also be expressed as presented in Equation 7.

$$\sigma_t = \sqrt{(1 - \alpha - \beta)V_L + \alpha r_{t-1}^2 + \beta \sigma_{t-1}^2} = \sqrt{V_L + \alpha(r_{t-1}^2 - V_L) + \beta(\sigma_{t-1}^2 - V_L)}$$

(7)

In this paper we first calculate the GARCH volatilities for each of the assets and in case that by maximum likelihood γ = 0, the EWMA volatility is calculated. After estimating the volatilities for the financial assets, the VaR was calculated by two methods: variances-covariance's and Monte Carlo, these methods are part of the parametric VaR methods.

The variances-covariance's method has this name because it uses the variances-covariance's matrix to calculate the VaR. Equation 8 shows how to estimate the VaR of the portfolio in percentage form.

$$VaR_P = Z_{99\%}\sigma_P\sqrt{T}$$

(8)

where: $Z_{99\%}$ is the value of Z of the standard normal distribution with a probability of 99%. σ_P is the volatility of the investment portfolio. To use the dynamic volatilities, the VaR of each asset was first found and then, through the matrix of correlation coefficients, the VaR of the investment portfolio was calculated.

For the Monte Carlo method, the price of each of the assets was modeled with the Geometric Brownian Motion of Equation 9.

$$S_t = S_{t-1}e^{\left[\left(\mu - \frac{\sigma^2}{2} \right)\Delta T + \sigma\sqrt{\Delta T}\epsilon \right]}$$

(9)

In this model the price in the period *t*, S_t depends on the price in period *t - 1*. It is also a recursive model. Geometric Brownian Motion is a stochastic process that assumes that logarithmic returns are distributed normally with zero mean and variance one, that is, as a standard normal distribution (Jiménez, Restrepo and Acevedo 2015).

Because modeling is considered an investment portfolio, simulation must be performed as a correlated process where the random values of ∈ of each asset must be correlated with the other financial assets. For this, the Cholesky decomposition is used for correlated processes. With this method a matrix is determined that multiplied by its transpose, the result is the matrix of correlations between the variables. In other words, Equation 10 is fulfilled. Where A is the matrix found with the Cholesky decomposition and P is the matrix of correlations.

$$P = A \times A^T$$

(10)

Thus, the correlated random values K are found by multiplying the matrix A with a vector of uncorrelated random values Y. In this way, the uncorrelated random values are transformed into correlated random values K (see Equation 11).

$$K = A \times Y$$

(11)

The way to find the matrix A is by means of Equations 12 and 13.

$$a_{jj} = \sqrt{\rho_{jj} - \sum_{k=1}^{j-1} a_{jk}^2}$$

(12)

$$a_{ij} = \frac{\rho_{ij} - \sum_{k=1}^{j-1} a_{ik}a_{jk}}{a_{jj}}$$

(13)

Solving the Cholesky decomposition for six variables, we obtain the following equations for matrix A (see Equations from 14 to 35).

$$a_{11} = 1 \tag{14}$$

$$a_{21} = \rho_{12} \tag{15}$$

$$a_{31} = \rho_{13} \tag{16}$$

$$a_{41} = \rho_{14} \tag{17}$$

$$a_{51} = \rho_{15} \tag{18}$$

$$a_{61} = \rho_{16} \tag{19}$$

$$a_{22} = \sqrt{1 - \rho_{12}^2} \tag{20}$$

$$a_{33} = \sqrt{1 - \rho_{13}^2 - \frac{(\rho_{23} - \rho_{12}\rho_{13})^2}{1 - \rho_{12}^2}} \tag{21}$$

$$a_{44} = \sqrt{1 - \rho_{14}^2 - a_{42}^2 - a_{43}^2} \tag{22}$$

$$a_{55} = \sqrt{1 - \rho_{15}^2 - a_{52}^2 - a_{53}^2 - a_{54}^2} \tag{23}$$

$$a_{66} = \sqrt{1 - \rho_{16}^2 - a_{62}^2 - a_{63}^2 - a_{64}^2 - a_{65}^2} \tag{24}$$

$$a_{32} = \frac{\rho_{23} - \rho_{13}\rho_{12}}{\sqrt{1 - \rho_{12}^2}} \tag{25}$$

$$a_{42} = \frac{\rho_{24} - \rho_{14}\rho_{12}}{\sqrt{1 - \rho_{12}^2}} \tag{26}$$

$$a_{43} = \frac{\rho_{23} - \rho_{41}\rho_{13} - a_{42}a_{32}}{a_{33}} \tag{27}$$

$$a_{52} = \frac{\rho_{25} - \rho_{15}\rho_{12}}{\sqrt{1 - \rho_{12}^2}} \tag{28}$$

$$a_{53} = \frac{\rho_{35} - \rho_{15}\rho_{13} - a_{52}a_{32}}{a_{33}} \tag{29}$$

$$a_{54} = \frac{\rho_{45} - \rho_{51}\rho_{14} - a_{52}a_{42} - a_{53}a_{43}}{a_{44}} \tag{30}$$

$$a_{62} = \frac{\rho_{26} - \rho_{16}\rho_{12}}{\sqrt{1 - \rho_{12}^2}} \tag{31}$$

$$a_{63} = \frac{\rho_{36} - \rho_{16}\rho_{13} - a_{62}a_{32}}{a_{33}} \tag{32}$$

$$a_{64} = \frac{\rho_{46} - \rho_{16}\rho_{14} - a_{62}a_{42} - a_{63}a_{43}}{a_{44}} \tag{33}$$

$$a_{65} = \frac{\rho_{56} - \rho_{16}\rho_{15} - a_{62}a_{52} - a_{63}a_{53} - a_{64}a_{54}}{a_{55}} \tag{34}$$

$$a_{12} = a_{13} = a_{14} = a_{15} = a_{16} = a_{23} = a_{24} = a_{25} = a_{26} = a_{34} = a_{35} = a_{36} = a_{45} = a_{46} = a_{56} = 0 \tag{35}$$

4. Results

To determine the benefit for international diversification, the locally diversified VaR was calculated first with the shares of the Colombian market and then compared with the internationally diversified investment portfolio with the SPY ETF. From the daily data, the following returns were obtained, which is shown in Table 1 for 10 days for the six financial assets. The highest profitable asset is the international asset (SPY) and among the local actions, the highest profitability is PFBCOLOM. It is highlighted that two shares have expected negative returns, EXITO and ETB. For the purpose of the investigation these two actions were not ruled out.

From the Monte Carlo simulation, the average of the present value of the cash flows is 17,132,914 USD and the average of the NPV is 11,668,586 USD. This negative NPV result shows that the investor's decision is to reject the project and not to build the wind farm. The current conditions do not favor the start-up of these wind farms. This decision is made under the traditional methodology of valuation of investment projects. However, under the unconventional methodology of Real Options, the VPN needs to quantify the managerial flexibility that project managers have when market conditions change. In this case, managerial flexibility is associated with postponing investment in the wind farm until market conditions improve and a positive NPV is obtained, but in order to do this, the Real Option must be evaluated to postpone wind farm investment.

The Real Option was postponed by means of the binomial tree methodology to evaluate American financial options. The initial data to assess the Real Option are shown in Table 1.

Table 1. Profitability of financial assets

	ECO	PFBCOLOM	ISA	EXITO	ETB	SPY
Returns	0.17%	0.29%	0.26%	-0.05%	-0.44%	0.33%

On the other hand, volatilities for 10 days are shown in Table 2. The asset with the lowest volatility is the SPY ETF and the riskiest is ETB. The volatilities of the five local shares were calculated with the GARCH (1,1) method, but the volatility of the SPY ETF was calculated with the EWMA method because with the application of the maximum likelihood function the parameter ω equaled zero, therefore, the estimated lambda value was 0.796448373. Table 3 presents the estimated parameters for calculations of GARCH (1,1) volatilities of the five local actions.

Table 2. Volatilities of financial assets

	ECO	PFBCOLOM	ISA	EXITO	ETB	SPY
Volatilities	4.94%	3.50%	2.34%	5.47%	8.64%	1.71%

Table 3. Estimated parameters GARCH (1,1) volatility

	ECO	PFBCOLOM	ISA	EXITO	ETB
Omega	0.00001242	0.00000176	0.00000424	0.00001381	0.00000569
Alpha	0.20000032	0.06925082	0.14111260	0.24013483	0.05328534
Beta	0.79998726	0.93074742	0.85888316	0.75985136	0.94670987

Table 4 shows the correlation coefficients between the six financial assets. The PFBCOLOM and ISA shares had the highest correlation coefficients, while the SPY ETF and the ETB share had the lowest correlation coefficients. The ISA and EXITO shares with a value of 0.3837, followed by the PFBCOLOM and ECO shares with a value of 0.3606 hold the highest correlation coefficient. Conversely, the lowest correlation coefficients are SPY and ETF with a correlation of 0.1482 followed by the ETB and ECO shares with a value of 0.1490.

Table 4. Correlation coefficients.

	ECO	PFBCOLOM	ISA	EXITO	ETB	SPY
ECO	1	0.3606	0.3321	0.2689	0.1490	0.2934
PFBCOLOM	0.3606	1	0.3359	0.3239	0.1594	0.3655
ISA	0.3321	0.3359	1	0.3837	0.1744	0.2486
EXITO	0.2689	0.3239	0.3837	1	0.1688	0.2019
ETB	0.1490	0.1594	0.1744	0.1688	1	0.1482
SPY	0.2934	0.3655	0.2486	0.2019	0.1482	1

With the data presented above, the VaR was calculated with the parametric variances-covariances method. The VaR with a level of confidence for a 10-day time horizon of the locally diversified portfolio is 7.42% and the internationally diversified portfolio is 6.45%. The foregoing shows the benefit of diversifying internationally, the portfolio with the SPY ETF decreases the risk of the investment portfolio.

For the VaR by the parametric Monte Carlo simulation method, the Cholesky decomposition matrix should be used for five assets for the VaR of the locally diversified portfolio and the matrix for six assets for the VaR of the internationally diversified portfolio. Tables 5 and 6 show the values of the Cholesky matrices. These matrices are used to perform simulations with correlated random values.

Table 5. Cholesky matrix for five assets

	ECO	PFBCOLOM	ISA	EXITO	ETB
ECO	1	0.36062	0.33209	0.26886	0.14896
PFBCOLOM	0	0.93271	0.23174	0.24334	0.11327
ISA	0	0	0.91433	0.20805	0.10793
EXITO	0	0	0	0.90841	0.08664
ETB	0	0	0	0	0.97254

Table 6. Cholesky matrix for six assets

	ECO	PFBCOLOM	ISA	EXITO	ETB	SPY
ECO	1	0.36062	0.33209	0.26886	0.14896	0.29342
PFBCOLOM	0	0.93271	0.23174	0.24334	0.11327	0.27841
ISA	0	0	0.91433	0.20805	0.10793	0.09480
EXITO	0	0	0	0.90841	0.08664	0.03910
ETB	0	0	0	0	0.97254	0.11621
SPY	0	0	0	0	0	0.90132

In this way, the VaR with a confidence level for a 10-day time horizon of the locally diversified portfolio is 7.07% and the internationally diversified portfolio is 6.03%. The foregoing shows the benefit of diversifying internationally, the portfolio with the SPY ETF decreases the risk of the investment portfolio.

Conclusion

This article demonstrates the benefits that investors of the Colombian stock market have by including international assets in investment portfolios. The risk of a local portfolio is determined and purchased with the same portfolio, but diversified internationally with the SPY ETF. To avoid conversions of exchange rates, the VaR is calculated in percentage units.

As the SPY ETF is the asset with the lowest volatility, it is the asset with the highest expected return; otherwise, it found the ETB share that has the most negative profitability and the highest risk. Likewise, the SPY ETF and the ETB share are the assets with the lowest correlation coefficients. What makes the ideal ETF for diversification purposes?

To calculate the VaR, two parametric methods were implemented, the variance-covariances method and the Monte Carlo simulation method. For both methods, the VaR of the internationally diversified portfolio is lower. The SPY ETF decreases the risk to the portfolio of shares of the Colombian market due to its lower volatility and low correlation coefficients with local shares. This shows the benefit of the inclusion of this international asset in the stock investment portfolios in Colombia. Finally, it is highlighted that by the Monte Carlo simulation method lower values are obtained for the VaR.

This research determines that the SPY ETF that replicates the S & P 500 index has a low correlation with local assets and manages to reduce the risk of the portfolio of Colombian market shares. This was also found by Lessard (1973) when determining that lower VaR is obtained by including international assets with low correlations with the assets of the local portfolio. However, Errunza, Hogan, and Hung (1999) found that the assets that replicate the stock indexes have a higher correlation, but significantly reduce the risk of the portfolio. Similarly, Driessen (2007) and this research agree that the inclusion of foreign assets generates better benefits for emerging market investors, in this case Colombia. As in Estrada (2008) and Miralles *et al.* (2015) and in this research, the benefits of internationally diversifying local portfolios with ETFs that replicate stock indices were demonstrated.

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The Interaction Effect of Task – Technology Fit and Job Satisfaction on Job Performance in Enterprise Resource Planning Context: Case Study of Vietnamese Enterprises

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Abstract:

Job performance and technology in work have been researched with a number of global issues. The effect may have different levels in countries with the rapidly development in technology. It is important to know the impact with moderator value of job satisfaction to this relationship conducted by many previous papers. The main aim of this study was to examine the role of job satisfaction in the relationship between individual job performance and task – technology fit in Enterprise Resource Planning (ERP) environment. The study was test and examined by 225 individuals in the Vietnamese enterprises. The results of the study provided additional bases for assessing the success of ERP system to researchers, businesses, and suppliers. In addition, final figures of the PLS analysis revealed that task – technology fit was significantly and positively related to job satisfaction and individual job performance in ERP environment. Furthermore, job satisfaction had an effect on individual job performance in ERP context.

Keywords: Enterprise resource planning; job performance; job satisfaction; task – technology fit.

JEL classification: M15; O15; O3.

1. Introduction

Companies all over the world have adopted Enterprise Resource Planning (ERP) systems to integrate their business processes and stay competitive (Wei and Wang 2004). Because ERP is information system (IS), user perceptions about an ERP system play an important role in both usage and success of ERP (Delone and Mclean 2003). Some organizations have applied the ERP system but users are non-adoption of the system (Plaza and Rohlf 2008). In this case, job performance and job satisfaction are lower and turnover rates are higher (Sykes *et al.* 2014). In addition, if the job performance of individual is low, it will adversely affect the performance of organization (Kositanurit *et al.* 2006). As a critical indicator of ERP implementation success, it is important to examine possible factors that affect employee job performance (Sykes *et al.* 2014).

Bradford and Florin (2003) developed and tested a model of ERP implementation success which is measured by perceived organizational performance and user satisfaction. While the study of Bradford and Florin (2003) examined perceived organizational performance, the others explored the factors that can impact individual performance when using ERP systems such as Kositanurit *et al.* (2006), Park *et al.* (2007), Sykes *et al.* (2014),

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Sykes (2015). Kositanurit *et al.* (2006) provided evidence that system quality, utilization, and ease of use are the three important factors bearing on individual performance in ERP environment.

The study of Park *et al.* (2007) found that the users' ability to understand ERP knowledge influenced its performance and organizational support moderated the relationship between their absorptive capacity and performance. Sykes *et al.* (2014) show workflow advice and software advice are associated with job performance.

Besides, that study found that the interactions of workflow and software get-advice, workflow and software give-advice, and software get- and give-advice impacted job performance. Similarly, Sykes (2015) disclosed both traditional support structures and peer advice ties were found to influence the various outcomes including system satisfaction, job stress, job satisfaction and job performance. On the individual level, the factors that are proven to have an impact on the job performance in ERP environment include system quality, utilization, and ease of use, users' ability to understand ERP knowledge, workflow advice, software advice, traditional support structures and peer advice ties. Similar to the above studies, this work seeks to examine post - implementation employee job performance.

Based on these above content, this paper is structured as follows. First, the article describes the theoretical background on individual job performance, job satisfaction and task – technology fit. Next, it presents the research methodology used. Then, the paper also demonstrates the key findings of research. Finally, it offers various conclusions and further work.

2. Literature review and background theory

2.1. Individual job performance

Job performance relates to the accomplishment of a portfolio of tasks by an individual (Goodhue and Thompson 1995). According to TTF theory, performance benefits improve a range of performance outcomes (Furneaux 2012). The specific outcomes that have been examined in prior TTF research have included system use/intention to use, job performance, satisfaction with technology, opinions regarding a technology, appropriation changes made, decision efficiency, decision quality, decision strategy employed, joint profit attained, number of ideas generated, quality of solution, task completion time, task accuracy, ability to perform tasks, perceived ease of use, perceived usefulness, perceived playfulness, perceived risk, and so on (Furneaux 2012).

High performance implies that there is a mix between improved efficiency, improved effective and/ or improved quality (Goodhue and Thompson 1995). It was often confused with productivity (Ruppel and Harrington 1995). However, it is actually measured by more global variables such as the quality of outputs, job knowledge, leadership, or judgment (Ruppel and Harrington 1995). In the traditional office, job performance is largely established by scanning for employees' presence and through direct and indirect observations (Ruppel and Harrington 1995).

There exists a wide range of employee outcomes in ERP implementation, such as systems satisfaction, job stress, job satisfaction, and individual job performance (Sykes 2015). Job performance is a way to measure employee outcomes. Job performance is a good way of performing an employee's work (Sykes 2015). This study defined individual job performance in ERP environment was that the employee feels that with the help of ERP systems, he/she can improve a range of performance outcomes.

2.2. Job satisfaction

Job satisfaction is a function of "the extent to which rewards actually received meet the perceived equitable level of rewards" (Porter and Lawler 1968, 31). Job satisfaction is somehow combined to determine overall job satisfaction (Jiang *et al.* 2012). Previous studies disclosed that an increase in the user satisfaction of information systems would lead to positive emotions, attitudes, intentions, and behavior (Michalos 1985). According to Jiang *et al.* (2012), achieving a satisfaction at individual level has become major objective of professional information systems. In addition, satisfaction is a concept that is frequently studied when evaluating a product, service, practice, or condition (Davis 1989). The use of satisfaction to measure success is also consistent with theories such as theory of reasoned action - TRA (Ajzen and Fishbein 1969), theory of planned behavior (TPB) (Aijen 1991), information systems success model (Delone and Mclean 1992, 2003). In addition, if a member of information systems is his/ her satisfaction, it will lead to less the intention to leave the organization (Ferratt *et al.* 2005). As a result, satisfaction is used to explain and predict various aspects of information systems and behavior of stakeholders (Jiang *et al.* 2012). At present, many studies have evaluated the information systems success in general and ERP system in particular by measuring user satisfaction (Kanellou and Spathis 2013). According to discrepancy theory, the user satisfaction is divided into two categories related to information systems including user satisfaction with information systems and individual satisfaction related to information systems job (Jiang *et al.*

2012). While studies on user satisfaction with information systems have been relatively well conducted, paper has not found many studies on individual satisfaction related to information systems job. In particular, we find only a small number of studies that have studied the job satisfaction of ERP users including Morris and Venkatesh (2010), Sykes *et al.* (2014) and Sykes (2015). According to Sykes *et al.* (2014), job satisfaction affects employee's job performance in an ERP environment. In this study, the effect of job satisfaction to individual job performance in ERP context was also examined. Job satisfaction in this context is understood to be a combination of different aspects of work from using an ERP that makes employee satisfied with ERP systems.

2.3. Task – technology fit

Task – technology fit concept derives from the Task-Technology Fit theory (TTF) (Goodhue1995; Goodhue and Thompson 1995; Zigurs and Bucklva 1998). According to TTF, the task – technology fit represents the degree of matching or alignment between the capabilities of an information system and the demands of the tasks that must be performed (Furneaux 2012). Goodhue and Thompson (1995) proved that task - technology fit has an effect on the performance impacts including job performance, satisfaction, perceived usefulness, utilization, ease of use, perceived risk, and so on (Furneaux 2012). To the best of our knowledge, there are few studies on tasks - technology fit in ERP context. Only research by Kositanurit *et al.* (2006) investigated the impact of task-technology fit on job performance in ERP environment. Similar to Kositanurit *et al.* (2006), this study examined the impact of task-technology fit on individual job performance in ERP environment. This study defined task – technology fit is the degree of relevance between the ability of ERP system and the tasks which an employee must perform.

3. Methodology research method and research model

3.1. Research model and hypotheses

Based on three theories including TTF, TAM and TTF models combined, and the DeLone and McLean (2013) IS Success Model, this study develops the hypothesis H1. Firstly, according to TTF, task – technology fit impact on performance benefit (Goodhue and Thompson 1995) while individual job performance is used as an indicator of performance benefit (Furneaux 2012). Secondly, TAM and TTF models combined show that task – technology fit have significant effect on actual tool use (Dishaw *et al.* 2012). At the same time, the user behavior has an impact on the job performance (Rajan and Baral 2015). Finally, Petter *et al.* (2013) suggested that task compatibility impact on the IS success. Task compatibility is the fit or consistency between the task and the IS that supports that task (Petter *et al.* 2013). In this study, task – technology fit was defined similarly to task compatibility. Petter *et al.* (2013) measured the IS success based on the update DeLone and McLean (2003) IS success model, including information quality, system quality, service quality, intention to use/ use, user satisfaction, and net benefits. In this study, individual job performance was considered an indicator of net benefits. Based on the above arguments, this study developed hypothesis H1.

This hypothesis is also supported by several studies, such as Norzaidi *et al.* (2009), Teo and Bing (2008), Kositanurit *et al.* (2006), D'Ambra and Wilson (2004a), D'Ambra and Wilson (2004b), Belanger *et al.* (2001), Wongpinunwatana *et al.* (2000), Goodhue *et al.* (1997), Goodhue and Thompson (1995), Goodhue (1995). In particular, Staples and Seddon (2004) show that task – technology fit had an impact on individual job performance in both kinds of IT use, voluntary and mandatory as well. In the study, if an enterprise is being used an ERP system, employees are required to use it. So, Staples and Seddon (2004) strongly support to the hypothesis H1.

H1: The task – technology fit has a positive effect on the job performance of employee in ERP environment

Beside DeLone and McLean (2013) IS Success Model and ECM, the study of Sykes *et al.* (2014) demonstrates that job satisfaction affects employee's job performance in an ERP environment. Based on these backgrounds, this study proposes the H2 hypothesis. Additionally, supporting H2, many studies in the field of psychology find individual job satisfaction influencing job performance (Judge *et al.* 2001). According to Igbaria and Tan (1997), the job satisfaction of IS users has a strong impact on their job performance. Etezadi-Amoli and Farhoom (1996) and Bradford and Florin (2003) also showed similar results.

H2: Job satisfaction has a positive effect on the job performance of employee in ERP environment

Based on the findings from TTF and Belanger et al. (2001), the H3 hypothesis was developed:

H3: The task – technology fit has a positive effect on the job satisfaction of employee in ERP environment.

Figure 1 represents the proposed research model that was used for this research.

Figure 1. Proposed research model
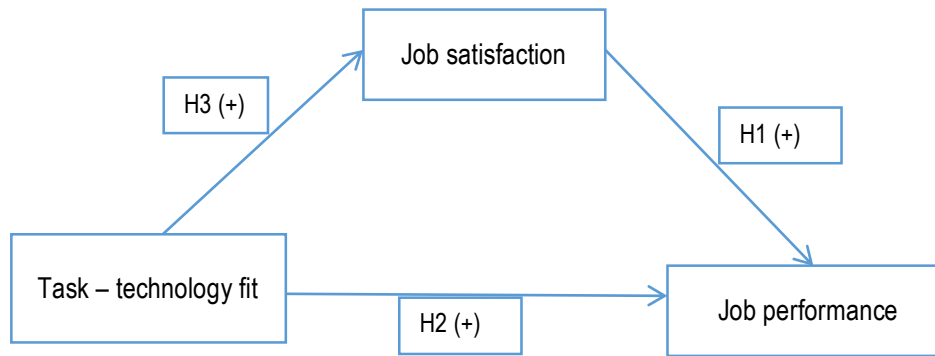
3.2. Research methodology

All research constructs included in this study had multi-item scales derived from the relevant literature. Each item in the survey employed a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree), and a not applicable (NA) option was available for the respondents to choose. The paper now elaborates its measures for the constructs. This study accepted scale of the individual job performance in ERP environment (PER) from Goodhue and Thompson (1995). PER is a first – order construct and reflective measures with 2 items. Paper measured task – technology fit (TTF) using a 11- item scale adapted from Kositanurit *et al.* (2006) that captures the eight dimensions including currency (CURR), right data (RDAT), right level of detail (RDET), meaning (MEAN), ease of use (EOU), training (TRAI), authorization (AUT) and system reliability (REL). TTF is a high – order construct and reflective – reflective measures. The job satisfaction (JOBSA) was measured with seven items adapted from Sykes *et al.* (2014). JOBSA is a first – order construct and reflective measures.

3.3. Data collection

This study was conducted using quantitative means as it aimed to validate the proposed relationships between factors affecting individual job performance in ERP context. The research instrument was used a questionnaire distributed to the end-users (employees). The data were collected from June 2017 to August 2017. The questionnaires were sent by email or postal mail to an initial sample of 500 employees who are using ERP system. This research collected 265 responses (response rate was 53%). Baruch and Holtom (2008) point out that for surveys addressed to individual, the average response rate is 52.7%. Thus, the response rate of our study seems to be above average. Of the 265 employees, 225 employees from 49 companies gave usable responses at all points of measurement. Hence, a number of final responders put into this research is 225 staffs.

Table 1 presents the sample characteristics age, gender, education and average computer experience. The sample consisted of 161 (71.6%) female and 64 (28.4%) male. Table 1 also shows that 75.5% of the sampled individuals were fewer than 35. In addition, 72% of the sampled individuals had bachelor degree. Average experience using an ERP system was 2.56 years.

Table 1. Sample characteristics (n = 225)

Category	Frequency	Percentages (%)	Category	Frequency	Percentages (%)
Age			*Education*		
< 35	170	75.5	Master	7	3.1
35 – 45	47	20.9	Bachelor	162	72
> 45	8	3.6	Colleges	43	19.1
Gender			Others	13	5.8
Male	64	28.4	*Average computer experience (years)*	2.56	
Female	161	71.6			

Because there was only one respondent for each individual, common method bias (CMB) was a potential problem. In this study, this article took a number of steps suggested by Podsakoff *et al.* (2003) to reduce the possibility of common method bias. Firstly, paper used multiple items for each construct and ensured the neutral wording of the items. Secondly, paper assured respondents of the anonymity of their responses and emphasized that there were no right or wrong answers; each of these actions enabled them to answer questions as honestly as possible. Thirdly, we separated the measurement of predictors and criterion variables in the questionnaire to diminish the respondent's ability and motivation to use his/her prior responses to answer subsequent questions.

Finally, we also used the Harman's single-factor test and the marker variable approach to control for Common Method Variance (CMV). Results are been discussed in data analysis and results below section.

4. Data analysis and results

4.1. Measurement model

This article estimated the internal consistency reliability, convergent validity, and discriminant validity of each measurement scale to assess the measurement model. Its research used two criterions for internal consistencies were composite reliability (CR) and Cronbach's alpha. All the reflective constructs in our model shown in Table 2 have a Cronbach's alpha over the cut off of 0.70, as suggested by Hair *et al.* (2016). Similarly, a composite reliability (CR) of all the constructs is also higher than 0.7, as suggested by Fornell and Larcker (1981), implying high internal consistency.

Convergent validity is verified through the t-statistic for each factor loading. In PLS_SEM, this paper could use an indicator's outer loading. An outer loading should be above 0.7 and the t-statistic for each outer loading significant (Hair et al. 2016). Results of measurement models show that the items including AUT1, AUT2, REL1, REL2 and TRAI have outer loading above 0.7 but the t-statistic for each outer loading was not significant. As such, the AUT1, AUT2, REL1, REL2 and TRAI were excluded from the TTF scales. Table 2 shows the results of final measurement models. All factor loadings are greater than the typical cut off value of 0.7 (Hair et al. 2016) and significant at the $p < 0.001$ level. In this study, we also used the average variance extracted (AVE) to assess convergent validity. An AVE value of 0.50 or higher indicates that, on average, the construct explains more than half of the variance of its indicators.

Table 2. Results summary of measurement models

Latent variable	Indicators	Convergent validity			Internal consistency reliability		Discriminant validity
		Loadings	Indicator reliability	AVE	Composite reliability	Cronbach's Alpha	
		> 0.7	>0.5	> 0.5	0.6 – 0.95	0.6 – 0.95	
PER	PER1: ERP systems system has a positive impact on my productivity in my job	0.966***	0.933	0.937	0.932	0.967	Yes
	PER2: ERP systems is an important aid to me in the performance of my job	0.970***	0.941				
JOBSA	JOBSA1: All in all, how satisfied are you with the persons in your work group	0.745***	0.554	0.608	0.892	0.916	Yes
	JOBSA2: All in all, how satisfied are you with your supervisor	0.809***	0.654				
	JOBSA3: All in all, how satisfied are you with your job	0.761***	0.578				
	JOBSA4: All in all, how satisfied are you with this organization, compared to most	0.787***	0.620				
	JOBSA5: Considering your skills and the effort you put into your work, how satisfied are you with your pay	0.748***	0.560				
	JOBSA6: How satisfied do you feel with the progress you have made in this organization up to now	0.808***	0.653				
	JOBSA7: How satisfied do you feel with your chance for getting ahead in this organization in the future	0.798***	0.637				

Latent variable	Indicators	Convergent validity			Internal consistency reliability		Discriminant validity
		Loadings	Indicator reliability	AVE	Composite reliability	Cronbach's Alpha	
		> 0.7	>0.5	> 0.5	0.6 – 0.95	0.6 – 0.95	
CURR	CURR: The data provided by ERP systems is up-to-date enough for my purposes	1.000	1.000	1.000	1.000	1.000	Yes
RDAT	RDAT: ERP systems available to me is missing critical data that are very useful to me in my job	1.000	1.000	1.000	1.000	1.000	Yes
RDET	RDET: ERP systems maintain data at an appropriate level of detail for my group's tasks	1.000	1.000	1.000	1.000	1.000	Yes
MEAN	MEAN: The exact definition of data fields relating to my tasks is easy to find out	1.000	1.000	1.000	1.000	1.000	Yes
EOU	EOU1: It is easy to learn how to use ERP systems	0.953***	0.908	0.912	0.904	0.954	Yes
	EOU2: ERP systems I use is convenient and easy to use	0.957***	0.916				

Note: *** $p < 0.001$.

To establish discriminant validity, we used the HTMT criterion, Fornell – Larcker criterion and cross loadings. The results of discriminant validity are shown in Table 3. Cross-factor loadings are reported in Appendix.

Table 3. Results of discriminant validity

	Mean	SD	CURR	EOU	MEAN	PER	JOBSA	RDAT	RDET
CURR	4.50	1.530	1.000						
EOU	4.428	1.383	0.390	0.955					
			0.410						
MEAN	4.62	1.346	0.387	0.535	1.000				
			0.387	0.562					
PER	5.029	1.327	0.351	0.716	0.634	0.968			
			0.362	0.779	0.657				
JOBSA	4.846	0.977	0.317	0.543	0.407	0.528	0.780		
			0.336	0.601	0.430	0.573			
RDAT	3.96	1.565	0.143	0.301	0.147	0.110	0.168	1.000	
			0.143	0.317	0.147	0.114	0.177		
RDET	4.69	1.338	0.618	0.375	0.519	0.492	0.374	0.125	1.000
			0.618	0.394	0.519	0.508	0.394	0.125	

Note: Number of the top rows: Fornell – Larcker criterion. Number of the below rows: HTMT criterion

The square root of the AVE of each construct should be higher than its highest correlation with any other construct (Fornell and Larcker 1981). Table 3 shows that the square root of AVE exceeds the correlation between other constructs. In addition, all HTMT of constructs are significantly smaller than 1 (Henseler *et al.* 2015). These results imply satisfactory discriminant validity.

4.2. Structural model

The structural model was examined to test the hypotheses. The R^2, which is generated for each regression equation, indicates the explanatory power or variance explained of the latent endogenous variable. Figure 2 shows the structural model result.

Figure 2. Result of proposed research model
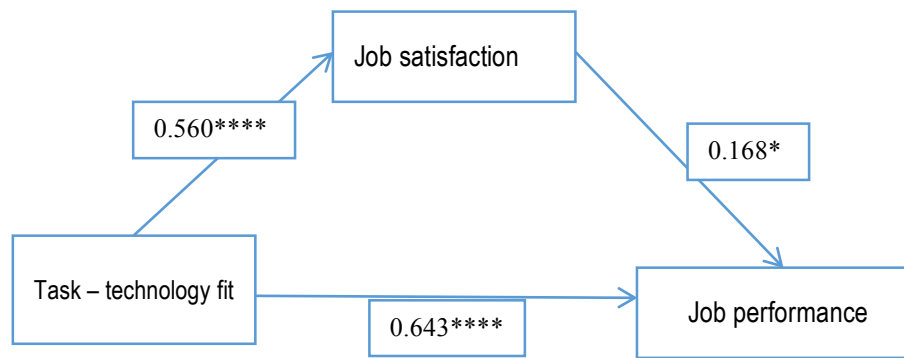
Note: *** p < .001.; * p < 0.05

The PLS path analysis results show that task – technology fit was significantly related to individual job performance ($\beta = 0.643$, $p < 0.001$) and job satisfaction ($\beta = 0.560$, $p < 0.001$) supporting hypotheses H1 and H2. Job satisfaction was significantly related to individual job performance ($\beta = 0.168$, $p < 0.05$) supporting hypotheses H3. The external variables including task – technology fit and job satisfaction could explain 56.2% variance in individual job performance ($R^2 = 0.562$). Task – technology fit explained 31.4% of variance of job satisfaction ($R^2 = 0.314$).

Next, it assessed the predictive relevance of the path model by Q^2 values. All Q^2 values are considerably above zero (Q^2 of individual job performance is 0.499 and Q^2 of job satisfaction is 0.175), thus providing support for the model's predictive relevance regarding the endogenous latent variables.

The final assessments address the f^2 effect sizes. Table 4 summarizes the results of the f^2 effect sizes with respect to all the relationships in the model. Target constructs appear in the first row, whereas the predecessor constructs are in the first column. Table 4 shows TTF has a large effect size of 0.647 on PER and of 0.458 on JOBSA. However, JOBSA has a small effect size of 0.044 on PER.

Table 4. f^2 and q^2 effect sizes

	f^2 effect sizes	
	PER	JOBSA
TTF	0.647	0.458
JOBSA	0.044	

Additionally, the variance inflation factor (VIF) was assessed to check multicollinearity. The collinearity diagnostics given in Table 5 shows that VIF for the independent variables higher than 0.20 (lower than 5) which further suggests that multicollinearity does not exist among the independent variables.

Table 5. Collinearity statistic

Construct	VIF
Task – technology fit (TTF)	1.458
Job satisfaction (JOBSA)	1.458

4.3. Mediation analysis

In this study, we examined a mediator variable, intervenes between two other related constructs. Specifically, it also examined the role of job satisfaction in the relationship from task – technology fit to individual job performance in ERP context. Table 6 shows result of mediator variable. Research finds that both direct effect and indirect effect are significant. Our finding provided empirical support for the mediating role of job satisfaction in the relationship from task – technology fit to individual job performance in ERP context. Because path coefficient of the relationship from task – technology fit to individual job performance was 0.643 and significant, path coefficient of the relationship from task – technology fit to job satisfaction was 0.560 and significant, and path coefficient of the relationship from job satisfaction to individual job performance was 0.168 and significant, job satisfaction represents complementary mediation of the relationship from task – technology fit to individual job performance in ERP context.

Table 6. Significance analysis of the direct and indirect effects

	Direct effect	95% confidence interval of the direct effect	*t* value	Significance (p < 0.05)?	Indirect effect	95% confidence interval of the indirect effect	*t* value	Significance (p < 0.05)?
TTF -> PER	0.643	[0.519; 0.757]	10.558	Yes	0.094	[0.017; 0.178]	2.283	Yes

4.4. The issue of Common Method Bias

This research used the Harman's single-factor test and the marker variable approach to control for CMV in PLS analysis. Result of Harman's single-factor test by EFA shows that one factor only accounts for 45.294% of the total variance. In this case, CMV is not a serious problem (Podsakoff and Organ 1986).

The marker variable approach was conducted by using marker variable. The first stage, we involved survey questionnaire that had a question as "Do you really like black coffee?" – this question was a marker variable (Lindell and Whitney 2001). The next stage, this paper used PLS to test path coefficient of the relationship from marker variable to other variable in proposal model including job satisfaction, task – technology fit and individual job performance. Analysis results showed that all path coefficients of the relationships from marker variable to job satisfaction, task – technology fit and individual job performance were less than 0.3 (-0.020, 0.097 and -0.110). This finding suggests that CMV was not a serious problem in this study. Besides, we also based on VIF to test CMB (Kock 2015). Table 5 shows that all VIFs resulting from a full collinearity test were lower than 3.3, the model can be considered free of CMB.

Conclusion

The results of this research supported most of the proposed relationships in the structural model. Most were consistent with the previous study results. Job satisfaction was significantly and positively related to individual job performance in ERP context (H1 is supported). Task – technology fit was significantly and positively related to job satisfaction and individual job performance in ERP environment (H2 and H3 are supported). This study also shows that job satisfaction is a complementary mediation variable in relationship between task – technology fit and individual job performance in ERP context.

In ERP context, Kositanurit *et al.* (2006) found that task – technology fit was the important factor bearing on individual performance. Besides, the study of Sykes *et al.* (2014) demonstrated that job satisfaction affects employee's job performance in ERP environment. However, the impact of job satisfaction on employee's job performance is not strong (Sykes *et al.* 2014). The result of this study is similar to the result of Kositanurit *et al.* (2006) and Sykes *et al.* (2014). We found that both task – technology fit and job satisfaction effected on employee's job performance in ERP environment but task – technology fit factor was more important than job satisfaction factor.

This research also proved that task – technology fit has a positive effect on the job satisfaction of employee in ERP environment. According to Belanger *et al.* (2001), task – technology fit had an impact on the job satisfaction in telecommuting. This result fits Belanger *et al.* (2001) but in ERP context. This study added to the empirical evidence in the application of background theories including TTF, TAM and TTF models combined, DeLone and McLean IS Success Model, and ECM. Besides, the results of this study also added to the theoretical background of ERP's success, namely, the individual job performance of employee in ERP context. Specifically, factors including job satisfaction and task - technology fit have a significant impact on the individual job performance of employee in ERP context. Furthermore, the results of this study help companies who are planning to use ERP systems and the ERP vendors and implementers become more knowledgeable about ERP's success and forecast success when using ERP systems.

In this study, the ERP success was measured by job performance of employees. The factors that have been tested are the impact on the individual job performance of employee in ERP context including job satisfaction and task - technology fit. Based on these results, the enterprises could plan the application to improve the efficiency of ERP systems. At the same time, the ERP vendors and developers could better advise and support their customers when delivering and deploying ERP systems.

This study has a few limitations. ERP implementations are complex and take time to complete (Markus and Tanis 2000, Volkoff *et al.* 2007). However, this study was restricted to the shakedown phase of the implementation, which is widely acknowledged to be the most critical in terms of continuation or abandonment of ERP (Morris and Venkatesh 2010). It could be that these findings might change over time, with some support structures gaining or losing influence on the outcomes of interest. Work that gives greater consideration to time would enrich our understanding of this phenomenon. Thus, an area for possible future work would be to examine ERP implementations and support structures over a significantly longer period of time - that is, across all phases of an

implementation. This study chose an approach for the employee to assess his or her job performance in ERP context that is not evaluated by the supervisor of the employee. Future research should collect data through supervisors to measure the job performance of employee in ERP context.

Acknowledgments

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APPENDIX

Cross loading

	CURR	EOU	MEAN	PER	PU	RDAT	RDET
CURR	**1.000**	0.390	0.387	0.351	0.314	0.143	0.618
EOU1	0.358	**0.953**	0.480	0.633	0.503	0.311	0.328
EOU2	0.386	**0.957**	0.542	0.732	0.595	0.264	0.387
MEAN	0.387	0.535	**1.000**	0.634	0.532	0.147	0.519
PER1	0.290	0.694	0.626	**0.966**	0.721	0.110	0.418
PER2	0.386	0.692	0.601	**0.970**	0.762	0.103	0.531
PU1	0.251	0.513	0.467	0.723	**0.884**	0.044	0.379
PU2	0.239	0.420	0.442	0.633	**0.855**	-0.060	0.422
PU3	0.318	0.469	0.358	0.633	**0.854**	0.039	0.356
PU4	0.292	0.485	0.469	0.679	**0.913**	0.013	0.382
PU5	0.250	0.535	0.543	0.687	**0.900**	0.030	0.342
PU6	0.302	0.593	0.506	0.669	**0.849**	0.064	0.323
RDAT	0.143	0.301	0.147	0.110	0.026	**1.000**	0.125
RDET	0.618	0.375	0.519	0.492	0.418	0.125	**1.000**

Study of Memory Effect in an Inventory Model with Price Dependent Demand

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Abstract:

In this paper, a memory dependent inventory model with price dependent demand rate has been developed. The paper wants to show that memory effects exist in the inventory model. To establish existence of memory effect in inventory system here, the fractional derivative has been used. The classical order inventory model is converted to fractional order model using memory kernel. Here we also establish the importance of time varying holding cost and price dependent demand. The long range, short range memory and no memory dependency of the inventory system has been recognized here using numerical examples. Using numerical example, we have also established that the minimized total average cost gradually decreases with increasing memory effect. Numerical example clears that in long memory effect the profit is maximum but in short memory effect profit becomes low. Finally, some conclusions are given.

Keywords: classical inventory model; long and short memory effect; fractional order inventory model.

JEL Classification: B20; B30; D53.

Introduction

Fractional Calculus (FC) is one of the important areas of research in basic science as well as in engineering (Agrawal 2007), (Baleanu, Asad and Petras 2012). It had been studied about three centuries to develop its basic theories and analytical schemes (El-Shamy and Fand Gohman 2014). Fractional calculus has huge applications on different subjects such as: fractional oscillator (He, Elagan and Li 2012), soliton rings in quantum semiconductor plasmas (Alexopoulos and Weinberg 2014), fractional-order formulation of power and exponential distributions (Saeedian *et al.* 2017), fractional entropies (Pakhira, Ghosh, Sarkar 2018). The integer order derivative and integration have physical and geometrical interpretations but fractional order derivative and integration has no such well establish physical and geometrical interpretation. Though the order of fractional derivative has no such geometrical meaning but this exponent is used in different physical and biological problem to carry different meaning. In physical problem it is notion of roughness (Banerjee, Ghosh and Sarkar 2017), in biological problem, economic (Pakhira, Ghosh, Sarkar 2018a; Pakhira, Ghosh, Sarkar 2018b; Pakhira, Ghosh, Sarkar 2018c and Pakhira, Ghosh, Sarkar 2019) it is the notion of memory (Saeedian *et al.* 2017). As it was used as the notion of memory of biological system, it can also be used as the memory parameter in the problems where human intervention present.

The inventory system (Harris 1915, Willson 1934, Within 1957, Ghare and Schrader 1963, Dave and Patel 1981, Duary 2014) is directly handled by human society. It is a memory affected system because in reality an object always gets its popularity to the society or the market due to its quality and commercial handling by the producing authority. If the product runs under poor impression to the customer, then its demand will gradually decrease. On

the other hand, in some sense demand of any object depends on dealing of the shopkeeper or staff of the company with the customer *i.e.* the selling of any product depends on some factors like the quality of the products as well as the shopkeeper's attitude or public relation etc. Hence, it can be claimed that past experience effect has great impact to increase or decrease profit of the business.

Recently, Pakhira *et al.* (2018a, 2018b, 2018c, 2019) developed some memory dependent Economic order quantity models. But the importance of price dependent demand and time varying holding cost has not been included there. In this article our purpose is to develop a memory dependent inventory model with price dependent demand (Burwell *et al.* 1997, Mondal, Bhunia and Maiti 2003). Many classical inventory models using classical calculus have been developed by many researchers (Harris 1915, Willson 1934, Ghare and Schrader 1963, Dave and Patel 1981). Inclusion of memory effect in the inventory model is necessary to handle practical business policy. One of the best ways of inclusion of memory effect in the EOQ model is the use of fractional calculus as fractional derivative is defined in terms of integration where the limits of integration are the initial state as well as current state.

Since, the Inventory models with ordinary derivative actually give only the instantaneous change of the inventory level. Integer order derivative is not able to incorporate memory effect to the system. To incorporate memory effect in the inventory, model the easiest way is fractional calculus (Saeedian *et al.* 2017, Pakhira, Ghosh, Sarkar 2018a, 2018b, 2018c, 2019).

In this paper, a memory dependent inventory model with price dependent demand has been developed. To develop the model, we have considered fractional order rate of change of inventory level. No fractional effect in the inventory holding cost, shortage cost has been included. It is clear from the numerical example that in long memory effect profit is more compared to the short memory effect.

The remaining part of the paper is organized as follows. In the section 2, some introduction of fractional calculus has been introduced, in section 4 classical inventory model is presented, fractional order inventory model with memory kernel is presented in the section 5, numerical example is taken in the section 6. Some conclusion is given in the last section.

1. Some introduction of fractional calculus

To develop the memory dependent inventory model, Caputo fractional order derivative has been used. Caputo fractional order derivative and some preliminary introduction of fractional calculus have been introduced in this section.

1.1 Caputo fractional derivative

For any differentiable function $f(x)$ on $[a,b]$ Caputo fractal derivative (Pakhira, Ghosh and Sarkar 2018, 14741-14751) of αth order is denoted by ${}_a^C D_x^\alpha \left(f(x) \right)$ and defined as follows:

$$ {}_a^C D_x^\alpha \left(f(x) \right) = \frac{1}{\Gamma(r+1-\alpha)} \int_a^x (x-\xi)^{(r-\alpha)} f^{(r+1)}(\xi) d\xi \tag{1} $$

where: $r \le \alpha < r+1$

The Caputo type fractional derivative is applicable for differentiable function only. Furthermore, in terms of Caputo definition of fractional derivative of any constant function is zero.

1.2 Fractional Laplace transforms method

Laplace transformation plays an important role in integer and fractional order differential equations. The Laplace transform of the function $f(t)$ is denoted by $F(s)$ and defined as:

$$ F(s) = L(f(t)) = \int_0^\infty e^{-st} f(t) dt \tag{2} $$

where: s > 0 and *s* is called the transform parameter.

The Laplace transformation of integer order derivative is defined as:

$$L\left(f^r\left(t\right)\right) = s^r F\left(s\right) - \sum_{k=0}^{r-1} s^{r-k-1} f^k\left(0\right) \qquad (3)$$

where: $f^r\left(t\right)$ denotes *r-th* order ordinary derivative of *f* with respect to *t* and for non - integer α, it is defined in generalized form (18) as:

$$L\left(f^\alpha\left(t\right)\right) = s^\alpha F\left(s\right) - \sum_{k=0}^{r-1} s^k f^{\alpha-k-1}\left(0\right) \text{ where } \left(r-1\right) < \alpha \le r. \qquad (4)$$

2. Assumptions

The model is developed depending on the below assumptions: (i)System consists of only one item; (ii) Time horizon is infinite; (iii)Lead time is zero; (iv)The demand rate is price dependent *i.e.:*

$$D\left(t\right) = a(p)^{-b} \qquad \text{for} \quad 0 \le t \le t_1$$
$$= c(p)^{-b} \qquad \text{for} \quad t_1 \le t \le T$$

(v) Shortages are allowed during the interval $[t_1, T]$; (vi) During the shortage time interval $[t_1, T]$, there is complete backlogging. The inventory model has been developed using the following notations, see Table 1.

Table 1. Used notations for the developed model

(i)D(t): Demand rate	(ii)Q: Total order quantity
(iii)h: Per unit cost	*(iv)*$C_1 t^\alpha$ Inventory holding cost per unit
(v)C_3: Ordering cost or setup cost per order	*(vi)I(t):* Stock level or inventory level at any time *t*.
(vii)T: Ordering interval	*(viii)*$HOC_\alpha(T)$*:* Inventory holding cost per cycle for fractional order model
(ix)T^*: Optimal ordering interval without fractional effect	$(x)TOC_\alpha^{av}$: Total average cost with fractional effect
(xi)TOC_α^*: Minimized total average cost for fractional order model	(xii)(B, .): Beta function
$(xiii)T_\alpha^*$: Optimal ordering interval with fractional effect	$(xiv)(\Gamma,.)$: Gamma function
$(xv)PC_\alpha$: Purchasing cost for fractional order model	$(xvi)SOC_\alpha$: Shortage cost for fractional order model
$(xvii)S$: Maximum backorder quantity	$(xviii)M$: Maximum inventory level
$(iv)C_2$: Shortage cost per unit per time	

3. Classical model formulation

Here, we assume that the inventory level depletes due to demand rate ap^{-b} during the time interval $[0, t_1,]$. Shortages are allowed during the time interval $[t_1, T]$. Inventory level reaches to zero level at $t = t_1$. Therefore, the classical inventory model is as follows:

$$\frac{dI(t)}{dt} = -ap^{-b} \quad \text{for} \quad 0 \le t \le t_1 \qquad \text{with } I\left(t_1\right) = 0 \qquad (5)$$

$$\frac{dI(t)}{dt} = -cp^{-b} \quad \text{for} \quad t_1 \le t \le T \quad \text{with} \quad I\left(t_1\right) = 0 \qquad (6)$$

Similar type of model has been described in Wilson (1934). Our attention is to develop memory dependent inventory model via fractional calculus.

4. Fractional order inventory model with memory Kernel

To study the influence of memory effects, first the differential equation (5-6) is written using the memory kernel function in the following form (7).

$$\frac{dI(t)}{dt} = -\int k\left(t - t'\right)\left(ap^{-b}\right)dt' \quad \text{for} \quad 0 \le t \le t_1 \qquad (7)$$

$$\frac{dI(t)}{dt} = -\int k\left(t-t'\right)\left(cp^{-b}\right)dt' \quad \text{for } t_1 \le t \le T \tag{8}$$

in which $k(t-t')$ plays the role of a time-dependent kernel. This type of kernel promises the existence of scaling features as it is often intrinsic in most natural phenomena. Thus, to generate the fractional order model, we consider $k(t-t') = \frac{1}{\Gamma(1-\alpha)}(t-t')^{\alpha-2}$, where $0 < \alpha \le 1$ and $\Gamma(\alpha)$ denotes the gamma function. Using the definition of fractional order derivative (Saeedian *et al.* 2017), the equation (7-8) can be written to the form of fractional differential equations with the Caputo-type derivative in the following form as,

$$\frac{dI(t)}{dt} = -{}_0D_t^{-(\alpha-1)}\left(ap^{-b}\right) \quad \text{where } 0 \le t \le t_1 \tag{9}$$

$$\frac{dI(t)}{dt} = -{}_0D_t^{-(\alpha-1)}\left(cp^{-b}\right) \quad \text{where } t_1 \le t \le T \tag{10}$$

Now, applying fractional Caputo derivative of order $(\alpha-1)$ on both sides of (5,6), and using the fact that Caputo fractional order derivative and fractional integral are inverse operators, the following fractional differential equations can be obtained for the model

$${}_0^C D_t^{\alpha}\left(I(t)\right) = -ap^{-b} \quad \text{for} \quad 0 \le t \le t_1 \tag{11}$$

$${}_0^C D_t^{\alpha}\left(I(t)\right) = -cp^{-b} \quad \text{where } 0 < \alpha \le 1.0, \text{ for } t_1 \le t \le T \tag{12}$$

with conditions $I(t_1) = 0$.

Long and Short Memory Effect. The strength of memory is controlled by the order of the fractional order derivative and fractional order integration. If memory index α is in (0, 0.5] then we define the system as the long memory affected system and for short memory affected system α is in (0, 0.5].

4.1 Fractional order inventory model analysis

Here, considering all the above assumptions like classical model, the fractional order inventory model is developed by the following fractional order differential equations as follows

$${}_0^C D_t^{\alpha}\left(I(t)\right) = -ap^{-b} \quad \text{where } 0 \le t \le t_1 \tag{13}$$

$${}_0^C D_t^{\alpha}\left(I(t)\right) = -cp^{-b} \quad \text{where } t_1 \le t \le T \tag{14}$$

$$D^{\alpha} \equiv \frac{d^{\alpha}}{dt^{\alpha}}, \text{where}, 0 < \alpha \le 1$$

Using the boundary condition I(t$_1$) = 0 on the equation (13, 14) and we get the inventory level at time *t* being,

$$I(t) = \frac{a(p)^{-b}}{\Gamma(1+\alpha)}\left(t_1^{\alpha} - t^{\alpha}\right) \tag{15}$$

$$I(t) = \frac{c(p)^{-b}}{\Gamma(1+\alpha)}\left(t_1^{\alpha} - t^{\alpha}\right) \tag{16}$$

Since, the positive inventory level reduces during the time interval [0, t$_1$] therefore the maximum inventory level is:

$$M = I(0) = \frac{a(p)^{-b} t_1^{\alpha}}{\Gamma(1+\alpha)} \tag{17}$$

Maximum backlogged demand is denoted by *S* and defined as:

$$S = -I(T) = \frac{c(p)^{-b}}{\Gamma(1+\alpha)}\left(T^{\alpha} - t_1^{\alpha}\right) \tag{18}$$

Therefore, order size during the total time interval [0, T] is obtained as:

$$Q = M + S = \frac{a(p)^{-b}\left(t_1^{\alpha}\right)}{\Gamma(1+\alpha)} + \frac{c(p)^{-b}\left(T^{\alpha} - t_1^{\alpha}\right)}{\Gamma(1+\alpha)} \tag{19}$$

Total order quantity is *Q* and per unit cost is *h* per unit, then purchasing cost with fractional effect:

$$PC_{\alpha} = h \times Q = h\left(\frac{a(p)^{-b}\left(t_1^{\alpha}\right)}{\Gamma(1+\alpha)} + \frac{c(p)^{-b}\left(T^{\alpha} - t_1^{\alpha}\right)}{\Gamma(1+\alpha)}\right) \tag{20}$$

Holding cost per unit is assumed as $C_1 t^{\alpha}$ then the total inventory holding cost [8, 9] is denoted by $HOC_{\alpha}(T)$ and defined as:

$$HOC_{\alpha}(T) = C_1 \int_0^{t_1} t^{\alpha} \frac{a(p)^{-b}}{\Gamma(1+\alpha)}\left(t_1^{\alpha} - t^{\alpha}\right)dt = \frac{aC_1\alpha(p)^{-b}\left(t_1\right)^{2\alpha+1}}{\Gamma(1+\alpha)(\alpha+1)(2\alpha+1)} \tag{21}$$

Shortage cost during the total time interval $[t_1, T]$ is denoted by $SOC_{\alpha}(T)$ and defined as:

$$SOC_{\alpha}(T) = -C_2 \int_{t_1}^{T} \frac{c(p)^{-b}}{\Gamma(1+\alpha)}\left(t_1^{\alpha} - t^{\alpha}\right)dt = \frac{C_2 c(p)^{-b}}{(1+\alpha)\Gamma(1+\alpha)}\left(T^{\alpha+1} - (\alpha+1)Tt_1^{\alpha} + \alpha t_1^{\alpha+1}\right) \tag{22}$$

$\left(\text{where } C_2 \text{ is the shortage cost per unit per unit time.}\right)$

Therefore, the total average cost per unit time per cycle is given below:

$$TOC_{\alpha}^{av}(T) = \frac{\left(PC_{\alpha} + HOC_{\alpha}(T) + C_3 + SOC_{\alpha}\right)}{T} = \left(AT^{-1} + B_1 T^{\alpha-1} + CT^{\alpha} + DT^0\right) \tag{23}$$

where, $A = \dfrac{\alpha C_1 a(p)^{-b}\left(t_1\right)^{2\alpha+1}}{(2\alpha+1)(\alpha+1)\Gamma(\alpha+1)} + C_3 + \dfrac{\alpha C_2 c(p)^{-b}\left(t_1\right)^{\alpha+1}}{(\alpha+1)\Gamma(\alpha+1)} + \dfrac{ha(p)^{-b}\left(t_1\right)^{\alpha}}{\Gamma(\alpha+1)} - \dfrac{hc(p)^{-b}\left(t_1\right)^{\alpha}}{\Gamma(\alpha+1)}$

$B_1 = \dfrac{hc(p)^{-b}}{\Gamma(\alpha+1)}, C = \dfrac{C_2 c(p)^{-b}}{(\alpha+1)\Gamma(\alpha+1)}, D = -\dfrac{C_2 c(p)^{-b} t_1^{\alpha}}{\Gamma(\alpha+1)}.$

The inventory model can be written in the following form as:

$$\begin{cases} \text{Min} TOC_{\alpha}^{av}(T) = \left(AT^{-1} + B_1 T^{\alpha-1} + CT^{\alpha} + DT^0\right) \\ \text{Subject to } T \geq 0 \end{cases} \tag{24}$$

The minimized total average cost and theoptimal ordering interval has been obtained from the non-linear programming problem (24).The numerical results of the minimized total average cost and optimal ordering interval are obtained in the next section for different values of the considered parameters.

5. Numerical example

To find the minimized total average cost and optimal ordering interval of the fractional order inventory model with different values of the memory index we consider values of the parameter values in appropriate units as: a = 6; c = 20; b =.08; h = 300; C_1 = 0.7; C_2 = 0.8; p = 120; C_3 = 200; t_1 = 1000.5678. For these values of the parameters and different values of memory index (α) we have calculated the afore said values, presented in Table 2.

Table 2. Minimized total average cost (TOC_{α}^{*} (T)) and optimal ordering interval (T_{α}^{*}) for $0 < \alpha \leq 1.0$.

α (Memory index)	T_{α}^{*} (Optimal ordering interval)	TOC_{α}^{*} (T) (Minimized total average cost)
0.1	2.4757×10^3	2.5492
0.2	1.9728×10^3	8.9393
0.3	2.0816×10^3	30.2383
0.4	2.4609×10^3	101.4846
0.5	3.0604×10^3	333.3243

α (Memory index)	T_α^* (Optimal ordering interval)	TOC_α^* (T) (Minimized total average cost)
0.6	3.8769×10^3	1.0671×10^3
0.7	4.9154×10^3	3.3417×10^3
0.8	6.1800×10^3	1.0301×10^3
0.9↑(gradually increasing memory effect)	7.6715×10^3	3.1449×10^3
1.0	9.3875×10^6	9.5584×10^3

It is clear from the Table 2 that for Long memory effect *i.e.* for $\alpha = 0.1, 0.2$ the minimized total average cost are 2.5492 and 8.9393 unit and optimal ordering interval is 2.4757×10^3 and 1.9728×10^3 unit respectively. On the other hand for low memory effect ($\alpha = 0.8$) minimized total average cost and optimal ordering interval are respectively 1.0301×10^3 unit and is 6.1800×10^3 unit but for memory less system $(\alpha = 1.0)$ those values are 9.5584×10^3 unit and optimal ordering interval is 9.3875×10^3 unit. Hence, the optimal ordering interval becomes least at $\alpha = 0.2$ and it increases with below and above. From the above discussion we can conclude that for long memory effect or low memory effect, business run long time to reach the minimum value of the total average cost.

In Figure 1 we have presented the total average cost as function of ordering interval (*T*) and the price value (*p*) for different values of the memory index (α) and other parameters are same as the previous. It is observed from the Figure 1 that for gradually decreasing memory effect, total average cost gradually increases. Thus the business will run positively if memory effect is included moderately. In reality if we apply a lot of previous memory then we fill fare to take any decision regarding new business policy.

Figure 1. Total average cost as function of ordering interval and price value

(a)

(b)

(c)

(d)

(e)

(f)
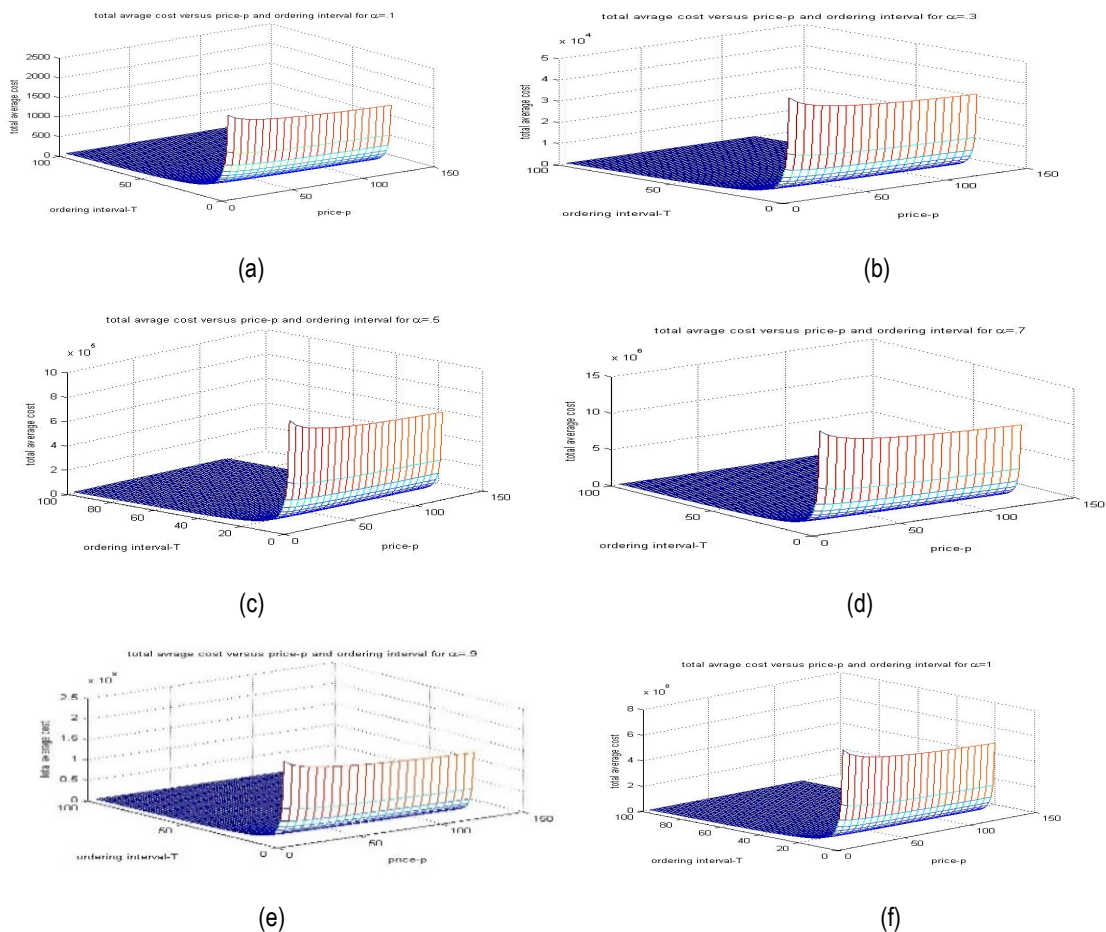
Note: (a) $\alpha = 0.1$ (b) $\alpha = 0.3$ (c) $\alpha = 0.5$ (d) $\alpha = 0.7$ (e) $\alpha = 0.9$ (f) $\alpha = 1.0$

To study the effect of memory parameter in the inventory system, we have drawn the inventory holding cost and shortage cost for different values of α.

Figure 2. Graphical presentation

(a)

(b)

(c)

(d)
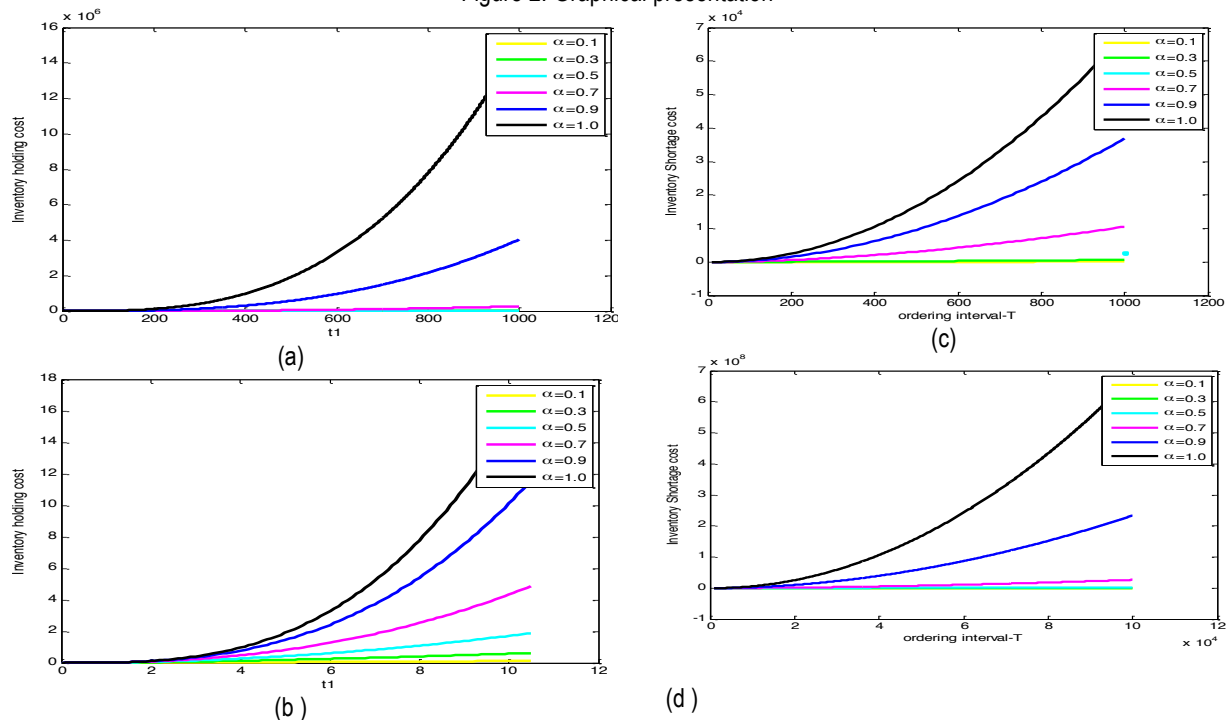
From the Figure 2, it is observed that the inventory holding cost and shortage cost are decreasing with respect to memory index α. Thus the existence of memory effect is justified in the inventory system. If we increase duration of stock period, then it is observed that shortage cost almost vanish for $\alpha > 0.7$.

Conclusions

In this paper, we have studied a memory dependent inventory model with price dependent demand rate where shortages are allowed and demand rate is also price dependent during shortage time. Numerical example shows that the minimized total average cost is gradually decreasing with gradually increasing memory effect. From the numerical example studies, it is clear that long memory effect profit is high compared to the low or memory less system. From the graphical presentations, it is observed that the pick of the total average cost is lowest for $\alpha = 0.1$.

All numerical examples and graphical presentations clear that system has memory effect. For the future purpose, more work on the inventory system will be done using fractional calculus. It may be extended to fit the practical data and theoretical data using the real market studies.

Acknowledgements

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Radio Frequency Identification (RFID) Technology for Support Supply Chain Strategic to Achieve High Performance in Textile and Apparel Industries of Indonesia

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Abstract:

The Textile and Apparel industry of Indonesia used to contribute about 1.2% of gross domestic product (GDP) in the past. However, this position has followed a reverse trend in recent years. The imports were increased as compared to the exports which decreased the overall contribution of Textile and Apparel industry between 2016 and 2017. To address this issue, this study examined the effective supply chain activities through radio frequency identification (RFID) using survey method to collect the necessary data. Questionnaires were distributed among the employees of Textile and Apparel companies. While analyzing the data by using PLS-SEM, it was found that RFID was contributing majorly in supply chain operations and maintained significant and positive effect on the performance of supply chain. Moreover, staff services quality had moderating role between RFID and the operations of Textile and Apparel industry. The study is one of the first attempts to examine the effect of RFID on supply chain operations of Textile and Apparel companies. Thus, the current study is helpful for practitioners to resolve the issues of concerned industry.

Keywords: RFID technology; supply chain strategic; performance; textile industry; Indonesia.

JEL Classification: O14; O32; O33.

1. Introduction

Textile industry is one of the fastest growing industries which has meaningful contribution to the nation's economic growth in Indonesia (Pang and Abdullah 2013). From other manufacturing sectors, this sector contributes significantly in economic growth (Douglas 1989). In Indonesia, this industry is the 3rd major foreign exchange contributor after the electronic as well as palm oil industries (Lim *et al.* 2010, Azmi *et al.* 2018). Therefore, Indonesian Textiles and Apparels industry is the backbone of Indonesian economy.

Based on the past few year data, the Textile and Apparel (T&A) industry of Indonesia has been contributing about 1.2% of gross domestic product (GDP) (Newspaper 2017). The performance of industry up to 2014 was sufficient to contribute in economy. However, export data before 2014 demonstrated to be very positive and predicted bright future for this industry. Following by the previous years, in 2014, the imports were $ 9.1 billion and exports were $11.03 billion. Exports were excess than imports. However, now the situation is not in the favor of industry. Indonesian Textiles and Apparels sector declining in the export performance as compared to the imports which has negative influence on GDP.

During the year of 2008, Indonesian Textile and Apparel (T&A) industry shows higher exports as compared to the imports. In this year, exports were $ 5.10 billion higher than the imports. Between 2007 and 2008, this industry also showed high exports as compared to the imports. Exports were $ 4.9 and $ 4.7 billion in 2007 and 2008, respectively, which were higher than imports. This had significant impact on GDP as compared to the other industries. This industry was leading with important contribution in the economy.

However, this position became reversed in immediate few years. As it is shown in the Table 1, in 2016 and 2017, the imports were increased as compared to the exports. In 2016, imports were $ 14.93 billion and exports were $ 11.90 billion. In cases of 2017, imports were $ 16.4 billion and exports were $ 12.06 billion. In these two years, total balance was not in the favor of industry. In 2016 and 2017, imports were $ 3.03 and $ 4.34 billion higher than exports, respectively.

Table 1. Indonesian textiles and apparels trading (2007-2017)

Year	Import	Export	Balance
2007	6.00	10.90	4.90
2008	5.60	10.30	4.70
2009	5.40	10.50	5.10
2010	4.40	8.93	4.53
2011	5.65	9.33	3.68
2012	8.17	10.81	2.64
2013	8.91	9.46	0.55
2014	8.78	10.25	1.47
2015	9.10	11.03	1.92
2016	14.93	11.90	-3.03
2017	16.40	12.06	-4.34

Source: Developed by the current study

Indonesian Textiles and Apparels Industry needs to explore the reasons of low performance and needs to find remedies. In the context of current study, in Textiles and Apparels Industry, supply chain is one of the important sectors, which has important contribution. As the supply chain activities have major role in Textiles and Apparels Industry of every country (Keung Kwok and Wu 2009). Low performance of supply chain practices in this industry has significant negative influence on overall performance. As it is one of the most important elements of the textile industry (Keung Kwok and Wu 2009).

The industries shall emphasis on contemporary as well as modernization of management, technology advancement on automation to enhance the performance through supply chain. Therefore, to address the above issues in Indonesian Textiles and Apparels, the current study comes up with supply chain strategies to determine the possible issues. This study is one of the attempts to boost this industry performance through effective supply chain activities by using radio frequency identification (RFID). Hence, the primary objective of the current study is to investigate effective supply chain activities through RFID to enhance Indonesian Textiles and Apparels Trading volume. However, the sub- objectives are as follows:

1. To investigate the role of effective delivery system and information communication technology (ICT).
2. To investigate the moderating role of staff services quality.

This study has major contribution in literature. As this study is one of the first study which creates a link between the implementation of supply chain practices and improvement of Indonesian Textiles and Apparels sector. In rare cases any study formally documented the issue of low trading performance of this sector through better supply chain management practices. This study reveals that staff services quality has significant contribution towards higher performance among textile firms. Effective delivery system, better use of information communication technology and good services can fix the issue in this industry. Thus, the study has multiple contribution in literature.

Practically, this study is important for Indonesian Textiles and Apparels firms to apply the current study to boost their supply chain operations. The current study is also helpful for practitioners to resolve the issue of this industry. Therefore, the current study contributed theoretically as well as practically.

2. Literature review

Radio frequency identification (RFID) technology is based on information communication technology (ICT) and it has recently been used for developing technology in Hong Kong. It encourages the accomplices to gather constant information at each point-of-sale (POS), which is powerful in imagining real offers of advertise patterns. The technology is additionally gainful for clients making choices in the best way to match different garments inside a couple of minutes which increases the quality of the services and decreases the issue in delivery time. In some retail shops, RFID labels are connected to fashionable garments, and afterward used to catch client inclinations and screen stock at every progressively. Notwithstanding, this technology is being connected to

traceability of the orders in a store network (Kelepouris *et al.* 2007), which is helpful to change on productivity of item (Zare Mehrjerdi 2008).

Figure 1. Supply chain network in the apparel industry
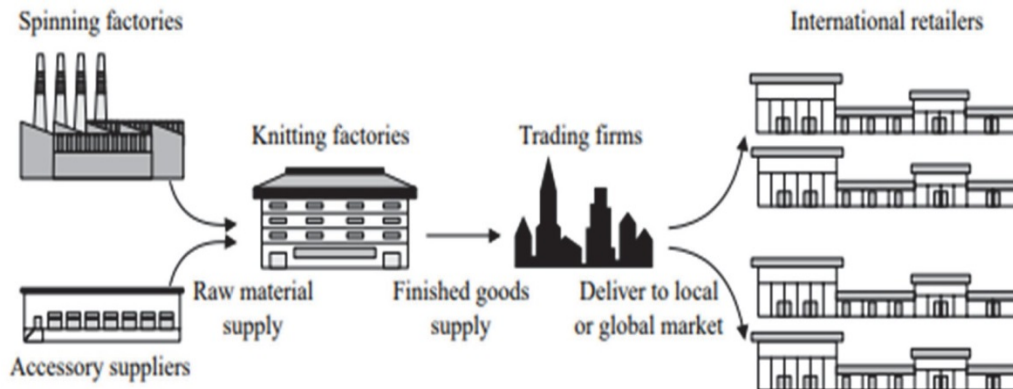
Source: Keung Kwok and Wu (2009)

Various issues present in the textile industry is more probable subject to regular variables and introduce various supply chain interventions to overcome problems. Short item life cycle, long creation lead time, and high anticipating errors are basic issues found in the textile industry (Lam and Postle 2006). To control these issues, the RFID technology through information communication technology (ICT) is recommended. Figure 1 shows how RFID is important to resolve issue and increases the quality of the services by decreasing the delivery time.

As per the Newspaper (2017), a supply chain management includes the arranging and management of everything being equal engaged with sourcing and acquirement, transformation, and all coordination's management exercises. In an intra-supply chain, collaborative supply chain organizes collaborators and connected to upgrade the straightforwardness of real-time information. Figure 1 and Figure 2 demonstrate inner supply chain process in which information communication technology (ICT), effective delivery time and staff services quality are important. The textile industry is a case for a coordinated supply chain, as seen by prior studies (Abernathy *et al*. 1999) and proclaimed that the textile industry is a worldwide framework. In a conventional textile industry, supply chain parties in a worldwide aggressive condition confront inescapable issues, for example, long transportation, long lead time, short item life cycle, and unusual request. Bruce *et al.* (2004) discussed with four organizations, including a fiber maker, an outsourcing organization, an outlining organization, and a retailer, in the clothing and textile industry with the point of distinguishing issue and arrangements, all of which exist in supply chain tasks.

In 2003, the RFID technology started to rise in supply chain operations (Delen *et al.* 2007). Big suppliers, for example, Procter and Gamble, Gilletter, and Kraft, co-worked with Walmart and effectively actualized RFID technology in a retail supply chain. Angeles (2005) expressed that Kitchen Inc. connected the RFID technology to its appropriation focus and spared $16.7 million in labor costs, and $ 6.9 million in errors due to paperwork as well as vendor mistakes. In retailer distribution center management, it is to work on latest technologies in supply chain which can facilitate low transit time and good staff services quality. However, political influence and supply chain investors investment decision making have also contribution in performance (Maqbool *et al.* 2018).

Srivastava (2004) expressed that applying RFID technology at any level improves the capacity to follow the correct areas of the dead inventory. As demonstrated by previous studies (Chow *et al.* 2005, Chow *et al.* 2006), the RFID technology expands the productivity of operations in the distribution center and decreases operational expenses. It additionally enhances accuracy of item traceability. These cases show that RFID technology is useful for the change of item stream and for the improvement of overall revenues at each phase of the supply chain. Therefore, RFID is one of the systems which is based on information communication technology and enhances the delivery system and staff services quality to increase supply chain operation.

Figure 2. Radio frequency identification (RFID) technology is a newly emerging technology for the apparel industry based on information Communication Technology (ICT)

Spinning factories	Knitting factories	Trading Firm	International Retail
RFID-enabled logistical System	RFID-enabled logistical System		RFID-enabled POS
Raw material inventory information	Raw material inventory information	Market information	Sales Figure
Order information	Order information	Distribution planning	Customer Data
WIP inventory information	WIP inventory information	Sales forecasting	Sales forecasting
Production capacity information	Production capacity information	Replenishment Planning	Replenishment Planning

Source: Keung Kwok and Wu (2009)

The Electronic Product Code Information Services (EPCIS) gives information combination and information-sharing inside the supply chain. The framework design of the RFID-based intra-supply chain is partitioned into four stages: the RFID entryway, information coordination stage, intra-supply chain information reconciliation stage, and electronic stage (Keung Kwok and Wu 2009). However, in this process, information communication technology (ICT) plays the key role, which facilitates quality services by staff of supply chain and minimum delivery time which ultimately effects positively on Textiles and Apparels Industry performance.

It is evident from the various studies, information communication technology (ICT) contributes towards logistic/supply chain performance (Imran *et al.* 2019). Latest technologies by facilitates logistic operations through decreasing the overall time. It allows the system to deal through computers which is time saving. However, enterprise risk management is also important to manage operations.

Information communication technology (ICT) improves the products and services of companies and permits new forms of partnership between various consumers as well as suppliers by different websites. It is compulsory for supply chain process to advance not only suitable and safe but also reliable with respect to security in payment transection (Changchit *et al.* 2009, Chen and Barnes 2007, Janaki *et al.* 2018). Therefore, information and communication technology (ICT) has significant positive role in supply chain activities which ultimately enhances the textiles and apparels industry performance. Therefore, from the above discussion, it is hypothesized that;

Hypothesis 1 (H1): Information communication technology (ICT) has significant positive relationship with textiles and apparels industry supply chain operations.

Moreover, effective delivery time is also an important element of supply chain process which is called transit time. Here the distribution channels have the key role to address effective transit time. This a possible through better RFID system through information and communication technology (ICT). As IT capability of supply chain firm has significant role in operations. Distribution is significant element of any supply chain system (Gunasekaran and Ngai 2003). It comprises delivery of goods to the real customer. The logistics operations comprise of inputting, storing, transporting and allotting physical goods to the end customers (Gunasekaran and Ngai 2003). Delivery of goods experiences a reasonable fee, which usually is charged by customers and has the impact on customer satisfaction and ultimately influences significantly on the overall performance. Here, the delivery time has the key importance. The customer paid the goods prices is required to insure the delivery of goods in specified time. Thus, it is hypothesized that;

Hypothesis 2 (H2): Effective delivery time has significant positive relationship with textiles and apparels industry supply chain operations.

Logistics service agent's state of mind, external picture of representatives, correspondence with the client, customized service and other related factors can substantially affect the impression of supply chain

services. A supply chain organization's staff service quality for its client, the picture, manner, and correspondence help to shape the general quality (Yuanxiao 2014). Assurance to appropriate logistics service alludes to the endeavor staff's ability to affirm quality services. Staff services quality enhances the supply chain operations and supply chain operations enhances the textiles and apparels industry supply chain performance.

Thai (2013) demonstrates that service quality is typically comprising of an attribute. Xin and Bo (2004) examined the service quality, its numerous assessment standard feature and found that it has major effect on the profitability of firms. Moreover, according to Hua and Jing (2015), staff service quality has important as well as positive association with e-logistic customer satisfaction through better supply chain operations. Hence, it is hypothesized that;

Hypothesis 3 (H3): Staff service quality has significant positive relationship with textiles and apparels industry supply chain operations.

Hypothesis 4 (H4): Staff services quality significantly moderates the relationship between information communication technology (ICT) and textiles, and apparels industry supply chain operations.

Hypothesis 5 (H5): Staff services quality significantly moderates the relationship between effective delivery time and textiles, and apparels industry supply chain operations. Nevertheless,

Hypothesis 6 (H6): Supply chain operations has significant positive relationship with textiles and apparels industry performance.

Figure 3. Theoretical framework of the current study showing effective supply chain practices through Radio Frequency Identification (RFID) technology
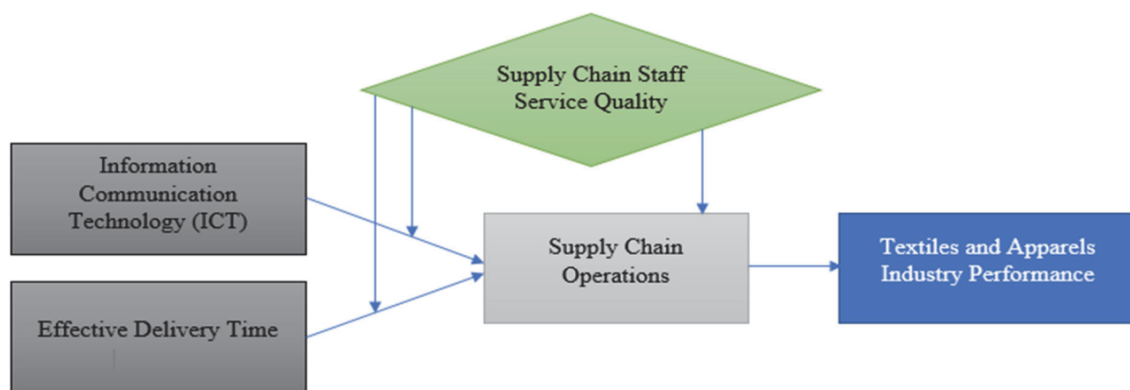
Source: Developed by the current study

3. Methodology

The population of current study is based on various textiles and apparels companies in Indonesia. Different companies were selected to collect the data. The staff of these companies involved in supply chain activities were selected to collect the data. The staff having no involvement in supply chain activities of textiles and apparels companies were not selected to respond the questionnaires. Survey was used to collect the data. Data were collected through simple random sampling technique. First of all, the list of all the staff from textiles and apparels companies were obtained and then respondents were chosen, randomly. All the respondents were approached through self-visit to these companies.

As the research method is most crucial, therefore, by examining the nature, problem and objectives of the study, cross-sectional research design was preferred with quantitative research technique. Survey instrument was adapted from previous studies to collect the primary data from textiles and apparels companies. Moreover, according to Comrey and Lee (1992) inferential statistics states that "sample having less than 50 participants will observed to be a weaker sample; sample of 100 size will be weak; 200 will be adequate; sample of 300 will be considered as good; 500 very good whereas 1000 will be excellent." Therefore, two hundred (200) sample size was selected for this study.

The survey questionnaire was based on two major sections. First sections of the survey questionnaires were comprised of demographic information's of respondents. It includes, age, income, gender, education and marital status. The second major section of the survey questionnaires was consisted of items related to major

variables, namely; staff services quality, information communication technology (ICT), effective delivery time, supply chain operations and finally items related to textiles and apparels company's performance were stated in the last part of the survey.

4. Case studies

4.1. Preliminary analysis

Before testing the reliability and validity, the preliminary analysis was performed. Preliminary analysis includes; missing value analysis, outlier and normality distribution. While preliminary analysis, it was found that data has no missing value. Moreover, it was also found that data has not outlier. After that the normality of data was examined by using Skewness and Kurtosis values. From Skewness and Kurtosis values, it was found that few values are not within satisfactory range and distribution is slightly not normal. To overcome this issue, Smart PLS was used to analyze the data. As Smart PLS is one of the software which does not require normal distribution of data.

4.2. Structural equation modeling

After preliminary analysis, structural equation modelling was utilized to check the reliability and validity. As it is one of the mandatory step before hypotheses testing. In this process, factor loading, Cronbach alpha, composite reliability and average variance extracted (AVE) was examined. According to Hair (2010), items having factor loading below 4.0 should be deleted. Moreover, the value of composite reliability and average variance extracted (AVE) should be more than or equal to 0.7 and 0.5, respectively. While measurement model assessment, it was found that all the items have factor loading more than 0.7. Figure 4 shows factor loadings and Table 2 shows the results of the measurement model assessment. Moreover, the discriminant validity was observed by square root of average variance extracted (AVE). Table 3 displays the discriminant validity which is attained by this study.

Figure 4. Measurement model assessment
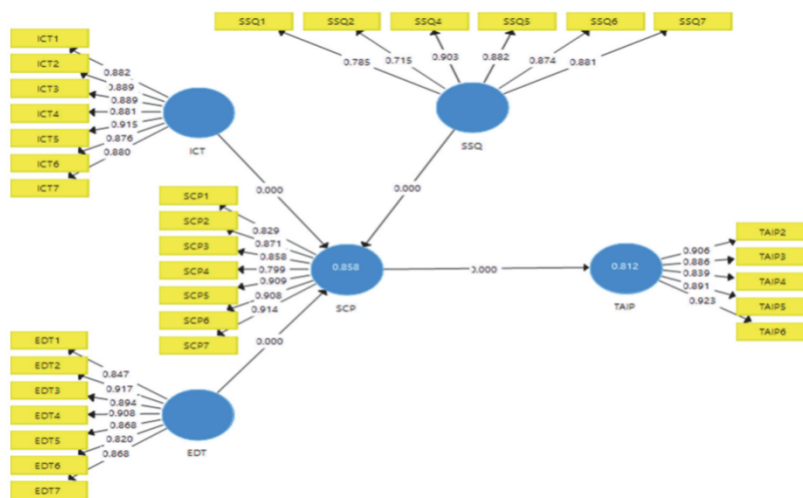
Table 2. Results of Measurement model assessment

Indicators	Cronbach Alpha	Composite Reliability	AVE
Effective Delivery Time (EDT)	0.742	0.865	0.512
Information Communication Technology (ICT)	0.710	0.880	0.501
Staff Service Quality (SSQ)	0.912	0.902	0.622
Supply Chain Operation (SCO)	0.781	0.816	0.592
Textiles and apparels industry performance (TAIP)	0.799	0.781	0.509

Source: Test result Smart PLS

Table 3. Results of measurement model assessment

1	2	3	4	5	6
EDT	0.748				
ICT	0.721	0.888			
SSQ	0.478	0.720	0.701		
SCO	0.517	0.688	0.685	0.818	
TAIP	0.611	0.694	0.550	0.724	0.742

Source: Test result Smart PLS

5. Results

After analyzing the measurement model assessment, the structural model was analyzed to check the relationship between dependent, independent and moderating variables. For this process, PLS bootstrapping was performed. This bootstrapping was performed on 5000 subsamples with 135 responses. Bootstrapping is a nonparametric technique that permits testing the statistical significance of different PLS-SEM results.

Figure 5 and Table 4 show the results of PLS bootstrapping. It is evident from the table that all the direct hypotheses are accepted. As the t-value for all the hypothesis is more than 1.96 and significance value is below 0.05. It accepts the H1, H2, H3 and H6.

Figure 5. Structural model assessment
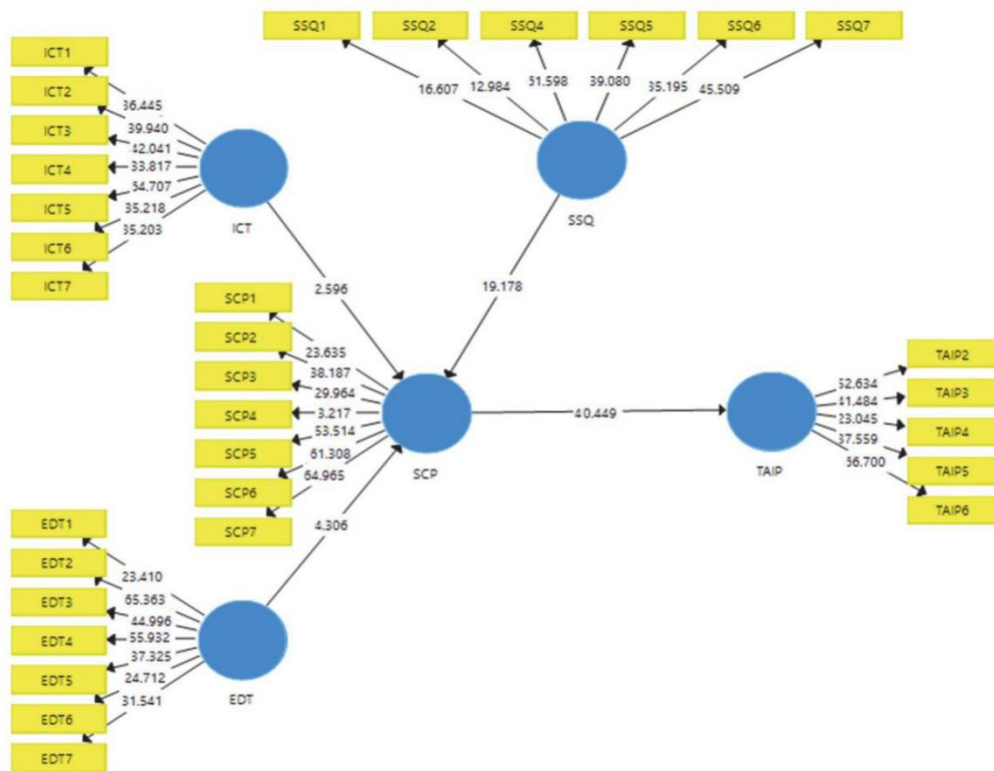
Table 4. Hypotheses results

Hypotheses	Relationship	(β)	SD	T-value	P-Values	Decision
H1	ICT → SCO	0.239	0.092	2.596	0.010	Supported
H2	EDT → SCO	0.131	0.030	4.306	0.000	Supported
H3	SSQ → SCO	0.910	0.048	19.178	0.000	Supported
H6	SCO → TAIP	0.901	0.022	40.449	0.000	Supported

Source: Test result Smart PLS

In case of moderation effect, it is evident from Table 5 that the t-value is more than 1.96 in case of effective delivery time, however, t-value is below 1.96 in case of moderation effect between information communication technology and supply chain operations. Thus, staff services quality significantly moderates the relationship of effective delivery time and supply chain operations. Moderation results are shown in Table 5.

Table 5. Moderation effect results

Hypotheses	Relationship	(β)	SD	T-value	P-Values	Decision
H4	ICT× SSQ → SCO	0.210	0.121	1.735	0.091	Not Supported
H5	EDT× SSQ → SCO	0.303	0.101	2.990	0.020	Supported

Source: Test result Smart PLS

Moreover, Table 6 shows the R-square value. According to the results, the R-square value is 0.812 which is strong value (Chin 1998). It indicates that all the variables collectively explain 81.2% variance in dependent variable.

Table 6. R-Square (R^2) Value

Latent Variable	Variance Explained (R^2)
Textiles and apparels industry performance	0.812

Source: Test result Smart PLS

6. Findings

The results of the study have revealed that staff services quality and information communication technology had significant positive relationship with supply chain operations. Skilled staff service quality and information communication technology will enhance supply chain operation in textiles and apparels industry. However, low quality services and information communication technology will affect negatively on operations. Moreover, better supply chain operation leads towards better performance. Furthermore, staff services quality has also direct effect on supply chain operations.

Figure 6. Staff services quality strengthens the positive effect of effective delivery time on supply chain operations.
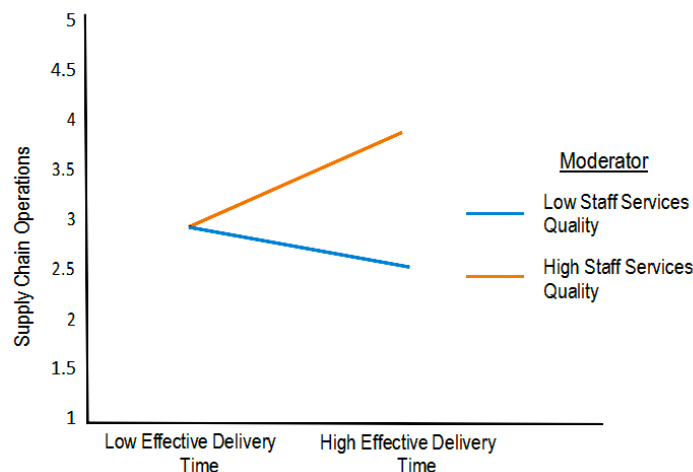
Source: Author's own estimations based on analysis results

In case of moderating role of staff services quality, the moderation effect is significant in case of effective delivery time. However, moderation effect is insignificant in case of information communication technology. Therefore, it demonstrates that staff services quality moderates the relationship between effective delivery time and supply chain operations.

More importantly, it is found that supply chain operation in textiles and apparels industry has significant influence on overall performance of industry. Increase in supply chain operation increases the performance of industry. Therefore, it is evident that information communication technology and effective delivery time enhances the supply chain operations and supply chain operations enhance the textiles and apparels industry performance.

Conclusion

The current study has been majorly based on textiles and apparels industry of Indonesia. The effect of radio frequency identification (RFID) technology was examined on supply chain operations by considering the information communication technology and effective delivery time. The employees of textiles and apparels companies were selected as the respondents.

Findings of the study investigated that radio frequency identification (RFID) was one of the most important elements of textiles and apparels industry. It has significant role to boost performance through

improvement in supply chain operations. Effective delivery system is generally based on radio frequency identification (RFID) which has positive role to enhance supply chain operations. Moreover, information communication technology is also one of the components of the radio frequency identification (RFID). Better information communication technology has major contribution in payment system, traceability of order, communication with customers and employees which has key role in supply chain operations. In this process, quality of services provided by staff is important. Good quality services decrease the delivery time and enhances communication between company and partners which has vital role to enhance company performance. Future research is needed to apply open innovation strategies in the framework of the current study (Hameed *et al*. 2018, Salem *et al.* 2016, 2018).

Acknowledgments:

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Econometric Combined with Neural Network for Coffee Price Forecasting

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Abstract:

Econometric is commonly used in economic forecasting model for short term, long term and it is applied in many different fields. While, neural network models have the advantage for fast calculating and high accuracy due to weight adjustment after training steps. The combination of econometric and neural network models will increase the effective individual models. It can achieve advantages of both econometric and neural network. In this paper, we present a method that combined two models for coffee price forecasting. Experimental results are predicted daily with the number of 427 training samples from the last 1 years with actual data with a mean deviation of 0.00243 indicating that our predictive model has acceptable accuracy.

Keywords: coffee price; forecasting; econometric; neural network; learning; machine learning.

JEL Classification: C45; C53; C88.

1. Introduction

Coffee is an agricultural product that is interested in the world market after the oil, rice. In the web page https://tradingeconomics.com, coffee is the one of 18 commodity agriculture products shown that the importance of them and they are seen as the factors that influencing other price movements of goods. In the coffee exporting countries such as Vietnam, Colombia, Brazil and Mexico, the fluctuation of coffee prices in the world has a great influence on the prices of micro and macroeconomic markets of these countries according to the economic impact of the whole region as well as the world (ICO 2016, Bacci *et al.* 2019).

Coffee price forecasting has significant in predicting macroeconomic situations of countries. Therefore, there are many different methods of forecasting method are proposed. They can use for exporting price forecasting or price of each type of coffee as Robusta, Arabica, *etc*. In this paper, we predict the average world coffee price. By forecasting the average price, we can predict coffee purchased by each country. The world coffee prices also help the government can regulate, forecast the situation of import and export, GDP of their countries. Accurate prediction also helps investors and farmers to make better decisions for their own purposes (Bacci *et al.* 2019).

Previous forecasting methods often use econometric models, linear regression models to forecast economic problems, especially macroeconomics, in medium to long term. This approach provides a simplest model of econometric such as y = f + bx$_{it}$ + e$_{it}$. Independent variables will combine to produce values for the dependent variable. Econometric models such as the sliding, regression, ARIMA, VAR, AR models combine seasonal factors, which predict the trend (ICO 2016).

Machine learning models, especially supervised learning model has begun to gain interest in forecasting field recently, it demonstrated improvements in computational speed, self-learning and self-updated training parameters. It usually a set of historical data sets for training and an individual set for forecasting. In this approach, it solved problems of data recognition, pattern recognition, knowledge mining, especially working with large data. The models are shown in nonlinear format, hybrid, performance enhancement algorithms such as bootstrap, bagging, boosting, context analysis, etc. they can also do well (Bacci *et al.* 2019, Norlin *et al.* 2017, Prasad *et al.* 2018).

Econometrics and machine learning used to perform well in their own orbits separately. They differ in purpose, focus, and methodologies. However, due to the abundant supply of "big data" and the demand for solving complex problems, there emerges a trend of applying econometrics and machine learning in an integral manner Zheng *et al.* 2017, Sendhil and Spiess 2017).

Econometric models often work with linear models, so it is face to some problems when solving with non-linear in practice, special big data or real - time data. Because these models cannot update data by real - time and train by themselves with new stream data. While machine learning models address this problem, machine learning model can self-learning, value-enhancing, model - enhancement and working with non-linear problems. But, feature selection is very important in machine learning, how to select them is becoming more difficult and it cannot solve multicollinearity when it has correlation between independent variables (called features in machine learning), missing value, random error, *etc*.

In this paper, we combined the advantages of two approaches by these reasons:
- Evaluating model and remove the defects of model;
- Creasing accuracy and speed of calculation through training;
- Self- learning and self-memorizing and storing with real-time data.

For solving with combining, we propose a new model as below:
- Collect data from essential news pages;
- Processing information, keep factors that affect to forecast results, build econometric model;
- Removing errors in econometric models;
- After completed econometric model, build a new machine learning model for training and testing.

The rest of this paper is structured as follows: Section 2 presents the related works in forecasting field. Section 3 introduces about our method that used econometric and neural network to forecast coffee price, section 4 is experimental and in the final are conclusions.

2. Research background

2.1 Econometric

Econometric is the application of statistical and mathematical theories in economics for the purpose of testing hypotheses and forecasting future trends. It takes economic models, tests them through statistical trials and then compare and contrast the results against real-life examples. Thus, an econometric model that describes the relationship between variables in economics, the correlation as well as the word can derive meaningful rules. As a result, we can use in policy evaluations, alternative variables or price forecasts, inflation, etc. The characteristics of econometric models are based on a set of economic variables that happened from history (like machine learning model) for inferring or forecasting. These variables include independence and dependent variables. Dependent variables are determined from independence variables (called affecting factors). A regression function is built by variables as follows:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + ... + b_tX_t + u \tag{1}$$

where: Y: the variable that you are trying to predict (dependent variable), X: the variable that you are using to predict Y (independent variable; a: the intercept; b: the slope; u: the regression residual.

2.2 Neural network model

An artificial neural network is built based on the biological neuron model. A processing unit is called a node in network or perceptron. They receive signals from units or an external source and process these signals before propagating to other units.

Figure 1. An artificial Neural Network
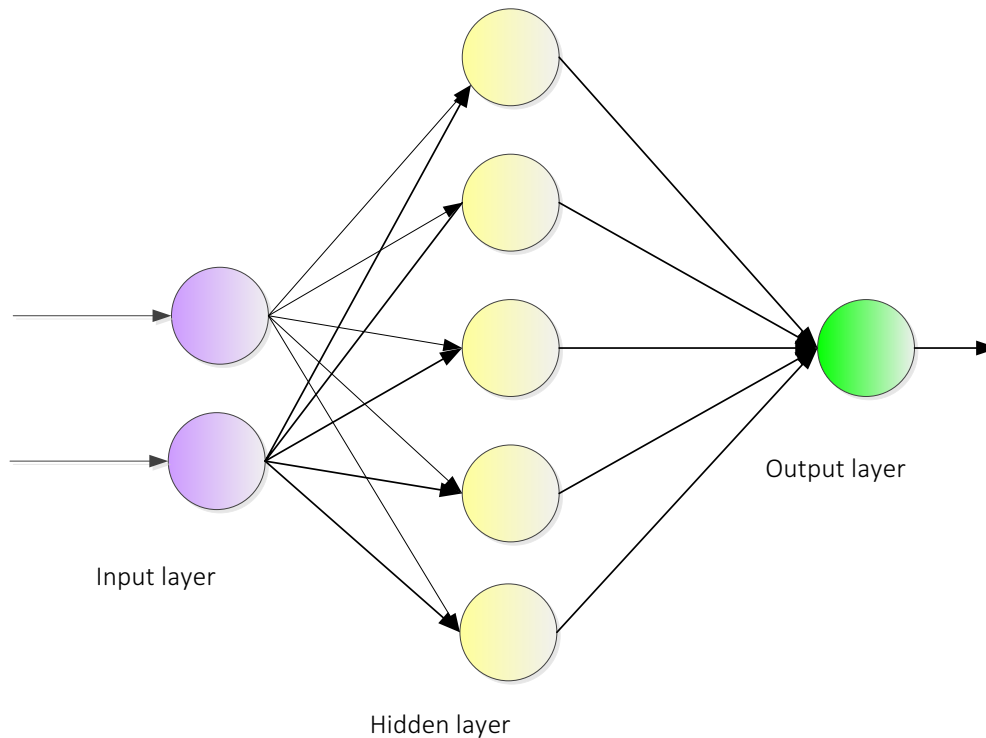
A multi-layer network consists of an input layer, an output layer and one or more hidden layers. The information flow in the neural network from left to right, the input values x is transmitted to the hidden layer through the connection weights then brought to the output layer. The number of connections from the neuron to the kth order neuron is denoted v_{jk}. Each neuron calculates its output based on the level of stimulus received from the input. Specifically, the input of the neuron is calculated as the sum of its input weights, the output of the neuron is calculated based on the activation function.

For each hidden neuron class *j*:

$$a_j = \sum_{i=1}^{n} w_{ij} x_i + \theta_j, y_i = f(a_j) \tag{2}$$

For neuron kth:

$$a_j = \sum_{j=1}^{k} v_{kj} y_j + \theta_k, z_k = f(a_k) \tag{3}$$

where: a_j, a_k: total of all inputs; x_i, y_j: is the input signal; w_{ji}, v_{kj}: is the synaptiques weight between the inputs of the jth neuron of the hidden layer and the kth neuron of the output layer; θ_j, θ_k: is a threshold (also called a bias)

Today's neural network model used in forecasting is widely applied and brings positive results. Girish K. Jha *et al.* also proposed a neural network model for agricultural price forecasting (2013). They use an ANN over linear model methodology applied for using monthly wholesale price series of soybean and rapeseed-mustard. The empirical analysis has indicated that ANN models are able to capture a significant number of directions of monthly price change as compared to the linear models. In study of Mbiriri Ikonya *et al.*, they compared ANN and seasonal autoregressive integrated moving average. ANN demonstrated a superior performance over SARIMA model. The authors' ANN has high performance compared to SARIMA and can accurately predict export price of tea in Kenya (Mbiriri, Mwita and Wanjoya 2014).

3. Methodology

3.1 Model

Forecasting is a very important problem in many fields of real - life. In business, forecasting to help open up business opportunities or forecast risk. To order to build a good model, data plays a very important role in the use of neural networks. A good of forecast model for agricultural products supporting farmers, enterprises that specialized in agricultural products, food industry or forecasting the situation of national export and import of agricultural products.

With the development of machine learning, many studies have combined with econometric model for finding a better model (Faruk 2010, Qin, Li and Du 2017, Khashei, Bijari and Hejazi 2012, Mehdi, Yan and Ma 2016). In reality, there is a number of proposed method proved good results in forecasting. Fang-Mei Tseng *et al.* (2002) combines the ARIMA model and the neural network model to enhance the accuracy of the system. Voort, Dougherty and Watson (1996) also uses this combination for short-term forecasting of traffic flow. They used Kohonen maps to classify. Wang and Leu (1996) used hybrid models to forecast stock indexes in Taiwan. They also demonstrated that the result of neural network was better predicted than other raw data. Godknows M. Isenah and Olusanya E. Olubusoye (2014) used a combination of ARIMA and artificial neural networks to forecast the Nigerian stock market. Alshaimaa, Ibrahim Elwasify (2015) also applied this hybrid model to forecast EGX30 stock prices, which showed the suitability of the model after testing with a 270-day data set from October 2009 to October 2010. In a hybrid model combined with complete ensemble empirical mode decomposition (CEEMD), co-integration model (CIM), generalized autoregressive conditional heteroskedasticity model (GARCH), and grey neural network (GNN) optimized by ant colony algorithm (ACA) for Carbon spot price forecasting, Jinliang Zhang *et al.* (2018) shown that the results are better than previous models. In study of Yi Xiao *et al.* (2014), they used ARIMA model to generate a linear forecast, then FNN is used to developed as a tool for nonlinear pattern recognition to correct the estimation error in ARIMA forecast. Empirical results demonstrate consistent better performance of this proposed.

Electricity price become a most important problem in modern city when all of the thing need energy for operating. A short-term hybrid electricity price forecasting model proposed by Rodrigo A. de Marcos (2019), which combines a cost-production optimization (fundamental) model with an artificial neural network model. In order to validate the advantages and contributions of the proposed model, it has been applied to a real-size power exchange with complex price dynamics, such as the Iberian electricity market. Moreover, its forecasting performance has been compared with those of the two individual components of the hybrid model as well as other well-recognized methods. The results of this comparison prove that the proposed forecasting model outperforms the benchmark models, especially in uncommon market circumstances. Another work used Combining wavelet transform ARMA and kernel-based extreme learning machine methods for Electricity price forecasting (Yang, Ce, Lian 2017). The performance of the proposed method is evaluated by using electricity price data from the Pennsylvania-New Jersey-Maryland (PJM), Australian and Spanish markets. The experimental results show that the developed method has more accurate prediction, better generality and practicability than individual methods.

The quality, reliability, availability and relevance of the data used to develop the system and helps the solution succeed. In addition, good models may yield unsatisfactory results if the data is too complex and complicated. All of these demonstrations encourage us to propose solutions for forecasting coffee prices. Our solution as Figure 2 follows:

Figure 2. Model of coffee price forecasting
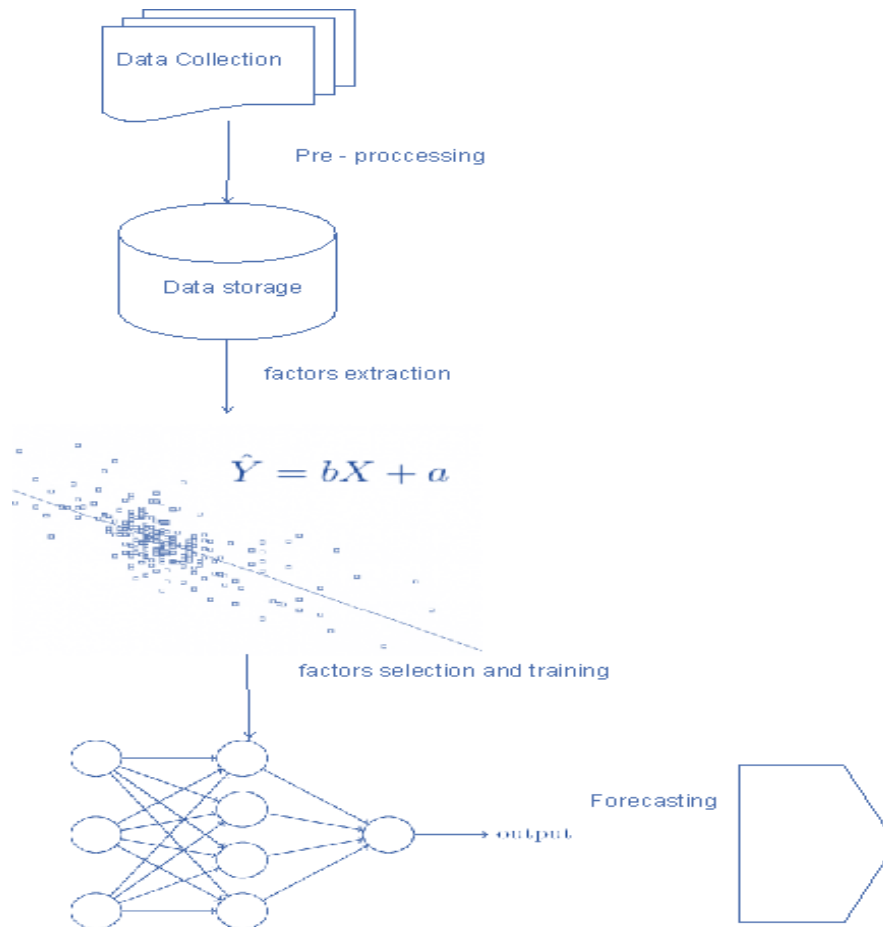
3.2 Affecting factors

We determine the factors that can affect to coffee price and based on heuristic, some factors can be:

- *Oil price*: Is the key point affect country's economic. Oil price increasing can also affect to inflation of each country;
- *Gold price*: In wholesale, gold price can use to transaction Coffee;
- *US Dollar exchange*: As the gold price;
- *Temperature*: The temperature of the region or country where till coffee will affect the yield and quality of coffee beans. Stable, consistent temperature will promote coffee trees for high productivity. Redundancy or scarcity of coffee will lead to lower or higher prices;
- *Humidity*: As the temperature, it can be affect to quality of coffee;
- *CPI*: CPI creasing will lead coffee price creasing;
- *Coffee price*: The price of coffee in history is used to forecast future coffee prices.

We used Eviews 9.0 for selection the best model with factors: Oil price, gold price, US dollars price, temperature and coffee price.

3.3 Building neural network model

Based on the influential inputs, the neural network development thesis consists of 05 inputs, and 01 output is the result of the forecast. For training, we through these step bellows:

- Step 1: Select input variables (features or factors): From section 3.2, determining factors with econometric model we have five features as Oil price, gold price, US dollars price, temperature and coffee price;
- Step 2: Determining data for training and testing;
- Step 3: Neural Network model and training with data;
- Step 4: Select evaluating standard: Least absolute deviation, MAPE.

We use a straight-forward neural network consisting of one input layer, one output layer, and one hidden layer. The number of inputs is customized depending on the number of data selected for training. The number of units in the hidden class will be determined after training a few tests. The number of hidden layers selected is 1 because practically using multiple layers does not significantly improve predictive performance.

The activation functions of the units in the hidden class are sigmoid functions. For the class, we choose the homogeneous function.

Figure 3. Architecture of Neural Network
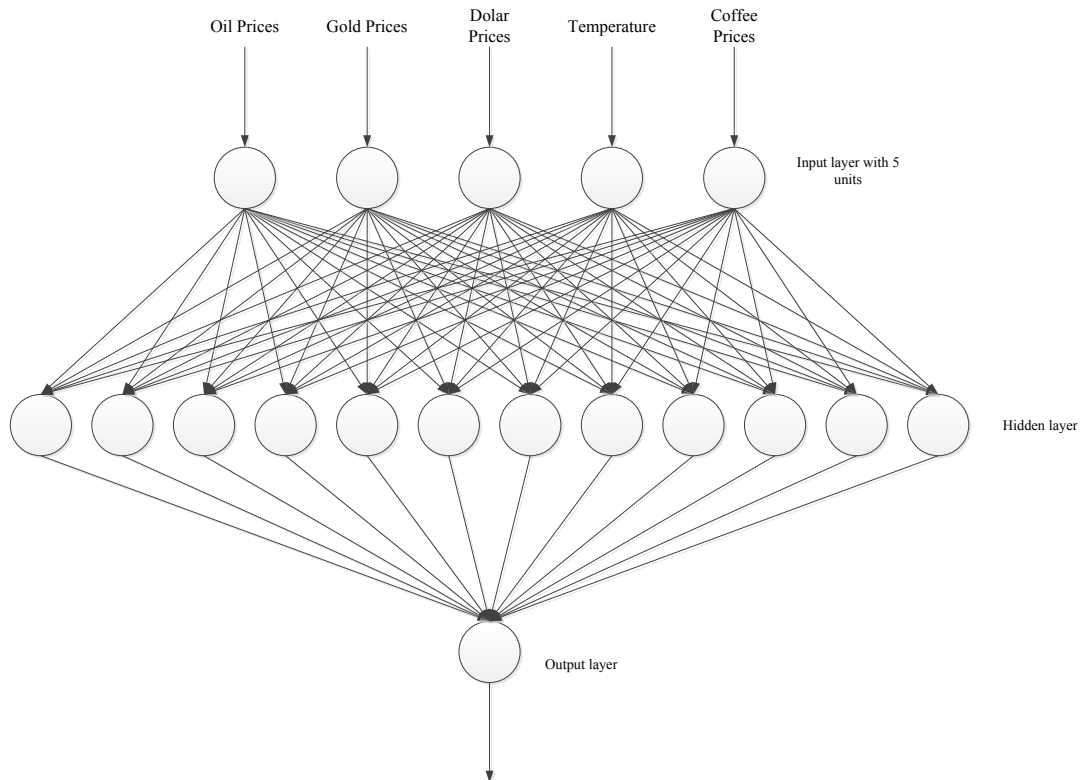
The picture depicts a neural network consisting of 05 inputs, 01 outputs and one hidden layer. After the training, the best selection for the network is 12 neurons in the hidden layer. Neural networks are trained by reverse-flowing algorithms. The error function uses the least squares average formula:

$$E = \frac{1}{2} \sum_{k-1}^{n} (t_k - y_k)^2$$

(4)

4. Experiments

4.1 Data preparing

Data in this paper used sources from:
- Oil price: http://www.investing.com/commodities/crude-oil-historical-data
- Gold price: http://www.investing.com/commodities/gold-historical-data
- US price: http://www.investing.com/currencies/eur-usd-historical-data
- Temperature: https://www.wunderground.com
- Coffee price: http://www.ico.org/coffee_prices.asp

The Table 1 illustrated some examples training data that is selected from a lager data (appendix)

Table 1. An example data for training

\<Oil Prices\>	\<Gold Prices\>	\<Dollar Prices\>	\<Temp\>	\<Coffee prices\>
50.43	1203.57	1.1176	28	123.35
51.53	1200.22	1.1079	27	126.35
50.76	1198.24	1.1031	28	125.39

<Oil Prices>	<Gold Prices>	<Dollar Prices>	<Temp>	<Coffee prices>
49.61	1167.16	1.0844	26	128.6
49.95	1167.01	1.0852	28	127.46
48.42	1161.69	1.0698	28	126.1
48.06	1155.21	1.0547	27	123.82
47.12	1153.58	1.0635	28	122.97
44.88	1158.29	1.0495	27	120.5
43.93	1154.68	1.0569	26	126.88
43.39	1149.1	1.0597	26	127.53
44.63	1167.37	1.0866	27	127.99
44.02	1171.04	1.066	27	131.78
46	1182.42	1.0822	27	131.59
47.4	1189.27	1.0946	28	131.15
47.03	1193.06	1.0926	27	128.33
48.75	1195.4	1.0972	28	130.02
51.41	1204.62	1.0884	27	130.16
48.83	1198.56	1.0889	28	128.39
48.66	1185.85	1.0834	26	124.66
47.72	1183.3	1.0731	28	124.13
50.12	1203.85	1.0764	26	126.07
49.13	1202.42	1.0883	26	129.28
52.08	1214.64	1.0923	28	132.46

4.2 Results

In this study, we divided the data into two sets, training set and testing set. The last two months price data (about 61 days) were retained for testing.

Firstly, we use the Eviews to select input features for neural network. After that, we built a software to experiment this method. Architecture of neural network as follows:

- One input layer, 1 hidden layer and 1 output layer;
- 12 nodes in hidden layer, 5 nodes in input layer and 1 node in output layer;
- Data for training: 427;
- Sigmod Alpha: parameter α of function is 2;
- Learning Rate: 0.001.

Figure 4. The interface of coffee forecasting system
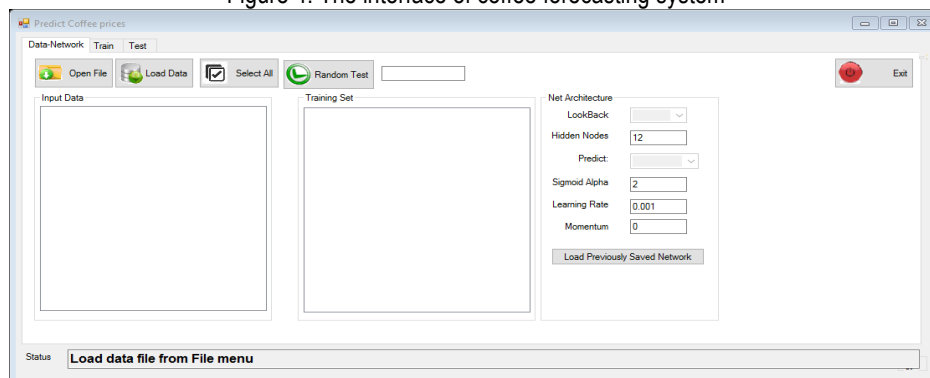
We use k-fold cross method for validation (k=10). The Table 2 illustrate 3 times for training.

Table 2. There times training

Test time	Number of training	Number of testing	MSE	Deviation
1	397	30	0.08084	0.00474
2	407	20	0.07875	0.00328
3	417	10	0.06758	0.00170

Average of error: 0.5679 and deviation: 0.00243.

Figure 5. The first experimental result
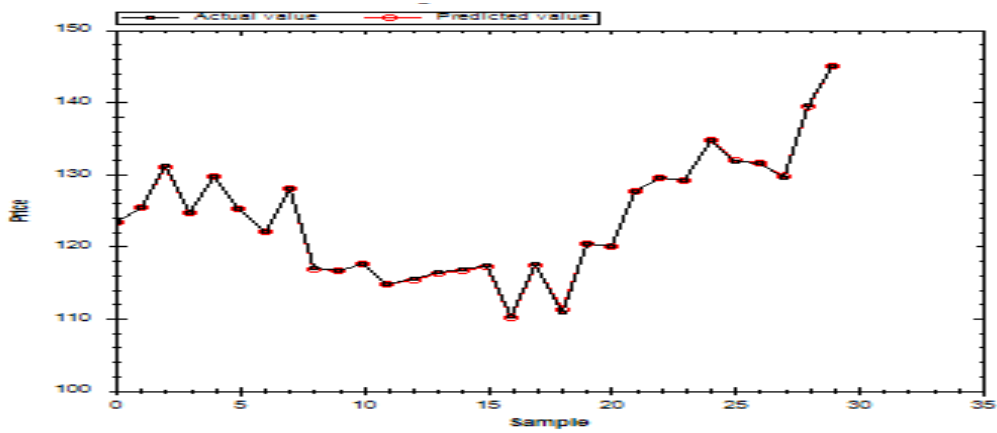
Figure 6. The second experimental result
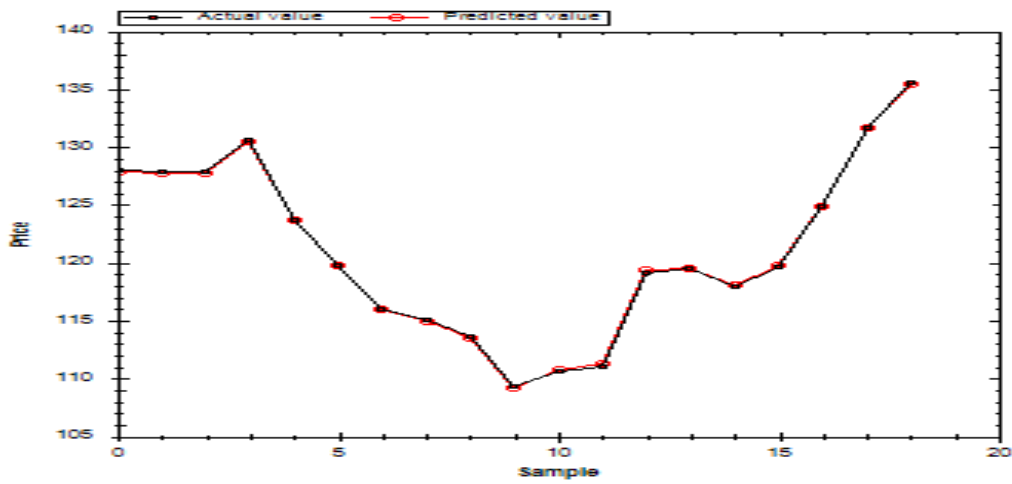
Figure 7. The third experimental result
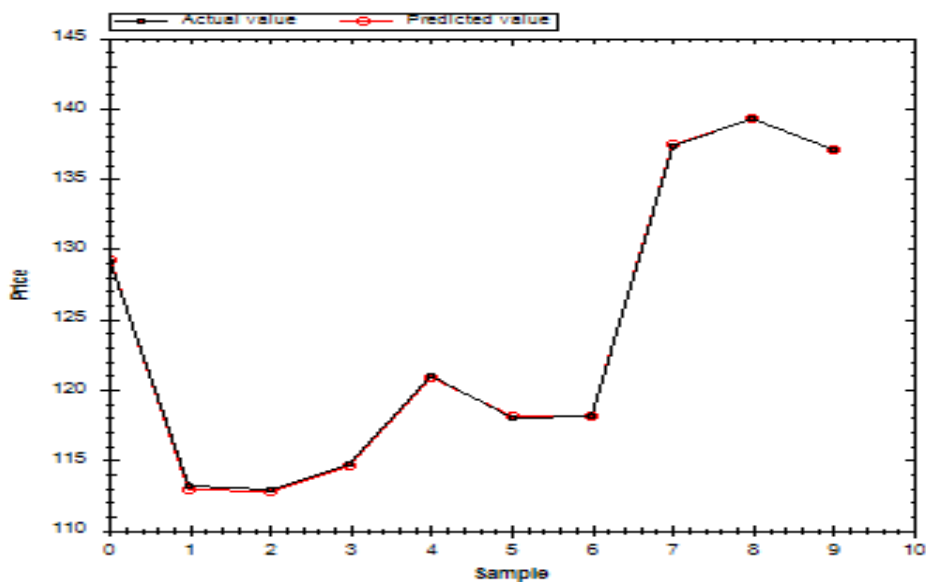
Conclusion

The International Coffee Organization (ICO) is an intergovernmental organization working in the coffee market. ICO members represent 97% of coffee production and more than 80% of global coffee consumption. The ICO index represents four main types of coffee in the international market - Arabica Columbia, Arabica, Brazilian Arabica and Robusta. This index is published daily by the International Coffee Organization using the agreed formula, which is

considered a benchmark for world coffee prices. Therefore, when forecasting this index soon will help coffee business enterprises have a reasonable strategy to buy and sell to increase competitiveness for businesses.

The hybrid model between econometrics and machine learning has proved its effectiveness in some prediction task, but in coffee forecast field has not been applied much. In our study, this hybrid model is used for short-term forecasts really showing the effective of the model with the actual data collected.

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Appendix

Table

STT	Coffee prices	Oil Prices	Gold Prices	Dollar Prices	Temp	STT	Coffee prices	Oil Prices	Gold Prices	Dollar Prices	Temp
1	123.35	50.43	1203.57	1117.6	28	215	113.28	33.97	1093.48	1078.1	30
2	126.35	51.53	1200.22	1107.9	27	216	112.09	33.29	1108.95	1093.6	28
3	125.39	50.76	1198.24	1103.1	28	217	112.64	33.2	1104.37	1093.2	29
4	128.60	49.61	1167.16	1084.4	26	218	109.33	31.42	1094.21	1086.0	28
5	127.46	49.95	1167.01	1085.2	28	219	109.40	30.42	1086.37	1085.7	28
6	126.10	48.42	1161.69	1069.8	28	220	109.96	30.42	1093.5	1087.7	27
7	123.82	48.06	1155.21	1054.7	27	221	110.01	31.22	1078.26	1086.5	28
8	122.97	47.12	1153.58	1063.5	28	222	109.79	29.45	1088.72	1091.7	26
9	120.50	44.88	1158.29	1049.5	27	223	109.75	28.47	1087.02	1090.9	29
10	126.88	43.93	1154.68	1056.9	26	224	106.74	26.68	1100.71	1089.1	28
11	127.53	43.39	1149.10	1059.7	26	225	108.22	29.55	1101.71	1087.4	27
12	127.99	44.63	1167.37	1086.6	27	226	109.97	32.07	1097.88	1079.7	28
13	131.78	44.02	1171.04	1066.0	27	227	110.34	30.31	1107.86	1084.9	28
14	131.59	46.00	1182.42	1082.2	27	228	110.38	29.54	1119.78	1087.2	26
15	131.15	47.40	1189.27	1094.6	28	229	112.15	32.32	1124.95	1089.3	26
16	128.33	47.03	1193.06	1092.6	27	230	112.27	33.21	1115.17	1093.9	26
17	130.02	48.75	1195.4	1097.2	28	231	110.09	33.66	1118.08	1083.7	28
18	130.16	51.41	1204.62	1088.4	27	232	111.43	31.62	1128.37	1088.9	26
19	128.39	48.83	1198.56	1088.9	28	233	113.61	29.90	1129.00	1091.9	26
20	124.66	48.66	1185.85	1083.4	26	234	114.84	32.29	1142.45	1110.4	28
21	124.13	47.72	1183.30	1073.1	28	235	117.65	31.63	1155.37	1120.8	28
22	126.07	50.12	1203.85	1076.4	26	236	114.77	30.86	1173.69	1115.9	27
23	129.28	49.13	1202.42	1088.3	26	237	111.26	29.71	1189.01	1119.8	28
24	132.46	52.08	1214.64	1092.3	28	238	110.75	27.96	1188.95	1129.3	28
25	131.76	53.95	1209.06	1081.6	27	239	110.60	27.54	1197.05	1129.0	28
26	127.39	50.44	1202.43	1078.0	28	240	109.35	26.19	1246.58	1132.4	28
27	128.37	50.79	1194.76	1065.9	28	241	111.36	29.32	1237.88	1126.0	28
28	127.82	51.63	1207.47	1060.4	26	242	111.59	29.05	1200.33	1114.4	29
29	126.99	51.95	1198.39	1056.8	28	243	110.98	30.68	1208.41	1112.8	29
30	126.71	53.30	1191.93	1065.4	27	244	110.44	30.77	1230.79	1110.7	28
31	127.50	56.25	1202.23	1068.7	28	245	110.85	29.59	1226.25	1113.5	27
32	129.77	56.69	1197.93	1076.1	28	246	113.11	31.37	1208.65	1102.9	29
33	129.81	55.71	1204.14	1080.7	28	247	112.41	31.84	1225.59	1102.0	28
34	129.73	56.37	1195.04	1073.7	28	248	110.49	30.35	1228.69	1101.3	28
35	131.09	55.58	1202.02	1073.6	28	249	109.99	31.40	1232.95	1102.3	29
36	132.18	56.17	1187.08	1072.7	28	250	109.51	31.65	1222.31	1093.4	27
37	130.61	56.59	1193.80	1082.6	28	251	110.07	32.74	1238.5	1087.3	29
38	130.74	55.98	1179.19	1087.4	28	252	109.37	34.39	1232.06	1086.7	28
39	126.05	55.56	1201.76	1088.9	28	253	110.06	34.57	1239.92	1086.8	24
40	127.82	57.05	1211.97	1098.1	28	254	111.64	34.56	1264.13	1095.7	27
41	127.88	58.55	1204.33	1113.2	28	255	113.55	35.91	1259.23	1100.4	28
42	129.31	59.62	1183.84	1122.4	28	256	113.52	37.90	1267.17	1101.4	24
43	126.92	59.10	1178.19	1120.1	28	257	114.38	36.67	1261.34	1101.1	26
44	126.25	58.92	1188.11	1114.6	27	258	114.80	37.62	1253.02	1099.9	26
45	125.53	60.38	1193.05	1118.6	27	259	114.40	37.77	1272.15	1117.7	25
46	122.29	60.93	1192.13	1135.4	27	260	116.78	38.51	1250.60	1115.3	27
47	122.83	58.99	1184.39	1126.6	28	261	118.65	37.20	1235.15	1110.6	26
48	124.98	59.41	1188.04	1120.4	27	262	117.58	36.32	1232.29	1110.9	29
49	124.85	59.23	1183.86	1115.5	28	263	119.5	38.43	1262.38	1122.5	28

STT	Coffee prices	Oil Prices	Gold Prices	Dollar Prices	Temp	STT	Coffee prices	Oil Prices	Gold Prices	Dollar Prices	Temp
50	125.39	60.72	1193.36	1121.4	28	264	122.77	40.17	1257.78	1131.9	28
51	124.93	60.5	1215.5	1135.8	28	265	123.57	39.47	1255.2	1127.0	28
52	126.17	59.89	1220.59	1141.0	28	266	122.61	39.91	1243.71	1124.1	29
53	127.55	59.73	1223.86	1145.3	28	267	124.95	41.45	1248.15	1121.7	28
54	130.59	59.44	1224.85	1131.6	29	268	122.95	38.28	1219.99	1118.4	27
55	129.14	57.30	1207.28	1115.0	26	269	120.42	38.14	1216.81	1117.4	28
56	125.50	58.96	1209.67	1109.3	28	270	120.93	37.99	1221.55	1119.6	28
57	121.35	60.18	1205.82	1111.3	27	271	119.75	36.91	1241.87	1129.1	26
58	119.83	58.88	1205.96	1101.8	28	272	120.18	36.91	1224.90	1133.8	28
59	116.99	57.29	1186.87	1087.4	28	273	119.93	36.94	1232.43	1138.0	28
60	117.35	57.51	1187.5	1090.5	26	274	119.76	35.36	1222.62	1138.7	28
61	117.90	57.69	1187.97	1094.9	28	275	116.95	34.3	1215.48	1139.2	28
62	118.94	60.25	1190.34	1098.8	28	276	115.23	34.52	1231.22	1138.4	29
63	122.58	60.24	1189.06	1092.8	28	277	116.04	37.74	1222.27	1139.9	28
64	124.39	61.30	1192.50	1115.5	28	278	117.01	37.3	1240.33	1137.7	28
65	125.35	59.67	1184.68	1127.5	28	279	116.00	39.74	1238.84	1140.1	28
66	126.39	58.00	1176.37	1123.9	28	280	117.77	40.46	1257.74	1140.8	28
67	125.98	59.11	1171.80	1111.3	28	281	119.16	42.12	1255.41	1138.6	28
68	126.95	58.15	1173.96	1129.2	28	282	117.14	41.70	1242.40	1127.4	26
69	127.83	60.15	1176.38	1128.3	28	283	118.00	41.45	1227.79	1126.8	28
70	127.49	61.36	1185.68	1132.6	28	284	117.82	40.40	1233.85	1128.3	28
71	124.16	60.74	1181.86	1125.8	28	285	119.50	39.74	1232.50	1131.4	28
72	125.21	59.96	1181.50	1126.9	28	286	120.53	40.88	1250.12	1135.8	28
73	122.58	59.53	1186.07	1128.3	28	287	120.99	42.72	1244.22	1129.7	28
74	123.75	60.01	1181.93	1124.8	28	288	118.72	43.18	1248.01	1128.8	28
75	122.05	59.89	1185.46	1133.7	28	289	117.74	42.76	132.54	1123.4	28
76	123.83	60.41	1201.43	1136	28	290	117.94	41.67	1237.77	1126.6	28
77	122.74	59.62	1200.06	1135.3	28	291	119.60	42.52	1243.30	1129.9	28
78	125.15	60.01	1185.42	1134.1	27	292	116.89	45.29	1245.78	1132.1	28
79	122.65	61.05	1178.53	1117	28	293	116.56	46.03	1266.17	1135.3	28
80	127.23	60.01	1175.33	1120.7	28	294	117.21	45.98	1292.87	1145.6	26
81	126.64	59.59	1172.98	1120.4	27	295	116.17	44.75	1291.40	1146.2	26
82	126.56	59.41	1175.28	1116.6	28	296	115.68	43.65	1286.53	1153.2	28
83	125.15	58.34	1179.69	1123.6	27	297	115.86	43.77	1279.60	1149.7	28
84	124.66	59.48	1172.24	1113.8	28	298	117.23	44.33	1277.68	1148.7	28
85	121.33	56.94	1168.75	1105.4	28	299	119.69	44.58	1287.72	1140.5	28
86	121.32	56.93	1166.06	1108.4	28	300	120.78	43.45	1263.79	1138.5	28
87	118.95	52.48	1170.09	1105.7	27	301	122.73	44.68	1265.75	1138.3	26
88	118.52	52.33	1155.19	1101.3	28	302	123.33	46.21	1277.34	1137.2	28
89	118.72	51.61	1157.99	1107.7	27	303	123.65	46.64	1263.66	1142.7	28
90	119.04	52.76	1159.12	1103.8	28	304	123.69	46.22	1273.12	1137.7	28
91	119.78	52.74	1163.67	1116.4	28	305	126.47	47.72	1274.20	1131.8	29
92	122.05	52.19	1157.82	1100.3	28	306	124.8	48.29	1278.84	1132.0	28
93	124.10	53.05	1155.82	1101.2	28	307	123.28	48.12	1258.47	1131.4	29
94	122.62	51.40	1149.39	1094.9	28	308	119.11	48.16	1254.55	1121.7	28
95	121.96	50.90	1145.28	1087.6	29	309	119.74	47.67	152.19	1120.3	30
96	121.06	50.88	1134.29	1083.0	28	310	118.49	48.12	1248.93	1122.1	28
97	120.72	50.11	1096.48	1082.7	28	311	118.18	48.04	1227.14	1121.9	28
98	119.52	50.59	1101.05	1093.7	28	312	117.74	49.10	1224.14	1114.1	29
99	120.04	49.27	1094.08	1093.4	28	313	117.97	49.00	1219.74	1115.5	26
100	117.40	48.11	1090.51	1098.2	26	314	117.66	49.36	1212.83	1119.4	27
101	117.86	47.98	1099.00	1098.4	28	315	118.14	49.10	1215.15	1114.6	29
102	116.03	47.17	1093.86	1109.4	28	316	118.53	49.07	1212.93	1113.2	28

STT	Coffee prices	Oil Prices	Gold Prices	Dollar Prices	Temp	STT	Coffee prices	Oil Prices	Gold Prices	Dollar Prices	Temp
103	116.02	47.97	1095.32	1105.9	28	317	118.98	49.14	1211.01	1118.8	28
104	117.23	48.77	1096.7	1098.6	28	318	121.74	48.69	1244.25	1115.1	28
105	119.27	48.53	1088.43	1093.3	28	319	124.86	49.71	1245.21	1135.1	28
106	119.62	47.11	1095.38	1098.8	28	320	125.55	50.37	1243.63	1135.5	28
107	118.65	45.25	1086.64	1095.1	28	321	130.20	51.23	1262.64	1135.8	29
108	119.4	45.75	1087.67	1088.1	28	322	127.17	50.52	1269.67	1139.4	28
109	120.35	45.13	1084.92	1090.6	28	323	127.65	49.09	1273.72	1131.6	28
110	119.67	44.69	1089.49	1092.5	28	324	127.68	48.89	1283.76	1123.9	28
111	122.20	43.87	1094.00	1096.9	28	325	125.98	48.49	1285.53	1129.2	28
112	125.44	44.94	1104.41	1101.9	28	326	127.56	47.92	1291.75	1120.8	27
113	128.07	43.11	1108.86	1104.0	28	327	128.23	46.14	1278.45	1125.9	28
114	124.61	43.22	1124.38	1115.7	28	328	129.64	48.00	1298.73	1122.6	28
115	127.98	42.27	1115.04	1114.9	28	329	129.47	49.40	1289.78	1134.7	28
116	128.16	42.45	1114.94	1110.6	28	330	129.21	48.95	1268.06	1131.4	28
117	126.93	41.93	1117.35	1108.1	30	331	128.39	49.16	1266.1	1124.2	29
118	126.86	42.58	1117.64	1102.1	29	332	130.16	49.34	1256.75	1129.7	28
119	123.77	40.75	1133.85	1111.9	29	333	126.30	46.70	1315.30	1138.8	28
120	122.10	41.00	1152.08	1124.1	30	334	125.36	45.80	1324.37	1104.0	28
121	117.60	40.45	1160.18	1138.9	28	335	128.98	47.93	1311.69	1102.6	29
122	115.01	38.22	1155.02	1162.0	30	336	131.49	49.85	1319.05	1106.6	28
123	114.21	39.15	1140.49	1151.7	29	337	132.04	48.27	1322.15	1112.5	28
124	115.33	38.50	1125.04	1131.6	28	338	132.99	49.02	1341.71	1110.5	26
125	116.98	42.47	1124.82	1124.5	28	339	132.58	46.73	1356.32	1115.6	27
126	116.09	45.29	1133.41	1117.9	30	340	131.04	47.37	1363.69	1107.6	28
127	116.05	49.20	1134.39	1121.5	28	341	130.5	45.22	1360.22	1109.9	27
128	114.34	45.38	1140.11	1131.9	29	342	132.18	45.37	1366.17	1106.3	26
129	112.24	46.30	1133.86	1122.6	30	343	135.83	44.73	1355.3	1104.4	28
130	112.86	46.75	1125.36	1112.3	30	344	134.24	46.82	1333.1	1105.8	27
131	113.16	46.02	1121.61	1114.7	30	345	134.36	44.87	1342.57	1105.9	27
132	114.18	45.92	1121.40	1120.0	30	346	137.36	45.64	1335.05	1109.0	26
133	115.03	44.13	1107.66	1120.7	29	347	135.12	45.93	1337.26	1112.0	27
134	110.87	45.85	1110.40	1128.0	29	348	134.80	45.23	1328.75	1105.6	26
135	110.73	44.75	1107.63	1134.0	28	349	134.14	44.64	1331.97	1107.4	26
136	113.95	44.07	1108.91	1132.1	30	350	134.78	44.96	1315.85	1102.2	28
137	112.72	44.58	1105.07	1126.6	30	351	134.24	43.96	1331.04	1101.5	28
138	112.50	47.12	1119.38	1128.9	30	352	130.97	43.41	1322.23	1102.5	28
139	112.16	46.93	1131.38	1143.7	30	353	129.40	42.40	1315.48	1096.9	26
140	111.92	44.71	1138.97	1130.5	30	354	130.40	42.16	1320.23	1099.4	28
141	112.23	46.67	1133.18	1118.9	29	355	129.97	41.90	1339.80	1098.7	26
142	111.29	46.17	1124.6	1112.0	30	356	130.57	41.13	1335.69	1105.8	26
143	111.72	44.53	1130.25	1118.6	30	357	133.52	41.54	1350.81	1107.6	28
144	113.08	44.94	1153.79	1123.0	30	358	132.22	40.05	1353.03	1116.7	28
145	116.70	45.55	1146.25	1119.5	30	359	131.83	39.50	1363.03	1116.2	28
146	113.94	44.40	1131.78	1124.5	30	360	131.56	40.80	1358.19	1122.7	29
147	115.29	45.24	1127.25	1124.9	30	361	131.92	41.92	1361.1	1114.9	30
148	115.54	45.06	1114.89	1117.7	30	362	132.62	41.83	1335.45	1113.0	30
149	114.80	44.75	1113.63	1119.5	29	363	131.77	43.06	1335.23	1108.7	29
150	117.27	45.54	1137.94	1121.1	30	364	131.71	42.78	1340.60	1109.3	30
151	119.92	46.28	1135.60	1118.5	31	365	130.43	41.75	1346.62	1111.9	30
152	119.95	48.53	1147.05	1127.2	29	366	129.69	43.51	1338.72	1117.7	30
153	117.62	47.86	1145.42	1123.6	30	367	129.03	44.47	1336.07	1113.7	30
154	119.72	49.46	1138.97	1127.9	30	368	129.24	45.72	1339.29	1116.4	28
155	122.45	49.67	1155.93	1135.8	28	369	128.82	46.57	1345.92	1118.4	29

STT	Coffee prices	Oil Prices	Gold Prices	Dollar Prices	Temp	STT	Coffee prices	Oil Prices	Gold Prices	Dollar Prices	Temp
156	124.19	47.09	1163.68	1135.6	28	370	127.06	46.81	1348.55	1127.8	30
157	124.25	46.7	1168.68	1137.9	29	371	129.42	48.20	1352.17	1128.8	30
158	125.08	46.63	1184.03	1147.4	29	372	129.49	48.48	1341.62	1135.4	28
159	124.57	46.38	1183.02	1138.3	28	373	132.66	46.80	1338.97	1129.8	30
160	119.26	47.30	1176.95	1134.6	30	374	133.18	47.54	1337.47	1131.9	30
161	117.72	45.91	1170.63	1132.7	30	375	130.98	46.29	1324.07	1130.6	29
162	117.51	45.84	1170.01	1134.5	30	376	130.64	46.97	1321.87	1126.3	28
163	115.47	45.22	1167.16	1133.9	31	377	131.57	47.64	1321.24	1128.3	29
164	114.71	44.90	1166.01	1110.6	32	378	132.03	46.97	1323.32	1119.7	30
165	113.48	43.91	1164.20	1101.8	30	379	131.99	46.32	1311.07	1118.9	30
166	113.95	43.19	1163.00	1105.7	30	380	133.03	44.68	1308.84	1114.3	30
167	114.03	43.21	1166.74	1104.9	30	381	136.56	43.17	1313.70	1115.8	30
168	115.38	45.93	1156.15	1092.0	30	382	136.58	44.39	1324.83	1119.8	26
169	116.36	46.02	1145.86	1097.7	32	383	138.08	44.85	1349.79	1114.7	30
170	117.67	46.60	1142.10	1100.5	31	384	139.29	45.47	1345.11	1125.6	28
171	116.26	46.12	1133.62	1101.5	30	385	139.51	47.63	1338.34	1123.9	29
172	117.69	47.88	1117.64	1096.7	30	386	137.08	45.88	1328.04	1126.1	30
173	118.11	46.32	1107.74	1086.2	29	387	137.11	46.28	1327.52	1124.0	29
174	118.30	45.27	1103.84	1088.3	27	388	136.25	44.91	1319.00	1123.4	30
175	115.45	44.32	1089.63	1074.1	30	389	136.04	43.62	1322.85	1122.0	30
176	115.44	43.87	1092.18	1075.2	30	390	135.89	43.85	1314.69	1125.0	29
177	114.69	44.23	1089.61	1072.3	30	391	135.60	43.04	1310.28	1124.4	28
178	115.17	42.95	1086.24	1074.4	29	392	138.40	43.34	1313.13	1115.8	29
179	113.20	41.74	1085.10	1081.7	31	393	140.43	43.85	1314.75	1117.4	29
180	110.75	40.69	1083.82	1077.9	30	394	141.69	45.33	1334.87	1115.5	30
181	112.94	41.68	1082.85	1068.7	30	395	141.67	46.10	1336.97	1118.9	29
182	112.53	40.73	1070.25	1064.4	30	396	138.49	44.36	1337.41	1120.7	28
183	110.45	40.75	1070.62	1065.9	30	397	139.06	45.60	1337.91	1123.8	30
184	115.12	40.55	1082.16	1073.4	30	398	139.72	44.65	1327.26	1125.4	30
185	117.19	39.39	1077.9	1064.6	30	399	139.44	47.07	1321.35	1121.5	30
186	114.90	39.27	1069.14	1063.6	30	400	138.60	47.72	1320.21	1121.6	30
187	116.41	40.89	1075.43	1064.1	30	401	138.69	47.72	1315.93	1122.3	28
188	116.61	41.22	1071.20	1062.7	30	402	136.17	48.80	1311.30	1123.3	28
189	115.52	40.57	1058.00	1059.3	30	403	136.05	48.67	1268.05	1121.1	29
190	112.18	40.43	1064.58	1056.4	30	404	137.28	49.75	1266.32	1120.4	29
191	113.02	40.58	1069.05	1063.2	30	405	136.05	50.44	1253.88	1120.5	30
192	113.63	39.93	1053.5	1061.5	29	406	137.04	49.76	1256.22	1115.1	30
193	115.53	41.08	1061.94	1094.1	28	407	140.31	49.76	1259.20	1119.5	29
194	117.12	40.00	1086.32	1088.6	29	408	139.23	50.72	1252.27	1113.8	30
195	116.87	37.64	1071.33	1083.6	30	409	139.90	50.14	1254.84	1105.4	28
196	116.50	37.46	1074.75	1089.4	29	410	140.59	50.47	1257.71	1100.8	28
197	117.14	37.16	1072.70	1102.5	29	411	142.07	50.35	1250.91	1105.7	28
198	116.90	36.76	1071.46	1094.0	29	412	143.43	49.97	1255.32	1096.6	29
199	113.58	35.65	1074.50	1099.0	30	413	145.27	50.30	1261.98	1099.9	29
200	112.83	36.31	1060.01	1099.2	30	414	144.50	51.59	1268.84	1098.0	30
201	113.05	37.32	1061.08	1092.8	30	415	143.26	50.31	1265.24	1097.4	30
202	113.00	35.55	1072.36	1091.3	30	416	143.99	50.61	1265.85	1093.0	30
203	112.27	34.98	1051.07	1082.5	30	417	144.90	50.18	1263.95	1088.0	24
204	112.89	34.72	1066.19	1086.8	30	418	148.73	49.45	1273.35	1088.3	28
205	112.47	34.55	1078.11	1091.5	28	419	148.77	48.75	1266.64	1088.8	28
206	113.45	36.12	1072.38	1095.5	30	420	149.33	49.71	1267.99	1090.9	30
207	115.96	36.76	1070.26	1091.0	29	421	150.00	48.72	1275.06	1089.7	26
208	114.11	37.62	1075.97	1097.3	28	422	149.27	46.83	1276.71	1098.3	28

STT	Coffee prices	Oil Prices	Gold Prices	Dollar Prices	Temp	STT	Coffee prices	Oil Prices	Gold Prices	Dollar Prices	Temp
209	113.56	36.36	1069.09	1096.8	29	423	147.29	46.66	1287.62	1098.1	28
210	114.66	37.88	1068.87	1091.7	29	424	148.14	45.32	1296.52	1105.6	29
211	116.03	36.59	1061.32	1093.3	30	425	149.61	44.66	1302.16	1109.7	28
212	117.35	37.13	1060.8	1086.0	30	426	153.41	44.07	1304.21	1110.5	30
213	116.35	36.81	1074.49	1083.2	27	427	155.52	44.88	1281.21	1109.5	30
214	115.43	35.97	1077.53	1074.8	30						

Iraq's Foreign Trade Performance: A Critical Analysis

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Abstract

Foreign trade has become an important feature in **t**ransforming the relationship between different countries. In recent years Iraq's foreign trade has excelled and it currently represents more than 73% of the country's Gross Domestic Product (GDP) suggesting an openness to trade. However, none of the studies related to foreign trade have explored Iraq's international trade. This paper attempts to explore the intricacies of Iraq's trade with the other countries. The trends in bilateral trades and trade intensity for the period between 2007-2017 with few chosen countries are investigated. This study throws light on the Iraq's untapped potential to develop as a major player in an international trade.

Keywords: Iraq, India, foreign trade performance, trade intensity index, trade reciprocity.

JEL Clasiffication: F13; F14.

1. Introduction

In developing economy the international trade sector is of large importance. The foreign trade encompassing export and import reflects on nation's consumption, the output to the world, integration to the world market and resourcefulness (Vijayasri 2013). The Gross Domestic Product (GDP), growth rate, trade deficit, *etc*. of the country largely depends on the export and import of goods and services. The increase in trade with the world brings about the change in volume, composition as well as the geographical distribution of export and import, which have a direct impact on the country's economic related issues like inflation rate, employment, *etc*. A well developed foreign trade policy helps to increase the growth of traditional sectors and increases the chances of foreign exchange earnings (Vijayasri, 2013).

Iraq has an abundant natural resource of oil and gas and many developed and developing countries depend on this natural resource. According to the Organization of the Petroleum Exporting Countries (OPEC) data in 2017, Iraq's proven crude oil and natural gas reserves amounts to 147,223 million barrels and 3744 billion cubic meters, respectively (see Organization of the Petroleum Operating Countries, 2018). Iraq ranks fourth in position in the world as the largest oil exporter and also holds the world's fifth largest proven reserves of petroleum (see World Bank Group 2017). Iraq's economic and political relationships with other countries have improved over the years, resulting in the establishment of trade relations with the European, American, Asian, and African nations (Cammet, 2018). Iraq is emerging as a major hub for international trades and is found to be leading the oil-rich countries of the Middle East (Griffiths 2017). Cordesman (2018) observes that Iraq's position in the arena of international trade is becoming unquestionable because of its abundant reserves of oil and natural gas. On the other hand, Iraq has a dearth of other basic commodities and lack development in the agriculture and service sectors due to which it relies on other countries for the basic requirement, and together this been the main driving force to establish bilateral trade relations. From long time, the Iraq's foreign trade factors like the size, composition and direction is influenced by oil revenues, Iraq's foreign policies and their economic relations with the neighboring and international community (Alnasrawi 1971). Ghimire *et al.* (2016) examined the impact of external financial aid on the exports and international trades of developing countries. It was found that althrough the effect of foreign aid was limited, developing countries witnessed a growth in their export performance due to the external financial assistance. Worldwide, Iraq has initiated the bilateral trade agreements and economic cooperation to spur the economic growth. Other than international trade, financial investments in the form of foreign direct investment (FDI) and foreign exchange reserves are also the key sources of wealth for Iraq's developing economy. Iraq is financially supported by the International Monetary Fund (IMF) and bilateral loans (financial assistance) by many countries (The World

Bank Report 2017). Salman (2016) conducted an empirical study of the barriers that prevented exports from small Iraqi organizations. It was found that financial constraints, crime, corruption, rigid trade policies, and inadequate infrastructure were the major roadblocks. Kitous *et al.* (2016) examined the effect of fluctuating price of oil. It was found that the GDP of exporting countries was impacted by fluctuations in the price of oil, resulting in economic destabilization. The researchers observed that such fluctuations were caused by the varying macroeconomic and political factors. Further studies on various factors affecting Iraq's trade relations are required to enhance the level of understanding. The growing foreign trade as well as the economic relationship between Iraq and the world over the last decade (2007-2017) forms the basis of this study. The objectives of this paper are to (i) analyze Iraq's foreign trade, including the export and import; (ii) measure the integration of Iraq's trade with the world trade; (iii) measure the trend and pattern in % share of Iraq's trade over a period of time.

2. Methodology

This study analyzes the trade relation between Iraq and partner countries. The data are collected for the period of 2007-2017. The secondary data is collected from World Integrated Trade Solution (WITS) Statistical Database and Trade Map-International Trade Statistics (ITC) Database. Trade performance was measured by computing the percentage share. Additionally, the Trade Intensity Index (TII) is also used to analyze the trade between Iraq and other partner countries.

2.1. Trade Intensity Index (TII)

The importance of trade between two countries with respect to the world trade is determined by TII. It is reported as the share of country's export with the partner country as a proportion of the share of world export to the partner country. This index, which ranges from 0 to 1 provides any changes in the trade flows between the countries. It is calculated as:

$$TII_{IrC} = (XI_{rC} / XI_r) / (XW_C / XW)$$

where: XI_{rC} and XW_C are the values of Iraq's (Ir) exports and of world exports to partner country 'C' and where XI_r and XW are Iraq's total exports and total world exports, respectively.

An index of more (less) than one indicates a bilateral trade flow that is larger (smaller) than expected, given the partner country"s importance in world trade. If the value is higher than 1 it indicates a higher trade relations. The Trade Intensity Index is further divided into Export Intensity Index (EII) and Import Intensity Index (III) to explain the pattern of exports and imports between the countries. The trade intensity index developed by Drysdale and Garnaut (1982) is adopted in this study.

a. Export intensity index (EII) between Iraq and partner country will be calculated as:

$$EII_{IrC} = (XI_{rC} / XI_r) / ((M_C / (MW – MI_r))$$

where: XI_{rC} = Iraq's export to the country; XI_r = Iraq's total export; MI_r = total import of the Iraq; MW = total world imports; M_C = total imports of the country.

b. Import intensity index (III) between Iraq and partner country will be calculated as:

$$III_{IrC} = (MI_{rC} / M_C) / ((X_C / (XW – XI_r))$$

where: MI_{rC} = import of Iraq from the country; M_C = total import of country; XI_r = total export of the Iraq; XW = total world export; X_C = total export of country.

The index value equivalent to one, implies a higher degree of trade intensity between two selected countries. The lower trade relation is represented by index value nearing to zero. For the index values greater than one reflect the over-representation of the nations export/import into other nations. Vice-versa the values lower than 1 reflects mean under-representation of trade.

2.2. Trade Reciprocity Index

Trade reciprocity index (TRI) was computed to measure the trade reciprocity between Iraq and the partner country for the study period of 2007-2017. This is the measure of overall balance of trade between any two trade partner countries (or two regions) (Wadhwa 1982). It is calculated as follows:

$$\theta = 1 - \frac{\sum_{j=1}^{n} \frac{|a_{ij} - a_{ji}|}{(a_{ij} - a_{ji})} \cdot \sum_{i=1}^{n} a_{ij}}{(n-1) \cdot \sum_{i=1}^{n} \sum_{j=1}^{n} a_{ij}}$$

where a_{ij}= exports of country i (Iraq) to partner j (country); a_{ji}= exports of country j (partner country) to partner i (Iraq); n= total number of countries involved in the context of the bilateral or regional; θ= the trade reciprocity index (TRI). TRI (*i.e.* θ) lie between zero and one.

The trade reciprocity index equal to one implies that the pair of trading countries is in the state of perfectly balanced bilateral trade. Whereas, a zero trade reciprocity index implies completely unbalanced trade or a one way flow of trade either exports or imports between the trading countries.

Iraq's Foreign Trade Performance from Macroeconomic Context

Over the last decade, economic relation of Iraq with partner countries and the economic growth is backed by increased oil revenues. Iraq's trade performance in terms of increase in real GDP growth is of economic importance. Figure 1 depicts the real GDP growth rate of Iraq for the period of 2007-2017. In the year 2004, it was 54.16%, the highest ever reported GDP growth in the past two decades. Since 2007, the GDP growth has increased from 1.38% to 13.94% in 2012. After that there has been a fluctuation in the GDP growth rate. In 2014, it dropped to 0.7%, which is also reflected in the decreased export revenue and decreased imports in comparison to the previous years (Table 1). In 2017, the GDP annual growth rate contracted to a negative value (-0.78%) for the first time in the past ten years due to contraction in oil production and lowered oil prices. In the past two decades, in 2002, the negative GDP growth corresponded to -33.1%, suggesting that there has been a decrease in the business. However, the foreign investment and improved oil production can aid to accelerate growth in the coming years. Over the years, there has been a change in the composition of Iraq's foreign trade, especially the import of goods and services. The oil still rules the export category and generate the maximum revenue for the Iraqi government required for the investment in the infrastructure development. In 2017, Iraq's export items were dominated by fuels (96.6%) followed by precious stones, hides and skin, and imports were dominated by machinery and electrical equipments (23%) and stones and glass (10%). Other imported items included consumer durable and non-durable goods such as clothing, textiles, food products and chemicals.

Evaluation of Iraq's Position in International Trade

Iraq's relative importance as a trading partner is largely driven due to the dependence of the global economy on oil and gas. In the past, the fluctuations in oil prices and constrained export of oil from Iraq have hit the global economic growth. At present, Iraq is on the verge of developing a steady trade relationship with the international community. In the last ten years, there has been an increase in the Iraq's total trade by 2.0 times, i.e., the total trade value has increased from 47.3 US$ billion in 2007 to 98.5 US$ billion in 2017. In comparison to other countries like the EU, USA, China who is hugely dependent on Iraq for the oil source, Iraq's total trade increase is way less (Table 1). However, for most of the study period the trade balance has remained positive. Despite the vast natural resource of oil and gas Iraq's share in world trade has improved very slightly from 0.16% to 0.29%. The international or world trade is the key aspect of any economy. The policy around exports and imports helps to improve the economic situation and factors related to it such as GDP, inflation rate, *etc*. The liberalization of trade involving elimination of tariff barriers, constructive use of revenue to develop the local industries helps to increase the flow of trade and economic growth (Barro, 1995). Iraq's foreign trade performance suggest that foreign trade policies involving export strategies with respect to the global market should be addressed to improve the trade with other countries. In this regard, Iraq has signed bilateral trade agreements with many foreign countries to enhance the economic cooperation and trade relation. Iraq has signed Memorandums of Understandings (MoU) with 32 bilateral trade partners and nine multilateral groupings (Salem, 2013). Iraq exports of oil and gas products to the United States (US), the European Union (EU), India, Turkey and China, and imports of diversified products from these countries remains mutually beneficial for economic and trade relations. In 2016, as per the Observatory of Economic Complexity (OEC) Iraq held the 47th place and 58th place in the exporting and the importing market in the world trade (OEC report). According to World Trade Organization (WTO) report in 2017, excluding intra-EU Trade, Iraq ranked 51st and 78th in the export for merchandise and commercial services, respectively, and 56th and 57th in the import of merchandise and commercial services, respectively (WTO Statistics Database, 2017).

Iraq's Trend and Direction of Trade

Over the last decade, the increased oil revenues have boosted the Iraq's economic growth and has provided with ample opportunities to improve the trade relation with neighboring countries and international communities. The trends of trade, export and import intensities between Iraq and partner countries are represented in Table 1. For most of the study period (2007-2017) the trade intensity of Iraq and partner countries has remained above one suggesting a uniform trade relations between Iraq and partner countries. In 2017, Iraq's largest trading partner was China with bilateral trade reaching around 22.1 US$ billion, followed by the EU (18.8 US$ billion), India (16.6 US$ billion), United Arab Emirates (UAE) (13 US$ billion), the US (12.3 US$ billion), Turkey (10.5 US$ billion), Korea and Italy. This bilateral trade is largely dominated by oil exports from Iraq.

China

From the Eastern hemisphere, China is an important trade partner of Iraq largely based on Iraqi oil and gas source (Liu, 2016). In the past decade, Iraq's exports to China has increased by 18 times. In 2007, Iraq's exports to China represented 2.0% of Iraq's total export which skyrocketed to 20.6% in 2017 (Figure 3) which mainly constituted fuels (99%) suggesting China as an important export partner with Iraq. In 2017, Iraq exported 270 million barrels of oil to China. Countrywise, with China the trade intensity index including both export and import intensity has increased from 2007 to 2017 suggesting that China is emerging as an important trade partner. To further consolidate the trade relations, in 2015, five agreements and a Memorandum of Understanding (MOU) was signed between Iraq and China to expand the cooperation in the energy sector and increase the investment in Iraq's oil sector to boost the exploration and development of oil fields (PMO Release, 2015).

Turkey

Currently, Iraq has the largest export market in Turkey. Turkey and Iraq's interdependent relation is largely due to their geographical proximity (Demir, Özmen & Rashid 2014). The higher import intensity index as compared to export intensity index between Iraq and Turkey suggests that Iraq imports are more from Turkey in comparison to the other countries. In 2007, Turkey supplied commodity worth 2.8 US$ billion to Iraq, which significantly increased to 9.1 US$ billion in 2017. In the last decade Iraq's import from Turkey constituted 20-29% of Iraq's total world import. Turkey remains one of the largest supplier of consumer goods including clothing, food products, vegetables, *etc*.

United States (US)

In West, Iraq's share bilateral economic relations with the US (Ponorîcă, Zaqeer & Al-Saedi, 2016). In 2013, the Trade and Investment Framework Agreement between Iraq and the US which was signed in 2005 was finally ratified (Salem, 2013). In 2016, Iraq was the 48th trading partner with the US. In 2007, the US imported fuel worth 11.4 US$ billion, which has not increased much in 2017, it remained 11.2 US$ billion, suggesting that the US has decreased their dependence on Iraq for energy needs due to shale oil revolution (Salameh, 2013). The US is working on revitalizing the domestic petroleum production and may emerge as a new power in the global oil market. However, in the last decade the fuel remained the main import commodity from Iraq. In the last decade, Iraq's share of trade with the US has drastically decreased from 25.4% to 12.2%, which is also reflected in the decrease in trade intensity and trade reciprocity suggesting that the US has expanded their market to other countries.

India

India and Iraq share a diplomatic and cordial relation since centuries. India and Iraq have signed trade agreements to extend the bilateral trade and economic relations (Alam, 2014). In the past decade (included in this study) the trade-intensity index has remained above 7 suggesting an intense trade relation between the two countries. The degree of export intensity which remained between 6.1-9.7 indicates Iraq's export to India is very high compared with the rest of the world. Between 2007-2017, Iraq's share of export to India has increased from 15% to 24% of Iraq's total world exports. In 2017, India imported fuel worth 15.3 US$ billion, representing 13% of India's fuel export from Iraq. Other export items included fruits, hides and skins, and wool items. The low import intensity index suggests that Iraq's export to India is more as compared to the Iraq's imports from India. The reciprocity index of trade has remained between 0.1 to 0.26 implying a non-uniform trade balance. India must focus on exporting items to Iraq. Iraq imports from India includes wide varieties of consumer and intermediate goods including vegetables, other food products, metals, machinery and electrical equipments, textiles and clothing, precious stones and glass.

European Union (EU)

The Memorandum of Understanding on Energy Cooperation (2010) and the Partnership and Cooperation Agreement (PCA; 2012) are the two bilateral agreements between the EU and Iraq, which covers the cooperation in the field of energy as well as trade (Ponorîcă, Zaqeer & Al-Saedi, 2016). In the period between 2007-2017, Iraq's export as well as an import intensity index with the EU was mostly maintained above 1 suggesting an efficient bilateral trade between Iraq and the EU. In the past decade Iraq's export to the EU constituted approximately 21% of Iraq's total export to the world. Iraq's export items include mineral fuels, lubricants and related materials which constitute the 99.6% of the EU imports from Iraq. Considering Italy and other EU members individually as a trading partner with Iraq, in 2016, Iraq exported oil worth 3.2 US$ billion (99.6% export product share) to Italy, 2.6 US$ billion (100% export product share) to Greece, 1.8 US$ billion (99.82% export product share) to the Netherlands, 1.4 US$ billion (99.9% export product share) to Spain. Other EU members also import fuels as a major commodity from Iraq. Iraq imports from the EU mainly constitutes machinery and electrical equipments (Italy, Netherlands, Hungary), food products (Greece, UK, Ireland) and chemicals (UK, Ireland, France). The trade reciprocity index has fluctuated between 0.4-0.8 between 2007-2017 suggesting that the trade (export and imports) between Iraq and the EU has been fluctuating but remained mostly balanced.

Organization of the Petroleum Exporting Countries (OPEC) Members

In 1960, Iraq along with Iran, Kuwait, Saudi Arabia and Venezuela founded the OPEC, an intergovernmental organization, to control the oil exporting market (Ebghaei 2007). So far, Iraq's trade with OPEC countries has been low in comparison to the world trade due to OPEC member's dependence on oil export. The trade intensity index shows very poor trade between Iraq and OPEC countries like UAE, Saudi Arabia, Kuwait and Iran (Table 2). Considering Iraq's higher import intensity index value with UAE and Iran as compared to Kuwait and Saudi Arabia suggests that Iraq tends to import with countries who are geographically closer. In the past decade Iraq's import from the UAE has increased from 17% to 36%. In 2007, Iraq's imports from UAE mainly constituted food products including vegetables, dairy and meat products, *etc*. However, in the past decade, there has been a shift in the composition of import commodity and in 2017 the imports mainly constituted machinery and electrical equipments, and the precious stones and metals. Between 2007-2017, Iraq's import composition from Kuwait, Iran and Saudi Arabia did not diversify much; import composition remained parts and accessories of rail sectors, plastic products, food products, dairy or meat products, machinery and electrical equipments and other miscellaneous items. Comparatively, the UAE and Iran's average share of trade (8% and 5%) in Iraq's world trade were higher as compared to Saudi Arabia (0.5%) and Kuwait (0.3%) average share.

The diplomatic relations between the Republic of Iraq and the Republic of Korea began in 1989. From the mid-1990s South Korea's bilateral trade with Iraq has grown at a slow and steady pace (Levkowitz, 2012). In 2017, the bilateral trade between the two countries amounted to 7.8 US$ billion, which corresponded to a 58% rise in trade from 2007 (3.3 US$ billion). This is also reflected in the trade intensity between the two countries (Table 2). The trade intensity data show Iraq exports to Korea is more as compared to the Iraq imports coming from Korea. The export items, mainly constitute the petroleum-related products (99.9% Korea's import from Iraq in 2017) and some of the major items that Iraq imports from Korea includes parts and accessories of the rail sector, machinery and electrical equipments, articles of iron and steel. Korea has been one of the consistent trading partners of Iraq in the last ten years registering an average of 8% share in Iraq's world trade (Figure 3). Trade reciprocity data (Table 3) also show an increase in bilateral trade between Iraq and South Korea in the last decade.
Other than these industrialized nations, Iraq also has trading relationships with a wide array of regional and international countries who regard Iraq as an important trading partner due to Iraq's oil sector. The trade encompassing without taxation or custom duty between Iraq and other countries will be of significant economic and social importance. This will ensure the growth in the energy sector, accommodate countries needs and simultaneously boost the trade and foreign investment.

Conclusion and Recommendations

In summary, Iraq's international trade has progressed over the past decade and has emerged as a key player in international energy markets. Iraq's federal revenue is highly dominated by income generated from the oil industry and thus any lowering of global oil prices will significantly affect the Iraq's overall trade. The composition of Iraq's export is dominated by petroleum-related products such as crude oil, refined petroleum oils, gold, petroleum gases and hydrocarbons, and petroleum oil residues. In the period 2011-2014, Iraq's overall trade had improved due to considerable increase in the export of oil. Unlike Iraq's export, Iraq's imports basket is highly diversified, which includes machinery and electronic equipments, food products, chemicals, stones and glass, *etc*. Currently, in terms

of direction, China, India, the EU, Turkey and USA remains the major trading partners or Iraq. However, the reform in Iraq's economic policies, import and export regulations can have a significant impact on the bilateral trade with other countries in the coming years. A centralized foreign policy will help not only to revive the oil sector and meet the global energy demand, but this will also spur the trade and investment with regional and global partners. To improve the oil trade, the Iraqi government is planning to introduce authorized export quality oil grades and develop the pipelines to increase the oil export (BTI, 2018 report). Additionally, the development of private sectors, import regulation and tariffs to support Iraq's industrial sector, ventures fostering partnership between private investors and state-owned enterprise (SOEs) will remove the blocks in trade (Ponorîcă, Zaqeer & Al-Saedi, 2016). The free trade policy will attract the industrial and capital investments in Iraq from the countries. This will also increase the export trade and foreign reserves. An efficient trade facilitation and transport infrastructure, including ports, air routes, road, rail links and sea routes will improve Iraq's trade opportunities with the international community. According to the United Nations Regional Commissions 2017 Survey on Trade facilitation Iraq should focus its trade facilitation efforts, in particular on the gradual implementation of "Transit" and "Paperless trade" measures, as well as on moving towards "Cross-border paperless trade". With the world's fourth largest proven oil reserves and low oil extraction costs Iraq holds immense potential to increase their share in the world trade.

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Figure 1. Real GDP growth of Iraq, 2007-2017
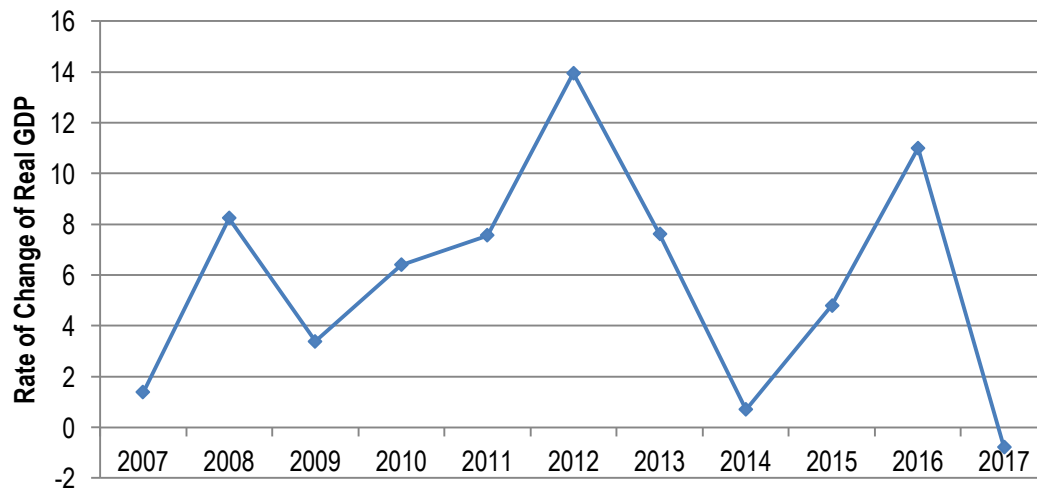
Table 1. Trade balance and trade performance of Iraq, 2007-2017

Year	Exports	Imports	Total Trade	Trade Balance	World Total Trade	Iraq's share in world trade (%)
2007	35983.1	11297.0	47280.1	24686.0	29267134.3	0.16
2008	58403.1	18866.0	77269.1	39537.1	33759744.2	0.23
2009	37602.3	22833.5	60435.8	14768.8	26212589.0	0.23
2010	49267.2	26091.9	75359.1	23175.3	32002344.0	0.24
2011	74431.7	32783.2	107214.9	41648.6	38219686.7	0.28
2012	89624.3	37818.9	127443.2	51805.4	38281194.5	0.33
2013	85072.1	42589.3	127661.4	42482.9	39363319.5	0.32
2014	82069.0	42424.3	124493.3	39644.6	39243521.1	0.32
2015	51514.0	36253.7	87767.7	15260.3	34294024.1	0.26
2016	46511.2	30515.0	77026.2	15996.2	33226513.1	0.23
2017	64025.8	34511.3	98537.1	29514.5	33940008.1	0.29

Figure 2. Iraq's position in foreign trade, 2007-2017
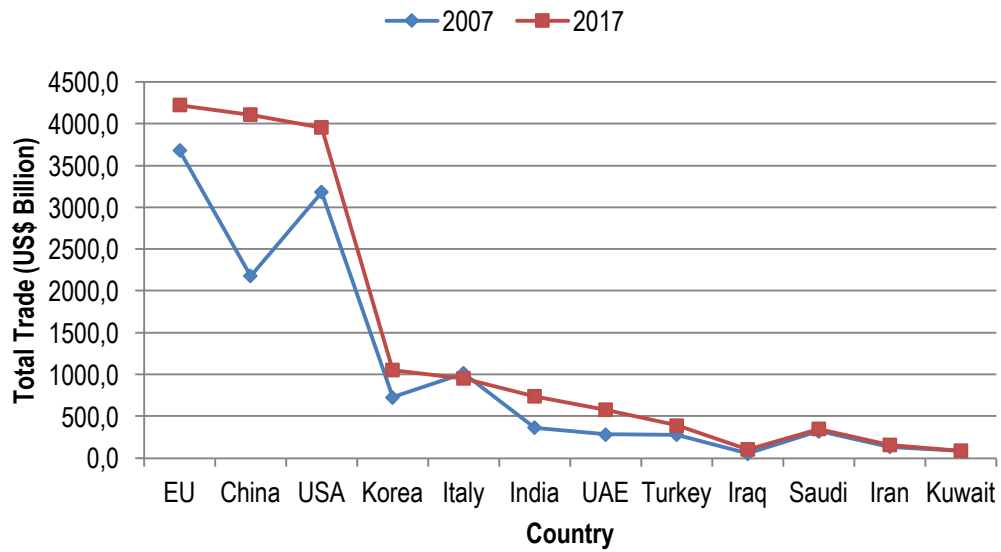
Figure 3. Percentage share of Iraq's trade with different countries
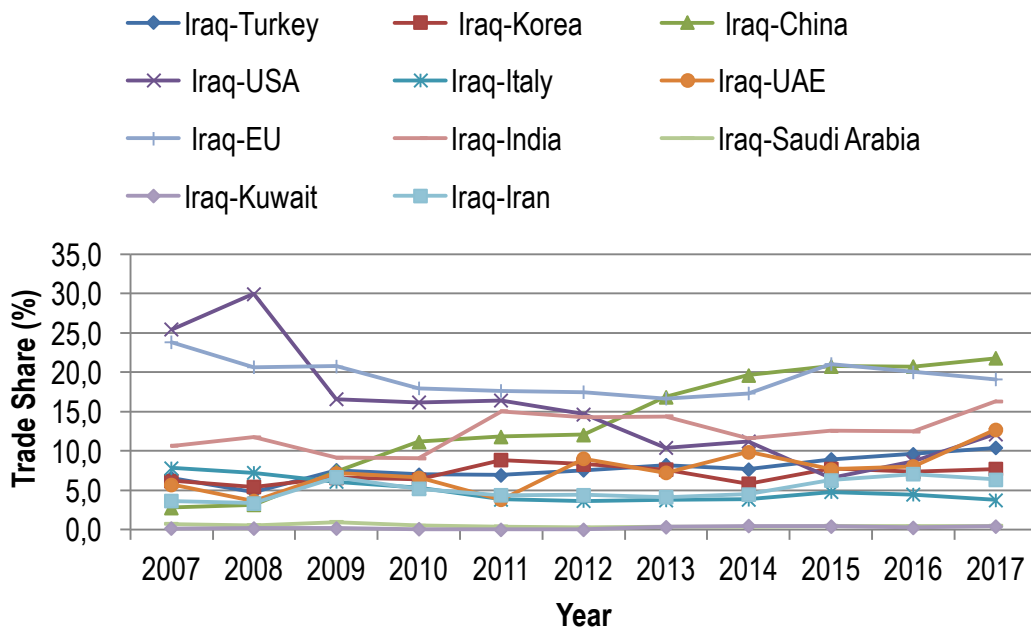
Table 2. Iraq's trade, export and import intensity index with the partner countries

Year		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
CHINA	TII	0.3	0.4	1.2	1.5	1.6	1.6	2.3	2.7	2.7	2.5	2.1
	EII	0.3	0.3	1.1	1.4	1.5	1.4	2	2.4	2.4	2.3	1.9
	III	0.8	0.8	0.9	1.5	1.2	1.3	1.5	1.6	1.7	2.1	1.9
TURKEY	TII	1.6	0.2	0.3	0.3	0.1	0.1	0.1	0.3	0.5	1.6	1.8
	EII	1.5	0.2	0.3	0.3	0.1	0.1	0.1	0.2	0.4	1.4	1.6
	III	35.9	27.7	30.3	34.1	37.8	37.8	38.5	33.7	29.6	30.8	29.7
USA	TII	2.5	3.2	2.2	2.2	2.1	1.9	1.4	1.5	0.7	1.1	1.3
	EII	2.3	2.9	2.0	2.0	1.9	1.7	1.3	1.3	0.6	0.9	1.2
	III	1.8	1.5	1.0	0.8	1.0	0.7	0.6	0.6	0.7	0.5	0.4
INDIA	TII	10.6	9.1	8.0	7.1	10.2	9.0	10.7	8.9	10.2	10.6	9.6
	EII	9.6	8.3	7.2	6.4	9.1	8.0	9.4	7.9	9.1	9.4	8.7
	III	1.8	2.0	1.8	2.0	1.4	2.3	1.4	1.2	2.1	2.1	2.2
KOREA	TII	3.7	2.9	4.3	3.6	4.7	4.4	4.4	3.2	5.1	4.7	3.7
	EII	3.3	2.7	3.9	3.2	4.2	4.0	3.9	2.9	4.5	4.2	3.3
	III	0.8	0.8	1.3	1.7	1.7	1.8	1.7	1.5	1.4	1.7	1.3
ITALY	TII	3.3	3.1	3.1	2.9	1.9	2.1	2.0	2.3	3.2	3.0	2.0
	EII	3.0	2.8	2.8	2.6	1.7	1.9	1.8	2.0	2.8	2.7	1.8
	III	0.4	0.5	1.0	0.8	0.8	0.9	1.6	1.2	1.1	0.9	0.7
EU	TII	2.0	1.8	1.9	1.6	1.5	1.6	1.5	1.7	2.5	2.3	2.0
	EII	1.8	1.6	1.7	1.4	1.4	1.4	1.4	1.5	2.2	2.0	1.8
	III	1.6	1.2	1.5	1.4	1.5	1.5	1.5	1.3	1.3	1.2	1.0
UAE	TII	0.2	0.1	1.7	3.2	1.7	3.2	0.8	0.9	1.0	2.4	0.7
	EII	0.1	0.1	1.6	2.9	1.5	2.8	0.7	0.8	0.9	2.1	0.7
	III	25.9	13.4	14.5	14.9	7.9	14.3	12.6	17.0	10.1	10.3	20.4
KUWAIT	TII	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	EII	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	III	2.0	1.7	1.5	0.9	0.3	0.4	2.4	3.3	3.9	3.3	4.4
IRAN	TII	0.8	0.4	0.4	0.3	0.6	0.4	0.4	0.3	0.4	0.6	0.4
	EII	0.7	0.3	0.4	0.3	0.5	0.3	0.3	0.3	0.4	0.5	0.4
	III	29.9	24.0	35.5	26.9	23.1	25.4	32.0	35.0	51.6	42.4	31.2
SAUDI ARABIA	TII	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	EII	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	III	2.2	1.4	2.1	1.2	0.8	0.6	0.7	0.8	1.2	1.3	1.2

Table 3. Trade reciprocity between Iraq and partner countries

Turkey	Korea	China	USA	Italy	UAE	Saudi	EU	Kuwait	Iran	India
0.88	0.18	0.99	0.32	0.09	0.99	0.99968	0.46	0.99998	0.96	0.10
0.97	0.23	0.98	0.24	0.15	0.98	0.99957	0.42	0.99998	0.98	0.11
0.98	0.45	0.82	0.42	0.44	0.89	1.00000	0.71	0.99978	0.99	0.24
0.98	0.55	0.83	0.32	0.34	0.88	0.99979	0.72	0.99958	0.99	0.24
0.99	0.39	0.66	0.33	0.40	0.88	0.99972	0.69	0.99990	0.98	0.11
0.99	0.42	0.68	0.27	0.41	0.88	0.99589	0.66	0.99903	0.99	0.18
0.99	0.47	0.68	0.36	0.72	0.93	0.99730	0.79	0.99997	0.99	0.13
0.98	0.55	0.67	0.35	0.59	0.94	0.99790	0.70	0.99997	0.99	0.14
0.97	0.49	0.86	0.72	0.55	0.91	0.99484	0.67	0.99966	0.99	0.26
0.92	0.57	0.90	0.45	0.46	0.88	0.98773	0.63	0.99953	0.99	0.25
0.90	0.49	0.85	0.27	0.45	0.95	0.98550	0.55	0.99983	0.99	0.22

Macroeconomic Determinants of Stock Market Volatility in Ghana and Nigeria

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Abstract:

The paper seeks to investigate the effect of both internal and external macroeconomic on stock market return volatility in Ghana and Nigeria over 16 year period of January 2000 to December 2016. The study employs time series approach to investigate the impact of lag of stock market return, consumer price index, 91 days Treasury bill rate exchange rate between domestic currency and US dollar, real domestic product, international crude oil prices, London Stock Exchange all share index and political cycle (independent variables) on stock market volatility of Ghana and Nigeria (dependent variables). It uses Exponential Generalised Autoregressive Conditional Heteroskedascity (EGARCH) as the main model. The results from the study indicate that macroeconomic/political factors affect stock market volatility. This is one of the few studies on Ghana and Nigeria and probably on Africa which tests for stock market volatility as a result of internal and external macroeconomic variable fluctuations.

Keywords: stock market; macroeconomic; volatility; EGARCH; Ghana; Nigeria.

JEL Classification: G11; G12; G18.

Introduction

With the rising level of globalisation, international trade and investment, Ghana and Nigeria just like other Sub-Sahara African (SSA) countries have become more connected with other developing and developed economies. The openness of the Ghanaian and Nigerian economies to the global economy has made their stock markets become more susceptible to volatility of external macroeconomic variables such as exchange rate, crude oil prices and international stock market indices.

Empirical evidence of the effect of macroeconomic variables on stock market return in SSA has been persistent since the 1990s. However, most previous studies failed to take into consideration some relevant domestic and external variables such as political risk, and international stock market indices which have been empirically found to have effect on stock market volatility. It is imperative to state that most previous studies relied virtually on few internal macroeconomic variables for their studies (Adjasi *et al.* 2008, Aggrawal *et al.* 2010, Prempeh 2016). Political risk virtually ignored in most studies on determinants of stock market volatility even though some scholars stress on its effect on stock market return (Bialkowski 2008). A few studies used crude oil prices as an external variable among the list explanatory variables employed for their work (Kuwornu 2012). Valadkhani and Chancharat (2008) and Diebold and Yilmaz (2012) have revealed that stock markets index especially those in the developed markets have influence on the developing and emerging ones.

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This study employs political cycle and London Stock Exchange all share index in addition to dominant explanatory variables normally used by researchers in establishing the link between risk factors and stock market volatility in Ghana and Nigeria within the framework of the Arbitrage Pricing Theory.

The paper continues as follows. In Section 2 the relevant literature on the subject matter are reviewed. The methodology employed for the study is discussed in Section 3. Empirical results are reported and discussed in Section 4. Finally, conclusion to the study is drawn in Section 5.

1. Literature review

The Arbitrage Pricing Theory (APT) introduced by Ross (1976) underlies the empirical model for this study. The APT stresses that the expected risk premium on a stock should depend on the stock's exposure to several pervasive factors mostly macroeconomic variables that affect stock return. However, it failed to state what these factors are, thereby leaving researchers to hunt for these factors in a typical empirical study. Nkoro and Uko (2016) argue that, various studies do not have clear cut criteria for selection of variables that should constitute the independent variables. Kuwornu and Owusu-Nantwi (2011) emphasised out that the selection of variables is influenced by the various works that have been carried out and reviewed in literature about their relationships with stock returns. A number of studies however highlighted the frequent use of inflation rate, interest rate and exchange rate as commonly used to explain stock movements. The selection of the macroeconomic factors must therefore be done taking into consideration variables used in previous empirical works as well as those that have the propensity to affect stock market return and volatility.

Stock market volatility is seen as the variance of monthly returns of market index (French *et al.* 1987). They argue that stock market volatility does not take a particular pattern for long since the factors that because it keeps on changing. They also asserted that fluctuations in the level of uncertainty of future macroeconomic conditions would create a proportional change in stock market return volatility.

A number of researchers have reported that changes in exchange rates, interest rates and inflation especially have substantial impact on stock market index movements. Adjasi and Biekpe (2005) for instance assert that a depreciating currency has negative impact on the stock market returns since it creates shifting of investments from domestic assets to foreign assets thereby causing a fall in domestic stock prices. In his study on stock market of South Africa, Chinzara (2011) established that stock market volatility is significantly affected by macroeconomic uncertainties. He established that volatilities in exchange rate and short term interest rates are the most influential variables in affecting stock market volatilities. The impact of other variables namely: crude oil prices, gold prices and inflation were not significant. Sekman (2011) established a negative effect of exchange rate volatility on stock market returns in their study on US Stock Market. This finding is buttressed by Nkoro and Uko (2016) who reported a negative relationship between stock market return volatility and exchange rate and inflation volatility in Nigeria. Investors can therefore take note of the existence of systematic risks as a result of exchange rate and inflation volatility when building their investment portfolios and diversification strategies. Khan and Khalid (2017) however found negative and significant impact of interest rate on the market index whereas exchange rate and inflation have a positive impact on stock market volatility.

More recent studies seem to buttress the findings that macroeconomic variables have significant effect on stock market volatility. Ashwani and Sheera (2018) observed that exchange rate, money supply, treasury bills rate, along with the controlling variables of net foreign institutional investment and stock turnover ratio had predictable capacity for stock market volatility. Again, Jan *et al.* (2018) employing the GARCH (1,1) revealed that exchange rate, oil and risk free rate are significant determinants of stock returns volatility. They established negative relationships between exchange rate, and oil and stock return volatility. Risk-free rate however showed positive and negative effect on the stock return volatility of majority of the firms in NYSE and PSX markets respectively. Mechri, *et al.* (2018) in their study on Tunisian and Turkish stock markets found that volatility of exchange rate has a significant effect on fluctuation of stock market return in Tunisia. The same applies to gold and oil prices volatility. They established that exchange rate, interest rate and gold price volatility also have impact on Turkish stock market. Yaya and Shittu (2010) also found that previous inflation rates have significant effect on stock market volatility.

Irshad (2017) on the other hand studied the impact of political instability in Pakistan on Karachi Stock Market 100 index. He found a negative relationship between stock market index and political instability. He specifically established that unstable political system ultimately leads to decline in stock market index.

Some studies have however established that the link between macroeconomic variables and stock market volatility can be bidirectional. Beltratti and Morana (2006) argues that stock market volatility can also affect volatility of macroeconomic variables. However, the causality duration is stronger from macroeconomic variables to stock

market volatility. Haider *et al.* (2017) found that relationship between volatility of macroeconomic variables and that of stock returns is bidirectional, and that both affect each other in different dynamics.

2. Methodology

2.1. Model specification and description of data

In line with scholars such as Chen *et al.* (1986), Nishat and Shaheen (2004), Adam and Tweneboah (2008), Kuwornu (2012), Nkoro and Uko (2016) who have empirically investigated the influence of macroeconomic determinants on stock market volatility using the APT theoretical framework presented by Ross (1976), the following empirical model has been specified (in Equation 1).

$$SMR_t = \beta_0 + \beta_1 SMR_{t-1} + \beta_2 CPI_t + \beta_3 TBILL_t + \beta_4 EXCH_t + \beta_5 RGDP_t + \beta_6 OIL_t + \beta_7 LSE_t + \beta_8 POL_t + \varepsilon_t \qquad (1)$$

where: SMR = All share index (proxy of stock market returns); SMR_{t-1} = Lag of all share index (proxy of stock market returns); CPI = Consumer price index (inflation) as a proxy for inflation; TBILL = Nominal 91 day Treasury bill rate as a proxy for interest rate; EXR = Nominal exchange rate between the domestic currency and the US dollar; RGDP = Real gross domestic product growth rate proxy for economic growth rate; OIL = World crude oil prices; LSE = London Stock Exchange all share index proxy for LSE stock market returns; POL = Political Cycle - periods of national elections in the typical SSA country

Equation 1 reveals that some modifications have been done to most models employed by previous scholars. This study uses two control variables LSE and POL. The study did not incorporate money supply as an explanatory variable. In the views of monetarists (Friedman 1970, Tymoigne and Wray 2013*)*, money supply can reflect in excess liquidity and for that matter inflation which is the main bane of most West African economy. High and persistent is a general feature in the region as a result of aggregate demand exceeding aggregate supply. Theoretically, therefore, money supply and inflation if put in the same equation can create the problem of multicollinearity. For that matter money supply was not added to the model for the study.

Significant number of previous African scholars who study the link between macroeconomic factors and stock market indices used either annual or quarterly data for their studies. This is particularly so because GDP which comparatively serves as a better proxy for economic growth is computed annually and quarterly in most African countries. Scholars who employed monthly data for their studies were compelled to use industrial production index (Hussin *et al.* 2012, Ibrahim and Musah 2014, Asaolu and Ogunmuyiwa 2011). This study employed computed monthly real GDP data from available quarterly data using the Chow-Lin interpolation procedure employing Matlab temporal disaggregation library developed by Abad and Quilis (2005). Estimated monthly real GDP from quarterly real GDP is arguably preferred since it also captures the entire economy.

Again, the study also employed political or election cycle as proxy for political risk. Changes in regimes, pronouncements of political leaders, violence before and after general elections are reported by scholars to have impact on stock market performance (Bialkowski *et al.* 2008).

This study also departed from the norm of relying basically on internal variables but took into consideration both internal and external factors mainly performance (composite index) of a world leading stock market - London Stock Exchange and world crude oil prices (which has been employed only by scanty scholars in their studies).

Monthly figures for crude oil prices, interpolated real GDP, LSE all-share index and political cycle were included as response to meet suggestions made by Kuwornu and Owusu-Nantwi (2011), Kuwornu (2012), Ouma and Muriu (2014) to include other salient macroeconomic and other variables that are likely to improve stock market return predictions, and because these variables have shown to be key determinants of stock market returns in previous studies. Oil serves a factor of production for most firms especially the manufacturing firms. Changes in crude oil prices are therefore likely to have effect on performance of firms listed on exchanges of SSA countries. The influence of external stock indices which operate in the form of co-movement of stock markets has become a leading research topic in recent times as a result of impact of stock market indexes on that of other markets. LSE was selected as a result the relationship between UK and the five selected countries.

Finally, the upsurge of political violence and negative and provocative utterances that come with national elections has made it imperative to add political cycle to the model used for this study.

The study also maintains that the performance of stock markets can be self-enhancing. The past stock market index can affect the present index. Past indexes of stock markets are therefore employed as explanatory variables in the model.

2.2. Tests and models used

Given that the estimated Exponential Generalised Autoregressive Conditional Heteroscedasticity (EGARCH) (1.1) model (Nelson 1991) is appropriate to describe the volatility of market returns, this model is used to explore the impact of macroeconomic fluctuations on the volatility of the Ghanaian and Nigerian stock market returns. The EGARCH (1.1) model has proved its adequacy in modelling the volatility of stock market returns. The study employed EGARCH analysis to examine the stock return volatility together with the presence of other explanatory variables (mainly macroeconomic factors).

2.3. Data description and sources

Table 1. Variable information

Notation	Variable	Brief Description of Data	Sources
SMR	Stock Market Index	Monthly all stock market index used as proxy for stock market return.	▪ Statistics Department of Ghana Stock; ▪ Exchange Statistics Department Nigeria Stock Exchange;
CPI	Consumer Price Index	Monthly consumer price index used as proxy for inflation.	▪ Research Department of Bank of Ghana; ▪ Statistics Department of Central Bank of Nigeria; ▪ Statistical Bureaus of Ghana and Nigeria;
TBILL	Treasury bill	Monthly 91-Day Treasury bill rate used as proxy for interest rate.	▪ Research Department of Bank of Ghana; ▪ Statistics Department of Central Bank of Nigeria;
EXR	Exchange Rate	Monthly nominal exchange rate between domestic currency and US dollar used as proxy for exchange rate.	▪ Research Department of Bank of Ghana; ▪ Statistics Department of Central Bank of Nigeria;
RGDP	Real GDP	Monthly real GDP used as proxy for economic growth.	▪ Research Department of Bank of Ghana; ▪ Statistics Department of Central Bank of Nigeria; ▪ Statistical Bureaus of Ghana, Nigeria;
OIL	Log of Crude oil price	Monthly crude oil prices per barrel proxy for world crude oil prices	▪ World Bank websites (www.worldbank.org);
LSE	LSE all share index	Monthly LSE all share index as a proxy of major stock market indices in the world	▪ London stock exchange website (www.londonstockexchange.com);
POL	Political cycle	Political cycle as proxy for political risk	▪ www.un.org/africarenewal; ▪ en.ikipedia.org/wiki/Elections_by_country.

3. Results

3.1. Stylized facts: Trends in SMR, CPI, TBILL, EXR and OIL

3.1.1. Stock Market Index (Stock Market Return)

Of particular mention are the trends in stock market return (all share index), which are presented in Figure 1. On the average, stock returns in Nigeria were the higher for the period under estimation. Stock returns have been relatively volatile, with significant structural breaks observed especially in the stock returns for both countries. Comparatively, the stock returns in Nigeria appear to have significant upward movements than that of Ghana.

Figure 1. Trend in Stock Market Returns (Jan 2000 – Dec 2016)

Source: Ghana Stock Exchange and Nigeria Stock Exchange

3.1.2. Consumer Price Index

CPI of Nigeria been rising steadily and gently. CPI in Ghana rose sharply as compared to that of Nigeria in the period under study. This depicts high inflation rate in Ghana. The sharp fall of CPI in Ghana was as a result of rebasing of CPI that occurred in May 2013. Figure 2 reveals that CPI (inflation) in general has been increasing in both countries.

Figure 2. Trend in Consumer Price Index (Jan 2000 – Dec 2016)
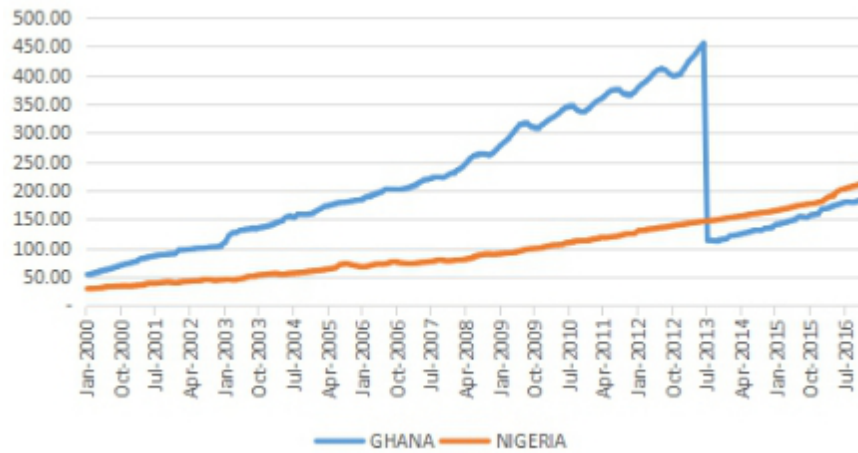
Source: Websites of Bank of Ghana and Central Bank of Nigeria

3.1.3. Treasury bill

Treasury bill rate seem to be the more volatile for Ghana than Nigeria with some structural breaks. This will undoubtedly affect the stock market returns of these countries.

Figure 3. Trend in 91-Day Treasury bill (Jan 2000 – Dec 2016)
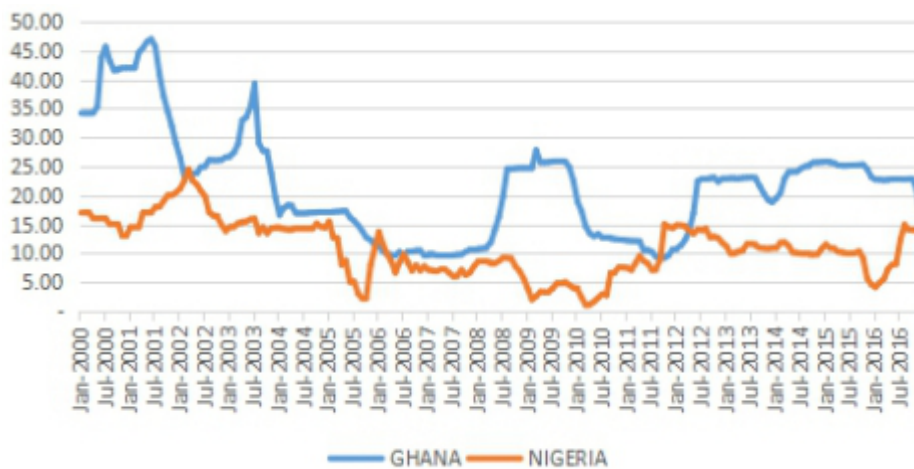
Source: Websites of Bank of Ghana and Central Bank of Nigeria

3.1.4. Exchange rate

Exchange rates between the domestic currency of the two West African countries and the US dollar have been increasing gently over the seventeen-year period (Table 4). The trend for Nigeria shows an exceptional situation where more than 100% rise in exchange rate was realised. It is worthy to note that the exchange rate between the Ghana cedi and the US dollar has been relatively low. This is as a result of redenomination of the cedi that erased four zeroes in 2007. On the whole domestic currencies in the two countries have depreciated against the US dollar over the seventeen-year period studied.

Figure 4. Trend in Exchange rate between domestic currency and US dollar (Jan 2000 – Dec 2016)
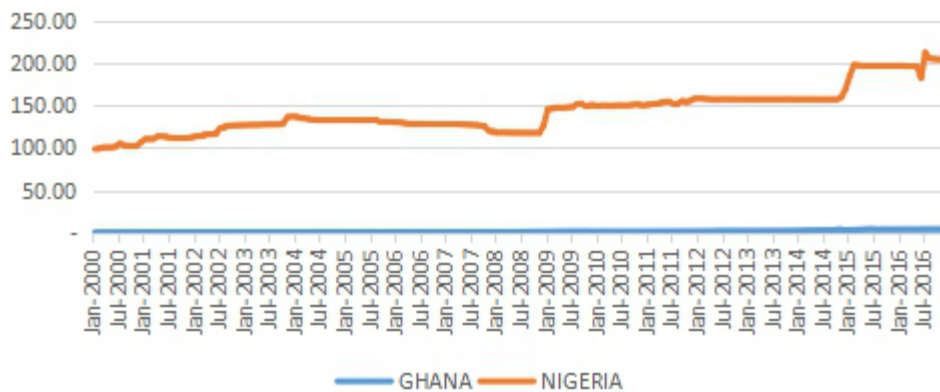
Source: Websites of Bank of Ghana and Central Bank of Nigeria

3.1.5. International crude oil prices

It is imperative to study the trend in international crude oil over the seventeen-year period (January 2000 – December 2016) (Figure 5). The variable generally increased over the period with some breaks. The period experienced increase in crude oil prices. It is expected that this trend will have positive effect on Nigeria which is a crude oil exporting country.

Figure 5. Trend in international crude oil prices (Jan 2000 – Dec 2016)
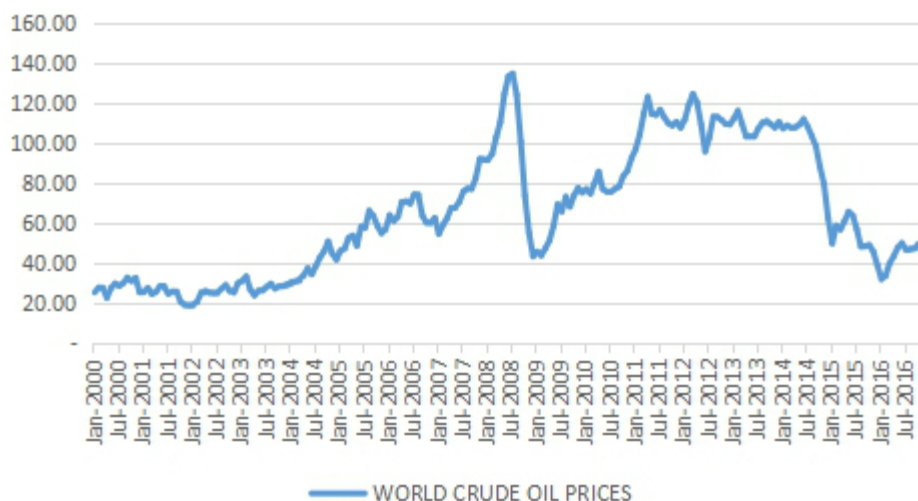
Source: World Bank Website

3.2. Descriptive statistics

The descriptive statistics for the two countries (Table 2 and Table 3 under Appendix) shows that the values were not normally distributed about the mean. All variables exhibit a positive mean. No randomness was found in the data. This indicates that aggregate stock prices (all share index) and macroeconomic variables selected for the study were all sensitive to periodic changes and speculations. An individual investor could therefore take advantage of emergence of arbiter and earn a significant higher return from the stock markets studied. This indicates inefficiency of the two stock markets.

All the variables for both countries are asymmetrical. More precisely, skewness, which is the measure of deviation of the distribution from symmetry is positive for five series for Ghana, indicating the fat tails on the right-hand side of the distribution comparably with the left-hand side. On the contrary, LSE and crude oil have a negative skewness, which indicates the fat tail on the left hand side of the distribution. Skewness for Nigeria is negative for five series, namely SMR, CPI, LSE, OIL and TBILL indicating the fat tails on the left-hand side of the distribution comparably with the right-hand side. The rest are skewed to the right. This shows all eight variables are asymmetrical.

Kurtosis values for all variables show that the data is not normally distributed for both countries because values of kurtosis are deviated from 3. The statistical implication is that the null hypothesis was rejected and the alternative hypothesis was accepted as a result of the residuals not being normally distributed.

The calculated Jarque-Bera statistics and corresponding p-values are used to test for the normality assumption. Based on the Jarque-Bera statistics and p-values this assumption is rejected at 5 percent level of significance for all variables

3.3. Unit Root Tests

The study investigated the time series properties of the variables used for the study by employing the unit root test to test for the existence of a stochastic trend in the regression model used. Besides, the unit root test helps to avoid spurious regression, which is brought about by the regression of non-stationary variables. In addition, the stationarity estimation on non-stationarity variables had the tendency to give a misleading parameter estimate of the relationship between macroeconomic variables and stock market returns, and therefore the test was necessitated by this condition.

Table 4. Augmented Dickey-Fuller and Philips Perron Unit Root Test - Ghana

Variables	Lag	ADF T-statistics	Test critical values @ 5%	Test critical values @ 1%	PP T-statistics	Test critical values @ 5%	Test critical values @ 1%
CPI	2	13.0874	2.87582	3.4630(0.000)	43.5815	2.87568	3.4627(0.0001)
EXC	0	19.7911	2.87568	3.4627(0.000)	19.7911	2.87568	3.4627(0.000)
LSE	0	143586	2.87568	3.4627(0.000)	14.4156	2.87568	3.4627(0.000)
OIL	0	15.2266	2.87568	3.4627(0.000)	15.1918	2.87568	3.4627(0.000)
POL	0	14.4787*	2.87568	3.4627(0.000)	14.1499*	2.87568	3.4627(0.000)
RGDP	0	14.1479*	2.87575	3.4629(0.000)	14.1479*	2.87575	3.4629(0.000)
SMR	0	12.0710	2.87568	3.4627(0.000)	12.2077	2.87568	3.4627(0.000)
SMR-1	0	12.0354	2.87575	3.4629(0.000)	12.1722	2.87575	3.4629(0.000)
TBILL	0	9.30984	2.87568	3.4627(0.000)	9.53629	2.87568	3.4627(0.000)

Note: All variables except POL are stationary at first difference; The probability of it having a unit root are in parenthesis

Table 5. Augmented Dickey-Fuller and Philips Perron Unit Root Test - Nigeria

Variables	Lag	ADF T-statistics	Test critical values @ 5%	Test critical values @ 1%	PP T-statistics	Test critical values @ 5%	Test critical values @ 1%
CPI	0	9.28215	2.87568	3.4627(0.000)	9.29194	2.87568	3.4627(0.0001)
EXC	1	9.93974	2.87575	3.4629(0.000)	10.1279	2.87568	3.4627(0.000)
LSE	0	14.3586	2.87568	3.4627(0.000)	14.4156	2.87568	3.4627(0.000)
OIL	0	15.2266	2.87568	3.4627(0.000)	15.1918	2.87568	3.4627(0.000)
PC	6	8.97615	2.87612	3.4637(0.000)	14.1421	2.87568	3.4627(0.000)
RGDP	2	4.94215	2.87582	3.4630(0.000)	11.5534	2.87568	3.4627(0.000)
SMR	2	5.27654	2.87620	3.4639(0.000)	12.9658	2.87589	3.4632(0.000)
SMR-1	2	5.24068	2.87627	3.4641(0.000)	12.8965	2.87597	3.4634(0.000)
TBILL	0	11.6861	2.87568	3.4627(0.000)	11.6590	2.87568	3.4627(0.000)

Note: All variables except POL are stationary at first difference; The probability of it having a unit root are in parenthesis

To ensure robust results, both the Augmented Dickey Fuller (ADF) and Philips Perron (PP) tests were used. The ADF and PP unit root tests help in determining the difference time series data and ensure stationarity (Nyamongo and Misati 2010). Hence the study conducted the ADF and PP test with constant intercept only scenario and assumed the same null hypothesis of no unit root in the data series. The results indicated that all variables were non-stationary at levels but attained stationarity at first difference except POL which attained stationarity at levels for Ghana, (Table 4) and for Nigeria, all variables were stationary at first difference (Table 5).

3.4. Cointegration Test Results

The result of the Johansen cointegration test based on the trace and maximum eigenvalue tests are shown in Table 6 and Table 7. The tables capture statistics that refer to Johansen's log-likelihood based maximal eigenvalue and trace test statistics based on cointegration with unrestricted intercepts and unrestricted trends in VAR. The test determines whether or not there exists a long-run relationship between the dependant and explanatory variables in Ghana and Nigeria. The results suggest at least one cointegration equation and therefore provides evidence of long run relationship among variables.

Table 6. Cointegration Test - Ghana

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized			Trace0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.237772	186.1508	159.5297	0.0008
At most 1 *	0.192726	132.1205	125.6154	0.0189
At most 2	0.153019	89.51605	95.75366	0.1244

Note: Trace test indicates 2 cointegrating eqn(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level;
**MacKinnon-Haug-Michelis (1999) p-values

Table 7. Cointegration Test – Nigeria

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized			Trace0.05	
None *	0.202633	176.5629	143.6691	0.0002
At most 1 *	0.199125	131.5013	111.7805	0.0016
At most 2 *	0.169436	87.31327	83.93712	0.0279
At most 3	0.125258	50.36893	60.06141	0.2506

Note: Trace test indicates 3 cointegrating eqn(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level;
**MacKinnon-Haug-Michelis (1999) p-values

The study starts with the null hypothesis of no cointegration and concludes on the existence of at least one (1) cointegrating vector if the null hypothesis is rejected at 5% significance level. Table 6 suggests at most 1 cointegrating equation based on trace test for Ghana and Table 7 give at most 2 contegrating equations based on trace test and two cointegrating equations based on maximum eigenvalue for Nigeria, thus showing evidence of long-run relationship among variables for both countries. The cointegration results establish that long-run relationship exists between macroeconomic/political variables and the stock market returns of Ghana and Nigeria.

3.5. Exponential Generalised Autoregressive Conditional Heteroscedasticity Results

Given that the estimated EGARCH (1.1) model is appropriate to describe the volatility of market returns, this model is used to explore the impact of macroeconomic fluctuations on the volatility stock market returns of Ghana and Nigeria. The results are presented in Table 8 to Table 9.

Table 8. EGARCH Results – Ghana - Dependent Variable: SMR

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	8.369059	2.192992	3.816274	0.0001
ARCH EFFECT	1.366351	0.337513	4.048292	0.0001
ASYM. EFFECT	0.665924	0.266354	2.500148	0.0124
VOL. PERS. EFFECT	0.212419	0.138776	1.530662	0.1259
$SMR_{(t-1)}$	0.935614	0.012871	72.69344	0.000
CPI_GARCH	-2.24E-06	5.05E-05	-0.044332	0.9646
TBILL_GARCH	-0.013466	0.009855	-1.366411	0.0178
EXR_GARCH	-3.247548	19.15495	-0.169541	0.8654
RGDP_GARCH	2.62E-06	3.00E-06	0.873121	0.3826
OIL_GARCH	0.006803	0.005629	1.208563	0.2268
LSE_GARCH	-5.50E-05	3.89E-05	-1.415245	0.157
POL	959.9772	100.8826	9.515788	0.000
R-squared	0.95641	Mean dependent var		3585.554
Adjusted R-squared	0.955756	S.D. dependent var		2758.348
S.E. of regression	580.1984	Akaike info criterion		13.71596
Sum squared resid	67326029	Schwarz criterion		13.95994
Log likelihood	-1384.028	Hannan-Quinn criter.		13.81466
Durbin-Watson stat	1.658082			

Note: Method: ML ARCH - Generalized error distribution (GED) (Marquardt /Eviews legacy)

Table 9. EGARCH Results – Nigeria - Dependent Variable: SMR

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	15.60648	5.473503	2.851279	0.0044
ARCH EFFECT	0.2638	0.3214	0.820785	0.4118
ASYM. EFFECT	0.197943	0.2159	0.916829	0.3592
VOL. PER. EFFECT	-0.051879	0.35605	-0.145707	0.8842
SMR$_{(t-1)}$	1.101119	0.024677	44.62211	0.000
CPI_GARCH	0.010491	0.071258	0.14723	0.883
TBILL_GARCH	-0.263806	0.152097	-1.734459	0.0828
EXR_GARCH	-4.04E-08	7.80E-09	-5.17305	0.000
RGDP_GARCH	0.015254	5688.426	2.68E-06	1.000
OIL_GARCH	0.014449	0.010077	1.433842	0.1516
LSE_GARCH	3.32E-05	3.09E-05	1.074082	0.2828
POL	3483.026	327.7013	10.62866	0.000
R-squared	0.968355	Mean dep var		26288.88
Adj. R-squared	0.967719	S.D. dep var		12466.4
S.E. of regression	2239.82	Akaikeinfo crit.		17.93603
Sum squared resid	9.98E+08	Schwarz crit.		18.19628
Log likelihood	-1813.475	Hannan-Quinn	crit	18.04131
Durbin-Watson stat	2.121537			

Note: Method: ML ARCH - Generalized error distribution (GED) (Marquardt /Eviews legacy)

From the Table 8 and Table 9, there is significant ARCH effect in the SMR for Ghana than Nigeria. Moreover, there is significant asymmetry effect in stock market volatility for Ghana. The high positive co-efficient (0.66) indicates that positive shocks influences stock return volatility more than negative shocks. This is statistically robust at 1%. The asymmetry effect for Nigeria is rather low (0.197).

The study reports of negative influence of TBILL on SMR in both countries with the result for Ghana being statistically significant. This result is not surprising especially for Ghana where TBILL has been very high creating a lucrative investment sector in the money market as against the stock market. These findings are in line with the findings of Gan *et. al.* (2006).

CPI reports divergent results. The result reports a negative impact of CPI on SMR in Ghana but positive influence on Nigeria SMR. Again, the result for Ghana is not surprising. Inflation in Ghana has been relatively high as compared to Nigeria and many other SSA countries. The finding suggests that stocks can be used as a hedge against inflation in Ghana. The positive results for Nigeria supports the views of scholars such as Maysami *et al.,* (2004) and Kuwornu and Owusu-Nantwi (2011).

Exchange rate fluctuations create negative volatilities in SMR in both countries. From Table 9, exchange rate uncertainty has negative and robust effect on stock return volatility. This implies that if exchange rate volatility between the Nigerian naira and US dollar increases, stock market return volatility in Nigeria decreases. This is statistically significant at 1% even though the coefficient (magnitude) is negligible. The result for Ghana also implies the depreciation of the Ghanaian cedi against the US dollar has adverse effect on SMR over the period selected for the study. The result for Ghana however is not statistically significant. These findings confirm that of Adjasi *et al*. (2008) and Najaf and Najaf (2016).

The effect of RGDP on SMR in both countries is positive. This implies the growth of the Nigerian and Ghanaian economies have positive effect on the stock market return volatility of their respective stock markets. The result for both countries is however not statistically significant.

The fluctuations of the all-share index of LSE exerts negative volatility in Ghana Stock Exchange composite index. The comovement of the two stock markets seems to be negative. The two markets are therefore seen as competitive markets to investors. On the other hand, the results reveal the Nigeria Stock Exchange and LSE play some complementary roles. That is upward adjustment of LSE all-share index result in positive volatility in NSE all-share index. The two stock markets seem to enjoy some collaboration and this is explained by the positive relations between their SMRs.

Crude oil seems to have positive influence on stock returns in Ghana even though not statistically significant. This result may explain that the commercial find of crude oil in Ghana is reaping some positive results even though marginal. The positive result for crude oil for Nigeria is not surprising since Nigeria is internationally recognised as a major exporter of crude oil. These findings seem to support the findings of Nandha and Faff (2008) who revealed

that stock market in exporting countries react to increase in crude oil prices positively.

Political cycle has statistically significant positive effects on stock market volatility of both countries. The result for Nigeria is rather surprising. It shows that violence and negative pronouncements from political leaders and members that come along with general elections and other political events have no negative effect on stock market volatility.

Conclusions, recommendations and implications

This study buttresses the assertions raised by previous scholars that macroeconomic and political factors predict stock market performance in Ghana and Nigeria. The revelation of the study is the effect of political cycle and London Stock Exchange all share index on the composite index of GSE and NSE. Investors can take advantage of this finding to guide their investment decisions. The findings also buttress the findings of earlier studies such as Adjasi *et al.* (2008) and Kuwornu (2012) that the three dominant variables of inflation, interest rates and exchange rates influence stock market returns

This study, it is hoped, will help policy-makers to implement appropriate monetary policies that will help control inflation, interest rates exchange rate and other macroeconomic variables in order facilitate the development and performance of the stock markets of the two countries. Governments' dependence on Treasury bill to mobilize funds for development purposes should not lead to reduction in demand for stocks and the crowding out of the private sector from the financial market mainly the banking sector. Thus, policy direction should constantly aim at developing and implementing sound and stable macroeconomic and political environment that will attract institutional and individual investors into the capital market and promote stock market development to spur economic growth.

Policies, regulations and laws that forbid negative and provocative utterances and violence especially during periods before, during and after general elections should be enforced. Efficient implementation of sound policies will attract more investors to invest in stocks and companies to list their issued stocks on the stock market. This will facilitate acquisition of equity capital which will aid performance of the stock exchanges of Ghana and Nigeria, and economic growth of the two countries in general.

Acknowledgement

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Appendix

Table 2: Descriptive statistics- Ghana

	LN_SMR	TBILL	EXR	POL	LNRGDP	LN_CPI	LN_OIL	LN_LSE
Mean	7.87	21.51	1.56	0.16	24.13	5.21	4.04	7.95
Median	7.72	22.77	1.04	0	24.1	5.19	4.11	7.99
Maximum	9.3	47	4.19	1	24.6	7.25	4.9	8.26
Minimum	6.61	9.13	0.37	0	23.64	4.02	2.92	7.45
Std. Dev.	0.82	9.30	1.02	0.37	0.32	0.54	0.55	0.19
Skewness	0.06	0.78	1.34	1.88	0.07	0.11	-0.26	-0.57
Kurtosis	1.6	3.29	3.57	4.53	1.56	2.91	1.82	2.51
Jarque-Bera	16.67	21.05	63.76	139.28	17.7	0.5	14.08	13.06
Probability	0	0	0	0	0	0.78	0	0
Sum	1,598.29	4,366.87	315.71	32	4,898.03	1,057.73	821.06	1,613.81
Sum Sq. Dev.	135.2	17,488.84	209.09	26.96	20.73	59.07	60.08	7.44
Observations	203	203	203	203	203	203	203	203

Table 3: Descriptive Statistic - Nigeria

	LN_SMR	LNRGDP	LN_CPI	LN_LSE	LN_OIL	POL	TBILL	EXR
Mean	10.05	24.13	4.44	7.95	4.04	0.14	10.88	146.12
Median	10.12	24.09	4.46	7.99	4.10	0.00	10.78	133.37
Maximum	11.09	24.60	5.36	8.26	4.90	1.00	24.50	312.50
Minimum	8.66	23.63	3.38	7.45	2.92	0.00	1.04	98.78
Std. Dev.	0.53	0.32	0.54	0.19	0.55	0.34	4.79	37.93
Skewness	-0.67	0.08	-0.17	-0.58	-0.25	2.11	0.15	2.45
Kurtosis	3.15	1.56	1.92	2.52	1.81	5.44	2.63	10.69
Jarque-Bera	15.48	17.78	10.89	13.19	14.27	201.93	1.87	706.26
Probability	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.00
Sum	2,050.43	4921.66	906.43	1621.81	824.29	28.00	2,219.78	29,808.63
Sum Sq. Dev.	57.72	20.98	59.68	7.45	60.74	24.16	4,666.88	292,058.20
Observations	204	204	204	204	204	204	204	204

The Influence of Leadership Style on Employees' Performance through Work Motivation at the Public Sector of the Government Bureau in Central Kalimantan, Indonesia

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Abstract:

This study aims at examining the influence of leadership style on employees' performance through work motivation at the Government Bureau of Central Kalimantan, Indonesia. The sample was determined by using purposive random sampling technique and the instrument to collect the data is by using questionnaire. The number of sample collected was 140 employees who work in the public sector of the government bureau in the Central Kalimantan Province, Indonesia. These data were then analyzed statistically by using structural equation model (SEM). This study confirms that leadership style has significant influence toward employees' performance of the public sector of the government bureau in Central Kalimantan. Also, it was found that work motivation played an important role in mediating the influence of leadership style on employees' performance. This finding suggests that both leadership style and work motivation need to be given attention in order to increase employees' performance of the government bureau at the Central Kalimantan.

Keywords: leadership style; work motivation; employees' performance; structural equation modelling.

JEL Classification: O15; J54; M54.

1. Introduction

It was widely confirmed in the literatures that the performance of any organizations was influenced by various factors. Of the many factors, leadership style and work motivation have been pointed out empirically influencing employees' performance of the organization (see, for instance, Martinko *et al.* 2018, Russell *et al.* 2018, Randel *et al.* 2018, Sweeney *et al.* 2018, Shamir and Shamir 2018, Weber and Gentry 2018 and Osabiya Babatunde 2015). Osabiya Babatunde (2015), for example, found that both leadership style and work motivation affect significantly employee's performance in the organization under his study. This finding was also confirmed by Ahmed et al. (2017), Memon (2014) and Elizabeth (2017) to name just three works.

Of the above two independent variables, work motivation has greater contribution toward employees' performance (see, for instance, Khan and Nawaz 2016). This is especially true for employees working at the public sector of the government bureau in many Asian countries, excluding Indonesia. As studies of this subject in Indonesia are limited, this study aims at examining the influence of leadership style and work motivation on employees' performance taking the case of the employees of the public sector at the Government bureau in Central Kalimantan province, Indonesia.

However, before discussing the results of the study, a brief literature review is given in the second section. In this section various definition of variables advanced in the literature are given to support the important of this

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study. This is followed by a brief research method and the source of data in section 3. Section 4 then addresses the results of the study. Finally, concluding remarks are given at section 5.

2. Literature review

Definition of the three variables under this study in the literature was so many. Leadership style, for instance, defined by Rivai (2004) as the process of influencing employees through the communication process in achieving company goals, while Terry (2012) defined leadership style as the ability to direct employees to cooperate with trust and diligently to work on the tasks given by the leader. Thoha (2012), however, defined leadership style as an act of leader who tries to influence the behavior of other people or groups at any time and place. Also, Pasolong (2010) defines leadership style as the direction of communication and ways in making decision and solving problems in various fields. Leadership style consists of four forms, namely, directive style, consultative style, participatory style and delegative style (Wahjosumidjo 2002).

Like leadership style, work motivation has also many definitions. Robbins (2007), for example, defines work motivation as a process that determines the intensity, direction and perseverance of individuals in efforts to achieve goals. This definition suggests three key elements of work motivation, namely, intensity, direction and long lasting.

However, Winardi (2005) defines work motivation as a potential force that exists in a human being. It can be developed independently or developed by a number of external forces which essentially revolve around monetary rewards and non-monetary rewards. This work motivation will further affect the performance positively or negatively to employees. Further, Hasibuan (2005) defines work motivation as the driving force that creates the work enthusiasm of someone, so that they will cooperate, work effectively and be integrated with all their efforts to achieve satisfaction. Whlist Sopiah (2008) defined work motivation as a condition in which a person's effort and willingness are directed to achieve certain results or goals.

Similarly, the definition of employees' performance was also many. This word has synonymous with the result of work. Bernardine and Russell (1998), for instance, simply define performance basically as what is done or not done by employees. They further suggest performance was affecting by how many contributions given by the employees to the organization in the form of: (a) quality of output, (b) quantity of output, (c) period of output, (d) presence of work place. Whilst Ruky (2002, 7) suggest elements influencing employees' performance are human, technology (equipment, work methods), the quality of the physical environment (occupational safety and health, layout, workplace and cleanliness), quality of inputs (including material), working environment and organizational culture (including supervision and leadership) and compensation and reward systems. Whereas Kaswan (2012) defined performance as the result or level of success of a person as a whole during a certain period in carrying out tasks compared to various possibilities, such as standard work results, targets or goals, or criteria that have been determined previously and have been agreed upon.

The above various definitions of leadership style and work motivation confirm that there are relations of the two variables toward employees' performance. This suggests that the theoretical background of this study is no doubt valid. For detail discussion can be seen in Bernardin *et al.* (1998), Frieder *et al.* (2018), Para-González *et al.* (2018), Nguyen *et al.* (2018), Mullen *et al.* (2018), Elbaz and Haddoud (2017), and other references cited in references.

3. Empirical results and discussion

This research was conducted at the Government bureau of Regional Secretariat Central Kalimantan. The sample in this study was collected using probability sampling method called a purposive random sampling method. The number of sampling collected was 140 respondents. The instrument used to collect the data from each sample respondent was questionnaire. These questionnaires were then analyzed using statistical method called Structural Equation model (SEM). The program used to estimate the model is by applying the Smart PLS program packages 3.2.7. Note that, as the variables in the model are latent variables, the Likert scale was then used to quantify the data collected from the questionnaires.

Before estimating the model, the unidimensionality test of each construct (latent variable) was examined. This was done by looking at the convergent validity of each construct indicator. An indicator is said to be reliable if the value of outer loading or loading factor is greater than 0.70. If the loading factor was from 0.50 to 0.60, it can still be maintained at the initial stage. Whilst when the outer loading is below 0.50, it can be dropped from the model (Chin 1998 and Ghozali 2011). The several reliability tests were done, namely, convergent validity, discriminant validity, and composite reliability.

Convergent validity test aims to find out whether the instrument items can be used as indicators of all latent variables or not. The convergent validity test results are measured based on the value of the loading factor (outer

loading) of the latent variables (construct) indicator. Convergent validity test results which have the value of outer loading below 0.50 will be dropped from the model. The results of convergent validity test of the questionnaire are given at Table 1. From this table, it can be seen that all indicators have the value of outer loading above 0.5. This suggests all the indicator meets the appropriate convergent validity criteria.

Table 1. Results of convergent validity test

Variable	Indicator	Outer Loading	Information
Leadership style (X)	Directive style (X1.1)	0.746	Valid
	Consultative style (X1.2)	0.766	Valid
	Participatory style (X1.3)	0.886	Valid
	Delegative style (X1.4)	0.860	Valid
Motivation (Z)	Responsibility (Z1.1)	0.683	Valid
	Success of employees in carrying out work (Z1.2)	0.904	Valid
	Level of career development of an employee (Z1.3)	0.873	Valid
Performance (Y)	Quality of work (Y1.1)	0.640	Valid
	Work quantity (Y1.2)	0.513	Valid
	Independence (Y1.3)	0.854	Valid
	Timeliness (Y1.4)	0.850	Valid

Source: Analysis results processed, 2018.

Unlike convergent validity test, the discriminant validity test aims to measure reflexive indicators based on cross loading with its latent variables. The method is by comparing the value of the square root of average variance extracted (AVE) of each construct with other constructs in the model. The measurement value must be greater than 0.50 to meet the requirements of convergent Validity based on the value of Average Variance Extracted (AVE). The results of Discriminant Validity tests are exhibited at Table 2.

Table 2. Results of discriminant validity test

Variable	Average variance extracted (AVE)
Leadership Style (X)	0,667
Motivation (Z)	0,682
Performance (Y)	0,531

Source: Analysis results processed, 2018

As shown at Table 2, all values of Average Variance Extracted (AVE) are greater than 0.50. Thus, it can be concluded that this measurement has met the requirements of Convergent Validity based on the value of Average Variance Extracted (AVE).

In terms of the composite reliability test, the results show that all the variable values have the value of composite reliability greater than 0,70 (Table 3). These reliability tests suggest that the data collected using questionnaire was reliable or consistent. Thus it can be concluded that all indicators are indeed the measure of their respective constructions.

Table 3. Results composite reliability test

Variable	Composite Reliability	Information
Leadership Style (X)	0.889	Reliable
Motivation (Z)	0.864	Reliable
Performance (Y)	0.813	Reliable

Source: Analysis results processed, 2018

3.1. Structural equations modeling

Using the Partial Least Square (PLS) program, the Structural Equation Model can be seen at Figure 1.

Figure 1. Analysis Results with PLS
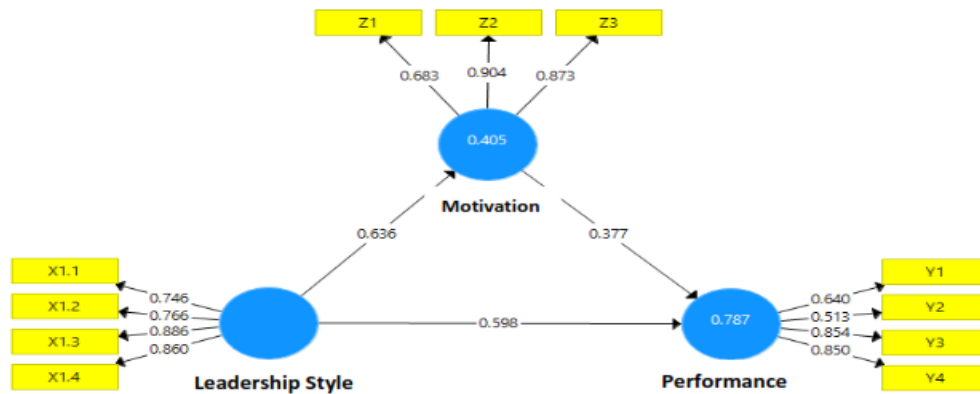
The study also found that the R2 value of endogenous variables in this study is fitted for structural model under study as exhibit at Table 4. The result of R2 shows predictive-relevance value of 0.775 greater than 0. It means that the variation of performance variables (endogenous variables) is explained by the variables used by 77,5% and the remaining 21,5% is explained by other factors outside the model. Thus, the model can be said to be feasible because it has relevant predictive values.

Table 4. R2 value of endogenous variables

Endogenous Variable	R-square
Performance (Y)	0.775

Source: Analysis results processed, 2018

3.2. Discussion of Hypothesis Testing

The results of the hypotheses testing using Partial Least Square show that the three direct influences of the hypotheses are found to be significant. Similarly, the test result of indirect influence was also significant. The significant results of the hypothesis testing can be seen at the t-values which are greater than t-statistics and/or p-values with less than 5% (Table 5). These results suggest that employees' performance of the public sector at the Government Bureau in Central Kalimantan are significantly influenced by the leadership style and work motivation.

Table 5. Results of Direct and Indirect Influence Hypotheses Testing

Direct Influence	Path Coefficient	t-values	p-values	Description
H1 : Leadership Style (X)-> Motivation (Z)	0.636	5,265	0.000	Significant
H2 : Leadership Style (X)-> Performance (Y)	0.598	5,169	0.000	Significant
H3 : Motivation (Z)-> Performance (Y)	0.377	2,757	0.006	Significant
Indirect Influence				
Leadership Style (X) -> Motivation (Z) -> Performance (Y)	0.240	2,629	0.009	Significant

Source: Analysis results processed, 2018

The explanation toward detail of the above results as follows. First, the positive and significant of direct influence of leadership style to employees' performance in this government bureau are due to the fact that the leadership style in this institution is in the form of delegated leadership style. In other words, the leaders in this institution were far from autocratic style or militaristic style in managing the employees to give their good work performance. This delegated leadership style is shown from the way leaders in this institution encourage the ability of employees to take the initiative, entrusting subordinates to represent themselves if they are unable to do, and dare to make decisions on the consideration to delegate subordinates to participate in activities that can improve performance in the Government Bureau of the Regional Secretariat of Central Kalimantan Province.

In the literature, it was argued that the factors that influence the leadership style among others are: a) things that come from the leadership include background and experience, b) things that come from subordinates include maturity, freedom of action, independence and the desire to obtain authority and responsibility, and c) things that come from environmental situations that include the style that is preferred by the working group, the nature of the task and the pressure of time (Asnawi 1999). A good leader must have the courage to make decisions and take responsibility for the consequences of risks that arise as a consequence of decisions that have been taken (Kouzes and Posner 2011, Chaleff 2009, Russell and Gregory 2002).

The significant finding of this study was also confirmed by the studies conducted by Frieder *et al.* (2018), Para-González *et al.* (2018), Nguyen *et al.* (2018), Mullen *et al.* (2018), Elbaz and Haddoud (2017), Masa'deh *et al.* (2017), Lim *et al.* (2017), Singh *et al.* (2018), Suryani (2016), Roscahyo (2015), and Siswanto and Hamid (2017).

Second, the positive and significant influence of leadership style to work motivation was also confirmed by the fact that leadership style in this institution was based thoughts, feelings, attitudes, behaviors of the members of the organization or subordinates and by directing and fostering their subordinates to carry out the work. This means that leadership style in this institution has not been merely directive, but it is more consultative, participatory, delegative to motivate the employees and provide opportunities for employees to express their wishes.

This finding supports the previous studies undertaken by Sumardianti (2016), Thoha (2009), Cahyono *et al.* (2016) and Syaiyid *et al.* (2013) to name just four relevant references. Syaiyid *et al.* (2013), for instance, suggested that leadership styles affect the motivation to work. If someone is motivated, he/she will try everything in his/her power to achieve goals even though he/she is not sure yet his/her effort will produce high performance.

Third, the study also found that there is a significant and positive direct influence of motivation on employees' performance. This suggests that motivation has made employees become more enthusiastic in completing his work. As stated by Mahardika (2013) that by giving motivation to employees, it creates desire, and produces action. This suggests that if the motivation given to employees is lack, then the performance given will not be so good. Thus, motivation is important to improve employees' performance.

This finding was confirmed by the previous studies conducted by Larasati and Gilang (2014) in that they found work motivation both simultaneously and partially has a positive and significant influence on employees' performance. This indicates that motivation can be one of the ways that can be done by the company in improving the quality of performance. This notion was also supported by Purwati (2015) and Setiawan (2015). This suggests that any organizations that give motivation to their employees will have a better performance. Motivation can encourage employees to work best and employees will be willing to take extra time and effort to do their work so that it will improve their performance, vice versa. Therefore, work motivation that was given by the leaders improve employees' performance in this government bureau.

Fourth, the indirect influence of leadership style on employees' performance mediated through work motivation was also positive and significant. This suggests that leadership style in this government institution is able to influence employee activities through communication either individually or in groups. Consequently, employees in the government bureau are motivated to do better work. This finding empirically confirmed by the previous studies undertaken by Leroy *et al.* (2018), Barbuto and Wheeler (2006), Jung *et al.* (2003), Bass and Steidlmeier (1999) and Amalia *et al.* (2016).

Amalia *et al.* (2016), for example, suggests factors behind this significant influence of leadership style on employee performance through work motivation were due to leadership effectiveness in arising compensation and delegative approach to employees. Also, this is because the leader in the organization provide conducive work environment to the employees including the volume of work, the quality of work, working time, and good cooperation between the leader and employees (Rosyidi 2014). Due to these conducive work environments, employees become more motivated and feel to have a better value, so they become loyal in their work. Therefore, to improve employees' performance in any organizations, the leaders should give work motivation.

Concluding remarks

Leadership style was found to be a necessary condition to improve employees' performance in the Government Bureau of the Regional Secretariat of Central Kalimantan Province. By giving a good leadership style, the employees become motivated to improve their performance.

The type of leadership style that can improve motivation and employees' performance was delegative style. This leadership style has made the employees in the regional government bureau increased the employees' confidence to develop themselves and greater movement for the employees to do other productive and valuable activities to achieve organizational goals.

However, as the coefficient determination of the variables under study was only 77.5%, this indicates there is a need to accommodate other relevant variables such as discipline, job satisfaction, work load and training to improve employees' performance of the government Bureau in a better shape. Thus, much remain to be done by the Government Bureau in Central Kalimantan in improving their employees' performance.

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The Effect of Users' Competence on the Security of Information System

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Abstract

The issue of information security is a serious matter in the world, especially in Indonesian banking institutions. Good users' competence is needed to minimize the occurrence of unsecured information system. A phenomenon occurring in several public banks in Indonesia indicates that information system in those banks is unsecured. The present study aims to ascertain the facts through testing the effect of users' competence on information system's security. Data in this study is obtained through survey by administering questionnaires in 70 public banks in Indonesia. Data is tested using SEMPLS. The study employs explanatory research methodology. The findings show that unsecured information system is caused by, among others, users' competence that is not as good as it has to be.

Keywords: users' competence; information system's security.

JEL Classification: E5; G2.

1. Introduction

As an organization with strategic position, bank plays a role of payment system facilitator, monetary policies implementer, and financial system stabilization achiever (OJK 2016, 13). Hence, banks need reliable and effectively designed information system. Bodnar and Hopwood (2010) argue that information system formulation and design should consider the following principles:

1) Information system should meet the principle of timeliness; *i.e.* accounting information system should be able to provide required highquality information in quick and timely manner.
2) Information system should meet the principle of feasibility; *i.e.* the cost of accounting system implementation should be relatively inexpensive.
3) Information system should meet the principle of security; *i.e.* accounting information system should be able to further the security of company's assets.

Security is a must. Information system security is an effort to protect information from threats in order to prevent bigger problems (Albrechtsen 2015). Since information system is designed to be open and accessible, its security is of an utmost importance, particularly in accounting information system. Information system security aims to ensure confidentiality, integrity, and availability of data (Lachapelle and Bislimi 2013). Curtis and Cobham (2005) add that the most devastating vulnerability in big companies with wide network is the security of information system application. Therefore, system security should focus not only on antivirus and network security but also on security of business transactions that involves valuable data.

The study of Eroğlu and Cakmak (2016) argues that security approach is an evaluation technique implemented to measure company's maturity and readiness in determining potential risks and solution for its information system. Managers often sacrifice system security to implement new technology. Such sacrifice affects the external financial reporting and the internal decisions, while security is an important factor in producing high quality information (Davis 1996). Loch, Houstan, and Merrill (1992) further argue that the biggest threat to information system security comes from inside the company itself. In line with this, Spears and Barki (2010) argue that at least half of information system security violation is conducted by internal personnel; particularly due to unauthorized system access. Similarly, Cox (2012) notes that company's information system users are often

engaged in risky behaviors that may harm the security and integrity of organization by exposing sensitive information or weakening technological security.

The following figure displays types of malware (destructing software) prevalent in Indonesia, which might be used as a tool to seriously threaten information system security.

Figure 1. Malware prevalence in Indonesia

Top 10 Malware in Indonesia per July 2015

- ■ Win32/Ramnit 8.46%
- ■ LNK/Agent.AV 6.81&
- ■ Win32/Bundpil 6.08%
- ■ Win32/Adware.Multi Plug 5.64%
- ■ Win32/Sality 5.01%
- ■ Win32/Virut 4.46%
- ■ LNK/Autostart 4.13%
- ■ INF/Autorun 3.68%
- ■ Win32/Conficker 3.05%
- ■ Defo2.75%
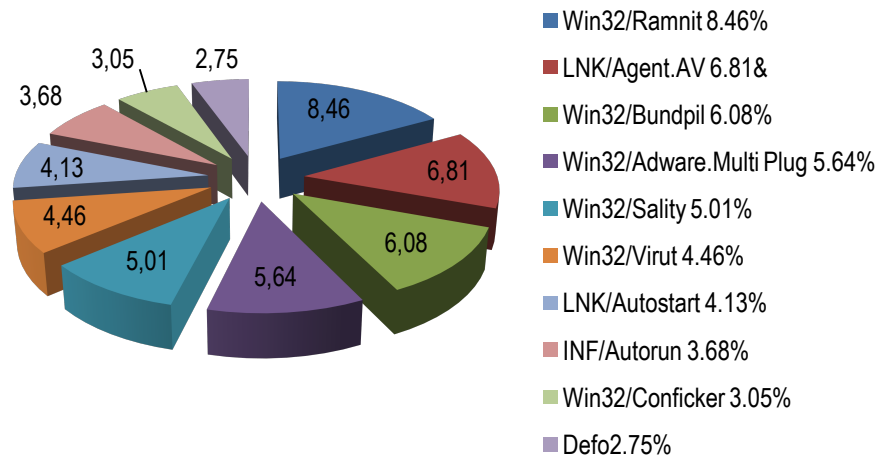
Source: https:// www.bacapikirshare.org/index.php

As shown in Figure 1, it can be said that malware (malicious software) is used by perpetrators to access a user's computer unit for espionage purposes, especially in industry sector. It is a way to spy on competitors and other individuals, to steal personal data of a site user or member, or to hack into bank accounts. Malware is still the biggest security problem in Indonesia since information system in the country has weak security (Kukuh 2013).

Persadha (2016) argues that information system in Indonesia is unsecured and the problem occurs in various types of industry. Particular to banking industry, Persadha (2015) notes that banking information system is unsecured so that developing security system is the most appropriate way to protect data. Waas (2016) agrees to this statement and adds that Bank Indonesia faces daily threats from hackers. In fact, Bank Indonesia once detected 273 viruses and 67,000 spam email in its email server and website in just half a day.

Cases of bank account hacking occur mostly because the perpetrators (hackers) use personal data obtained from cloning the victim's *simcard* (cellphone) or email and because the security system of Internet Banking is weak. There was a case in which IDR 420 million from victims' bank accounts was taken in 10 transactions (Permana 2016). Simanjuntak (2015) also notes that a new mode of bank account hacking takes advantages of the weak system in a bank. Another mode of hacking occurred in three prominent banks in Indonesia, using malware to steal account holders' data and taking at least IDR 130 billion from 300 account holders in the three banks (Waseso 2015).

Hackers also use virus to break into a bank. The virus operates when the account holder makes a transaction using e-banking (Lubis 2015). In another case, it was credit cards that were hacked by stealing the card holders' personal data. The hacker was able to obtain the data because he once worked in a private bank in Indonesia. He hacked into 20 credit cards and managed to take IDR 581 million from the bank (Wibowo 2016). *Otoritas Jasa Keuangan* (OJK - Indonesia's Financial Services Authority) admits that it is difficult to monitor and prevent bank hacking, especially when it involves employees of the bank as is the case in CIMB Niaga bank. IDR 22.87 billion was stolen by an IT employee of the bank (Tampubolon 2014).

Solic, Ocevcic, and Golub (2015) argue that todays' security problems are new threats with high flexibility. To avoid these problems, an organization should evaluate all aspects of its security, including network security, software and hardware, human factor, security policies, and damage mitigation plan. The main issue is the human factor. Users' competence plays a critical role in organizational success to achieve competitive advantage (Taber, Laith and Ayman 2014). Employees' capability and competence are important to facilitate an effective security (Romney and Steinbart 2015, 278). Walsham, Symons, and Waema (1988) believe that *brainware* integration plays an important role in information system and organizational relations. Nurhayati and Mulyani (2015) state that good user's competence will encourage the user to use accounting information system, which in turn will lead to better and more successful information system. Choe (1996) provides empirical evidence that there is significant and

positive correlation between information system users' competence and information system performance. Furthermore, Belsis and Kokolakis (2005) mention that information system security greatly depends on user's involvement. Management without knowledge will have problems with information system security. Meanwhile, Jennex and Durcikova (2014) state that information security and management knowledge should be integrated since knowledge facilitate the implementation of information system security.

It is a common phenomenon in Indonesia that the quality of human resources is low (not-competent). Therefore, it is high time that the government produces world class human resources (Widodo 2016). In banking industry, Mingka (2016) states that *sharia* banks should improve their human resources' competence to solve the problems of problematic funding. They should also be able to restructure *sharia* funding. Similar issue is also found in Bank Pembangunan Daerah (BPD/Regional Development Bank), in which its human resources' competence is very poor that it is difficult to improve BPD's performance (Hadad 2016).

2. Literary review

2.1. Users' competence

Meija, Davit, and Cardi (2010) argue that inherent characteristics of individuals that correlate with their performance success are called users' competence. Users' competence as a product of knowledge, skills, and values indicates that the individual has met practical requirements integrated in social values of work. Individuals have to obtain and implement their knowledge in critical thinking and in transferring knowledge, skills, and values in daily work practice (O' Hagan 2007, 17). Ward and Peppard (2002, 393) state that competence is a combination of knowledge, skills, abilities, and behaviors that exist and spread in individuals and organizational processes and that determine how individuals can improve and exploit their skills. The more an employee possesses knowledge, the more their existence is acknowledged in a company, particularly in information system. In summary, users' competence is unique characteristics inherent in individuals that correlate with organization's performance success and are displayed through their behaviors in organization.

Kondalkar (2007, 48) proposes two criteria of skills that have to be possessed: physical skills and intellectual skills. Gelinas and Dull (2008, 26) state that knowledge criteria is knowledge in principles of Accounting, Auditing, Information Technology, and System Development Method. In line with Gelinas and Dull (2008, 26), Wilkinson, Cerullo, Ravan, and Wong (2000, 66) argue that accountants, as the users of information system, should master the knowledge on information technology.

Ladjamudin (2005, 30) further outlines skills and knowledge to be acquired, which are:
- Knowledge and skills on data processing technique, computer technology, and computer programming;
- General knowledge on business;
- Knowledge on quantitative method;
- Skills in breaking up complex problem into smaller parts;
- Skills in communication and building relationships;

This study uses two dimensions: 1) knowledge criteria and 2) skill requirement, in accordance with McLeod and Schell (2008). The consideration for using these two dimensions is because it is sufficient to measure knowledge and skills, particularly those on information system, to analyze information system users' core competence. The indicators of these two dimensions can be described as follow:
1) *Knowledge.* The indicators are: Formal education; Certification of skills/non-formal education on information system; Work experience as information system users; Insight on information system.
2) *Skill.* The indicators are: Conceptual skill; Interpersonal skill; Technical skill; Management skill.

2.2. Information system security

Information technology changes and develops more rapidly than the follow up of controlling and improving employees' knowledge, skills, awareness, and accomplishment of information technology. These rapid changes will also cause security risk pertaining to the advancement of information system (Davis 1996). Information technology advancement also creates significant risk on security and integrity of information system. Even though accounting practitioners have attempted many efforts to reduce the vulnerability of computerized accounting information system, security improvement is still required (Musa 2003).

Kim and Solomon (2012, 8) argue that information system security is a series of activities that protect the information system and the data stored in it. Smith and Jamieson (2006, 24) state that information system security is an effective implementation of policies to ensure confidentiality, availability, and integrity of information and assets, as an effort to protect them from stealing, sabotage, manipulation, or corruption. This definition assumes

the risk on information primarily comes from human, and fails to consider other sources of threats such as natural disasters or technical problems. Thus, information system security can be concluded as all activities/processes to protect information system and data stored in it from intrusion or utilization by unauthorized parties.

The indicators to determine whether an information system is secure or not, according to Kim and Solomon (2012, 10), are three main principles as follow:

- *Availability* - information can only be accessed by authorized users every time they need the information;
- *Integrity* - only authorized personnel can modify the information;
- *Confidentiality* - only authorized personnel can see the information.

In line with this, Raggad (2010, 11) also argues that information system security is often described in terms of confidentiality, integrity, and availability. These components are often shortened as CIA. Dhillon (1997, 173) also state similar argument: the dimensions of information system security are confidentiality, integrity, and availability of information.

2.3. Framework

A study by Tait and Vessey (1988) concludes that if human resources involved are not competent, information system cannot follow the normal development procedure in a company. Information system will only benefit the organization if the employees contribute their knowledge to it (O'Brien and Marakas 2011, 68). Laudon and Laudon (2012. 84) state that managers who know how to work in a situation of organizational information system will be more successful than managers who are less competent in implementing information system.

Mulyani *et al.* (2016) describe that individuals' self-efficacy and attitude have positive correlation to the success of information system implementation. Thong (1999) proves that employees' knowledge about information system is a determining factor for information system's performance improvement in an organization. Steinbert *et al.* (2012) state that information system security greatly depends on the knowledge of internal audit board about information technology. Ifinedo (2014) argues that locus control of employees and competencies pertaining to information system positively affects information system security. In similar tone, Spears and Barki (2010) note that information system security requires users' business knowledge to contribute to more effective security measures.

Choe (1996) states that training and education of developers, owners and users are determining factors of information system implementation success in a company. Study by Sabherwal *et al.* (2006) finds that accounting information system process requires financial manager's experience with accounting information system and training in accounting information system and that the two are the constructs that determine the success of information system success. Belsis and Kokolakis (2005) argue that knowledge is required to solve information system security issues, allowing individuals to play important role in information system security. Based on these experts' arguments, it can be concluded that users' competence has positive effect on information system security.

3. Methodology

Cooper and Schindler (2014, 4) note that research objects are variables to be studied in a research; in this case are users' competence and information system security. The study employs descriptive method and explanatory research method. According to Sugiyono (2009, 29), descriptive method is a method used to describe or analyze findings of a study but not to draw broader conclusion. Meanwhile, Sekaran and Bougie (2013, 123) describe explanatory research as a research performed to obtain systematic, factual, and accurate description and overview of facts, characteristics, and relationships between variables being studied. This study is a cross-sectional study, which means it is conducted in a certain period of time to obtain necessary data to answer the research questions (Sekaran and Bougie 2013, 178). The variables are operationalized into dimensions and indicators. The sample in this study consists of 70 public bank (out of 120 public bank) in Indonesia. Data collection technique used in this study is questionnaire to obtain responses on the matter being studied. Hypotheses are tested using Structural Equation Modelling (SEM) with Partial Least Square (PLS) approach.

The hypotheses in this study are:

$H_0 : \gamma_{12} \leq 0$ Users' competence has no positive effect on information system security.

$H_1 : \gamma_{12} > 0$ Users' competence has positive effect on information system security.

4. Findings

The next hypothesis to be tested is the effect of users' competence on information system security. The path diagram of Users' Competence effect on information system security is as follow:

Figure 2. Testing the effect of users' competence on information system security
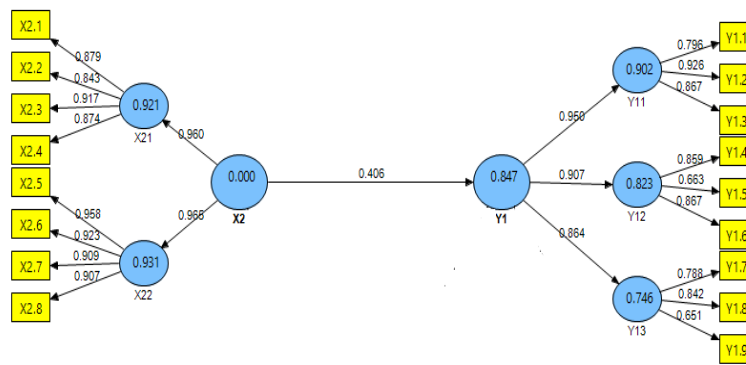
The result of the test is described in the following table:

Table1. The Result of the effects of users' competence on information system security test

Path Coef.	t_{calc}	$t_{critical}$	H_0
0.406	4.286	1.64	Rejected

In Table 1, it can be seen that t_{calc} value of users' competence variable (4.286) is higher than $t_{critical}$ (1.64). Since t_{calc} is greater than $t_{critical}$, on 5% deviation level, H_0should be rejected. In summary, users' competence has significant and positive effects on information system security in public banks. The findings of this study provide empirical proof that the higher users' competence are the more information system security will improve. It is because the coefficient path moves towards positive spectrum.

The test result on the effects of users' competence on information system security shows that t_{calc} is greater than $t_{critical}$ (4.286 > 1.64), which means that on 5% deviation level, H_0 should be rejected. In summary, users' competence has significant and positive effects on information system security in public banks. The findings of this study provide empirical proof that the higher users' competence are, the more information system security will improve.

The conclusion that users' competence has positive effect on information system security confirms previous studies. A study by Ifinedo (2014) argues that locus control of employees and competencies pertaining to information system positively affects information system security. One study of Sabherwal *et al.* (2006) finds that accounting information system process requires financial manager's experience with accounting information system and training in accounting information system and that the two are the constructs that determine the success of information system success. Belsis and Kokolakis (2005) argue that knowledge is required to solve information system security issues, allowing individuals to play important role in information system security. Based on these experts' arguments, it can be concluded that users' competence has positive effect on information system security.

All these point to a conclusion that knowledge and skills should receive special attention. It is even more so because Bank Indonesia has issued a regulation that requires banking institutions to implement continuous training for their employees; particularly continuous training to support information system security. This study has answered the problem stated by Mingka (2016), Widodo (2016) or Haddad (2016); which, in summary, argues that users' competence in banking sector in Indonesia is still problematic.

Based on this discussion, it can be concluded that information system security is also affected by good competence of users in all work units of organization. As a company attempts to secure information system from unauthorized parties, users' skills and knowledge are required to solve the information system security problems.

Conclusion

Users' competence has positive effect on information system security. Information system is not ideal because there are still a lot of members of the organization who are not fully competent in their jobs and unable to comprehend certain tasks, particularly concerning information system security. In addition, they also do not have full opportunities to improve their knowledge and competence. Therefore, it is suggested to improve users' competence through:

a) Recruiting and appointing managers with knowledge and competence background that fit their positions. For instance, a manager for finance division should have educational background of accounting, rather than of other fields.

b) Learning special knowledge by inviting instructors, for managers in new positions, to ensure that the managers do not have difficulties understanding their duties and tasks.

c) Improving managers' competence in information system, especially to obtain certifications of CISSP (Certified Information Systems Security Professional), CCSA (Check Point Certified Security Administrator), CCNA (Cisco Certified Network Associate), and CCIE (Cisco Certified Internetwork Expert).

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Generation Z and Y versus Tax Literacy in the 21st Century

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Abstract:

Taxes are the most important contributions to the state budget which influence the proper functioning of the state. Tax liability of the citizens has a long history. Constant change in the tax systems throughout the history can be observed. Different standards and principles had been applied. It does not matter whether we are entrepreneurs, businessmen or employees, different types of taxes cannot be excluded from our everyday life. If we would like to meet our tax liabilities, we should have some knowledge about the taxation. The dominant part of taxpayers is applicable properly in the prescribed amount. When studying tax evasion issues, respectively tax compliance he main research question is related to the search why people pay taxes, how they know about taxes. Our contribution also deals with issues of knowledge of tax and taxing motives.

Keywords: taxes; generation Z; generation Y; tax motivation; tax literacy.

JEL Classification: K34; H21; H24; H71.

1. Introduction

"*I contend that for a nation to try to tax itself into prosperity is like a man standing in a bucket and trying to lift himself up by the handle*" W. Churchill, British politician

The issue of tax evasion is one of the traditional and still topical public issues finance. Although there are often strongly publicized cases of tax debtors or huge tax payer's leaks create the impression of massiveness in conjunction with the general social climate of this behaviour, reality is rather the opposite. Taxation has always been a keen issue. The history of mankind is closely connected to the history of taxation. In the beginning, people formed groups to ensure the costs together. In the early years, farmers had to contribute for the treasury 20-30 oxen. In the ancient Mesopotamian culture, the rulers levied taxes on their subordinates to generate income for the aristocracy. The Code of Hammurabi is a well-preserved Babylonian code of law that emphasized the least popular form of taxation. Those who were not able to pay their debts fell into forced slavery (Ilonka 2004). The ancient Egyptians had developed tax registers. There are several records about the „harvest tax "3000 B.C., those crossing the Nile were subject to duty. The Roman Empire introduced the uniform tax system, and a debtor list was created to identify the taxpayers. Thanks to the expansion of the empire, people living in the territory of Italy were exempt from paying direct taxes. Emperor Augustus introduced a new tax reform by introducing the inheritance tax and the general sales tax (Grúň 2001). In the middle Ages, the most important source of income in Europe was the income gained from royal estates, often indirectly, by selling royal rights or real estate lease. The spread of Protestantism in Europe had changed the attitude of people towards taxation (Juhász 2009).

2. Literature review

Characterization and precise definition of taxation was addressed by numerous studies and the scientific literature. Tax is a non-repayable financial obligation levied on natural persons and legal entities by the state (possibly other public authorities) at predefined time and extent (Lymer and Hasseldine 2002). According to Sztanó (2013), the main duty of the state is to provide public goods for citizens – bear the burden of the public goods by transferring a part of their income into the state budget. Similar attitude is shared by Kubátová (2015), who emphasized that tax is a mandatory contribution to the state budget, paid by taxpayers at a determined time and determined amount of money. Tax is an economic tool that influences the macroeconomic demand and supply of the state. The payment of tax is a cyclically repeated activity and it generates the most important revenue for the state budget (Harumová 2002). After the above, it is worth clarifying some of the basic concepts of taxation in order to get a clearer picture of taxation itself: a taxable person: a natural or legal person with payment obligations towards the tax authority. We distinguish between taxable and taxable persons, who are responsible for the correct deduction - person or person, a taxpayer where, unlike the previous one, the tax burden is not directly on him, but on the final user:

- tax subject: any right, legal relationship, physical object, fact from which tax liability arises. As a result, the subject of the tax may be some kind of expenditure, gross income from products sold for sale, property growth and wage costs tax base: the quantitative parameter from which the tax rate can be calculated using the tax rate or tax rate (Rácz 2001);
- tax rate (tax rate, tax rate): Csányi (2011) describes the tax base or the tax on one part of it, which may be linear, progressive and regressive depending on the tax base.

The tax system is a set of taxes that are simultaneously applied and complement each other. Each country decides what kind of tax system to apply. The tax system has to be favorable for citizens and correspond to traditions of the country. If there is a change in the economic structure of the country, changes in tax system are also required (Herich 2016). In order to be effective, the following aspects must be followed:

- *Simplicity* – different types of taxes should be transparent and easy to calculate, make tax avoidance difficult;
- *Neutrality* – the economic decisions of the tax payer should not be influenced. The activity of the tax payer should continue without recognizing changes in the tax system;
- *Fair* – taxpayers with higher income should pay higher tax than those with low income;
- *Consistency* – a harmony exists between the tax system of the country and the tax system of the international partners unless the impact of individual taxes is ambivalent;
- *Predictability* – no frequent change in the tax system of the country can be observed. If it does occur, the tendency of change must be predictable (Sztanó 2013).

In the context of your research paper the literature review should be a critical synthesis of previous research in the subject field. The evaluation of the literature leads logically to the research question. Who is doing what? Who has done what? Who first did it or published it? Taken from published papers, research monographs, catalogues etc. based on primary sources. Offering a, probably new, structured view of the field of study.

Before turning to practical part of this research, we found it necessary to introduce the generations influencing our present and the target group of our research. In our research we focused on Generation Y and Z. Different generations and the group of them are determined by the experience, values and impulses they share. Differences between generations can be perceived without any information received from experts.

The members of generation Z were born between 1995 and 2009. They are also referred to as digital natives or „zappers "seeking new challenges and impulses to test themselves. Generation Z has grown up in the current environment of ubiquitous mobile communications. The members of this generation are courageous, proactive and determined in their abilities. They are used to interconnectedness and instant access to the Internet (Tari 2011).

Table 1. Characteristics of generations based on different indicators

	Generation Y	Generation Z
Private life	- like variety; - strive to reach goals; - live in present, friends are important; - open to fast lifestyle.	- comfortable, do not fight to achieve goals; - rather intelligent than wise; - possess a load of information; - the Internet is essential part of their life.
Studies	- work on PC has become an essential part of their lives during their high school years;	- majority of them are provided the possibility to continue their studies after finishing the high school;

	Generation Y	Generation Z
	▪ majority of them decided to continue their studies after finishing the high school.	▪ start their university studies or have already been the students of these institutions.
Family	▪ single parent families appear; ▪ decreasing number of programmes with children, less communication with parents.	▪ the communication between the parent and child has changed; ▪ their parents ensure everything to provide better life for them; ▪ share their problems with friends instead of parents.
Work	▪ have already entered the labour market; ▪ specific ideas; ▪ they are trying to choose workplaces that suit their skills; ▪ multitasking; ▪ prefer work over family.	▪ low percentage of the generation have already entered the labour market; ▪ high expectations, not enough work experience, find difficult to handle conflict situations.

Source: Schäffer (2015, 85)

3. Methodology

Before turning to practical part of this research, we found it necessary to introduce the generations influencing our present and the target group of our research. In our research we focused on Generation Y and Z. Different generations and the group of them are determined by the experience, values and impulses they share. Differences between generations can be perceived without any information received from experts.

Generation Y (born between 1980-1994) are those in their twenties and thirties. They are the first wave of digital generation who were born in the atmosphere of the constantly changing consumer society.

The digital world has become the part of their life. The PC, the smartphone and the Internet are determining factors of their everyday life. Their workplace preferences differ from the preferences of previous generations. They find it important to maintain work-life balance (Tari 2010). While examining the personal characteristics, we considered the factors of gender and age of the respondents. A total of 150 questionnaires were completed by the representatives of Generation Z (18-23) and Generation Y (24-29). Figure 1 illustrates the age distribution of the respondents. The questionnaires were filled by 72 respondents from Generation Z and 78 representatives from Generation Y. A total of 150 questionnaires were completed by the representatives of Generation Z (18-23) and Generation Y (24-29). Figure 1 illustrates the age distribution of the respondents.

Figure 1. The age distribution of the respondents
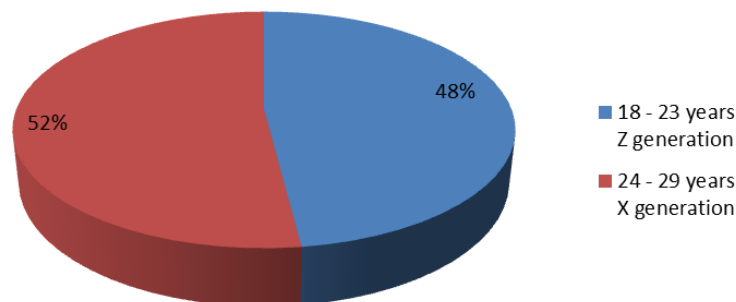
Source: Own proceeding based on the results of the questionnaire survey

4. Case study

Our data collection also addressed the gender of the respondents. From 150 respondents, 85 females (57%) and 65 males (43%) answered the questions. Our next question focused on the highest qualification degree achieved by the respondents. In this subgroup of questions, we asked general questions to measure the differences between Generation Y and Z, as well as assessing their awareness and knowledge about the basics of tax law.

The next question of the survey addressed the personal income tax in Slovakia. We were interested in how many of the respondents are informed about the rate of the personal income tax since all of the taxpayers have a liability to pay income tax after their earnings resp. income. The income tax in Slovakia is levied at 19% or 25% depending on a tax base, 44 respondents from the older generation (56%) and 29 respondents from the younger generation (40%) provided a correct answer for the question. This can be explained by the fact that most of the respondents of Generation Z have not entered the labour market yet. Only 5 respondents of Generation Y and 7

respondents of Generation Z provided an answer of estimated the tax rates at 16% and 20%. Smaller number of respondents estimated the level of income tax at 25%. It means 11 respondents representing Generation Y and 2 persons representing Generation Z. 18 respondents of Generation Y and 34 respondents from Generation Z provided an answer that Slovakia has a flat tax system with a 20% rate levied on income.

According to Sztanó (2013), the effective tax system is simple, neutral, fair, stable and predictable. Most of the respondents think that the tax system is effective when it is fair (31%) and transparent (32%). Many respondents answered that the tax system should be effective (17%) and fair (18%). The results of data evaluation show that 98% of the respondents share the opinion similar to the results provided by the scientific publications. Only 24 respondents from the younger generation could describe the characteristics of tax havens, 25 respondents marked only one correct answer and 10 respondents have no idea about the tax havens, while 13 respondents declared they have never heard about them.

All of the citizens in Slovakia can donate 2% of their annual income tax to help any non-profit organization. If we do not exercise our duty, this amount of money is transferred to the state budget (podnikajte.sk, online).

The most popular institutions to be donated by 2% of the annual income tax were the animal shelters (95), hospitals (81), orphanage (52), nursing homes (43) and sport clubs (18). The options listed above were supplemented by further alternatives to be chosen. The respondents were provided a possibility to list institutions they show willingness to donate 2% of their annual income tax. Only two respondents provided further alternatives. One of them would choose a social enterprise, and the other respondent would choose to donate a foundation that helps people with serious health problems (*e.g.* serious immune diseases, cancer, mental illnesses, etc.).

Figure 2 presents the ratio of correct answers respondents provided for the statements. The respondents had to decide whether the following statements are True or False: taxes fall into 2 big categories: direct and indirect (A), corporate and local taxes are differentiated (B), VAT is paid by legal entities conducting business activity in Slovakia (C), the current tax rate for legal entities is 21% (D), the deadline to file tax return cannot be extended. Tax return should be submitted by everybody within the set deadline (E), the rise in a fuel price is the result of the excise duty (F), tobacco products are not subject to mandatory taxation (G), there are revenues exempt from income tax (H).

Both generations provided correct answer for (A) – taxes fall into two big categories: direct and indirect. The following results were given by Generation Y: A(1,94), B(1,78), C(1,90), D(1,72), E(1,90), F(1,51), G(1,59), H(1,67). Generation Z provided the following answers: A(1,93), B (1,51), C(1,69), D(1,61), E(1,53), F(1,53), G(1,58), H(1,46).

Figure 2. The ratio of correct answers respondents provided for the statements
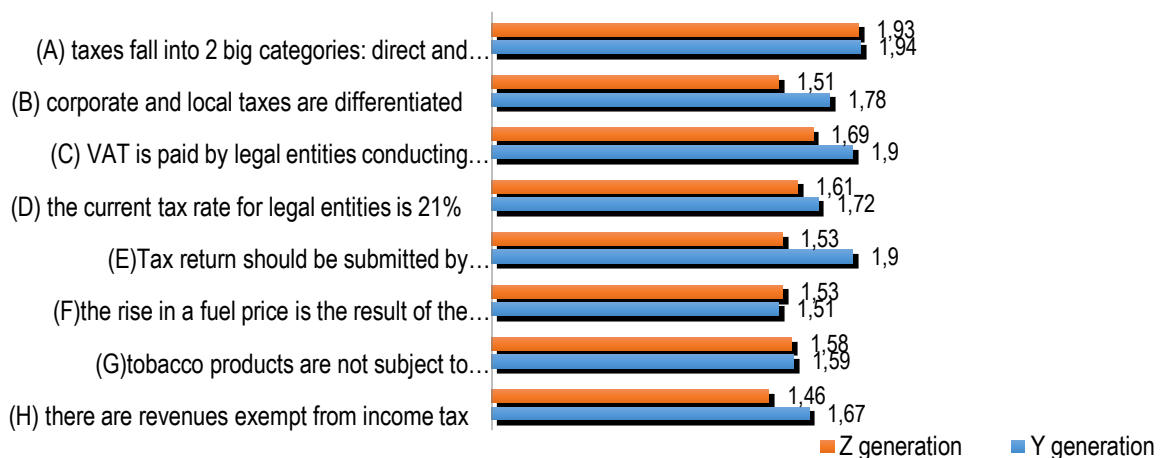
Source: Own proceeding based on the results of the questionnaire survey

The following questions measured the satisfaction of Generation Y and Z with the following: the process of tax declarations, helpfulness of the staff, the electronic information system, the interpretation of documents, opening hours of the tax office. We found it important to ask our respondents about the importance of knowledge sharing between the younger and older generation. They provided their answers on a Likert Scale (1 – not important at all, 5 – very important).

Table 2. Importance of knowledge sharing

Generation	N	Average	Standard deviation
Generation Z	72	4.52778	0.75
Generation Y	78	4.23077	1.25

Source: Own proceeding based on the results of the questionnaire survey

Based on the results (Table 2) both Generation Y and Z found the knowledge transfer important between the younger and older generation. They believe in the power of knowledge and also think that the practical experience is important to be shared. The value of deviations indicates that the respondents do not always share the opinion compared to the average. The high value of standard deviation (1.24758) indicates that the opinion of older generation is not entirely the same.

Our study is focusing on the assessment of knowledge in the field of tax law among the representatives of Generation Y and Z. The main objective of this research was to highlight and reveal the differences and correlations between the generations and their attitude. The summary of our research results from the perspectives of the researched generations is presented in the Table above.

The results can constitute differences and correlations in the studied field of research. The older generation, Generation Y has relatively stable knowledge about taxation and the taxation law. It cannot be said about the younger generation. The results can be explained by the fact that most of the representatives of younger generation have not completed their studies and majority of them have not entered the labour market yet. Since their representation on the labour market is not significant, they have no direct contact with taxation and taxes. It can be said that representatives of both generations find information and knowledge transfer important to enhance the knowledge of generations. The Internet is the main source of information, the representatives of both generations are in constant and direct connection with the world wide web.

In order to gain information and detailed knowledge about taxation, it would be important to introduce it in the of secondary school curricula. More and more young people enter the labour market earlier than the generations before. Most of them apply for student work during their studies or enter the job market after finishing the secondary school education.

Conclusion

The roots of taxation were identified in the prehistoric times. In the early Middle Ages tax appears as an allowance to be paid. The general tax liability was introduced in the new era, which is characterized by the emergence of the nation states, the democracy has strengthened, and the working class emerged. The state started to have an increasing role in social distribution that resulted in increased tax revenues by the governments. The tax system is constantly changing and undergoing different reforms to establish the best possible form of tax systems. The rate of individual taxes is determined by the state and levied on natural and legal persons. Since the tax system and different type's contributions paid by citizens play an essential role in the society, it is an intensively discussed issue. It can be declared that taxation is one of the most important issues regarding the economic policy of the country.

Our research has addressed an issue that has impact on life of every citizen. We were interested what kind of knowledge and information the representatives of Generation Y and Z have about the taxation. Since each type of tax has a specific regulation easily accessible online, we had a chance to study the different types of taxes. Our main objective was to study and provide transparent information about the differences in knowledge representatives of both surveyed generations have about the topic of taxation. It was important to provide a comprehensive picture and clear interpretation of the issue.

We also emphasized that different generations have different attitude towards the situations they face on their workplaces. While representatives of the older generation were introduced slowly to the technological development, the younger generation has been in direct contact with the technological progress since their birth. The older generations have developed a fear of losing their jobs if they pass on their knowledge on the younger generation. The assessment and evaluation of the questionnaire survey showed many differences but also similarities. Most of the representatives of Generation Y have already entered the labour market and have enough work experience. They proved to be informed and more successful, providing more correct answers in the questionnaire survey. The biggest differences between the answers provided by respondents addressed the issue of tax rates.

However, there were issues the respondents of different generations have reached consensus. Representatives of both generations declared that the Slovak tax burden is high. Both generations are well informed about the tax allowances linked to student work. This can be explained by the fact that most of them work as students and should be well-informed about the tax paid after their work. When answering questions about tax return and responding to general taxation issues, Generation Y proved to be more informed. The research results and the data obtained will encourage us to conduct further research in the field of taxation and contributions paid by the citizens.

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The Effects of the United States Monetary Stimulus (Quantitative Easing) towards the Indonesian Economic Fluctuations

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Abstract:

Quantitive Easing (QE) policy and its impact have become discussion and debate among policymakers and academics associated with the post-crisis economic conditions. There are controversies about the effectiveness and potential global spillover of non-conventional monetary policy measure such as QE. This study seeks to analyze the influence of US monetary stimulus on the economic fluctuations in Indonesia and the transmission mechanism of monetary policy shocks in a flexible exchange rate regime. To explain the shocks of US monetary policy conducted through QE, this study examines two basic models, namely the basic Mundell-Fleming-Dornbusch model and the intertemporal model, and use the best model to estimate the effect of QE policy towards Indonesian economic fluctuations. The method used in this research is Structural Vector Autoregressive (SVAR) which aims to examine the effect of monetary policy shocks and identify the policy transmission mechanism. SVAR is an econometric model system with dynamic equations suited to capture the macro-financial relations across borders. SVAR will specify spillover of QE policy by identifying shocks and tracing these out by employing Impulse Response Function (IRF) and Forecast Error Variance Decomposition (FEVD). The results of this study indicate that QE produce mixed effects or results towards the economic fluctuations in Indonesia

Keywords: monetary stimulus; quantitative easing; economic fluctuations; structural vector autoregressive (SVAR); Mundell-Fleming-Dornbusch and intertemporal models.

JEL Classification: C22; C52; E52; F52; F62.

Introduction

The severity of the global financial crisis that followed the collapse of Lehman Brothers in September 2008 led governments and central banks around the world to perform various steps to stabilize financial conditions and support aggregate demand. In the United States (US), significant monetary policy easing was done both by employing conventional and non-conventional measures. On December 16th 2008, the Federal Open Market Committee (FOMC), in an effort to improve the condition of the recession referred to as the worst since the recession of 1937-38, cut the federal funds rates close to zero. Since then, after using all conventional standard measures, the Federal Reserve (Fed) began a non-conventional policy measure called quantitative easing (QE).

This study will analyze the influence of the US monetary stimulus after the 2008 crisis to the economic fluctuations in Indonesia and the transmission mechanism of monetary policy shocks in a flexible exchange rate regime. Figure 1 shows some indicators that explain the US monetary expansion, *i.e.* the US real interest rates and its exchange rates, and how they affect the Indonesian economic fluctuations. Monetary expansion caused a decrease in the federal funds rates and significant depreciation of the US exchange rates. Despite the decline in the federal funds rates, as a result of people's purchasing power was very low (negative inflation), the US real interest rates in 2009 increased and showed positive values. In addition, Figure 1 also shows the condition of

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seasonality in Indonesian economic fluctuations. A decrease in the federal funds rates and depreciation of the US exchange rates seemed to boost the economic fluctuations in Indonesia. In September 2008 its economy expanded which exceeded the conditions of expansion in the same period of the previous year. Nevertheless, in September 2009 Indonesia economic expansion was not as high as in the same period of 2008.

Figure 1. Indonesian economic fluctuations due to quantitative easing policy
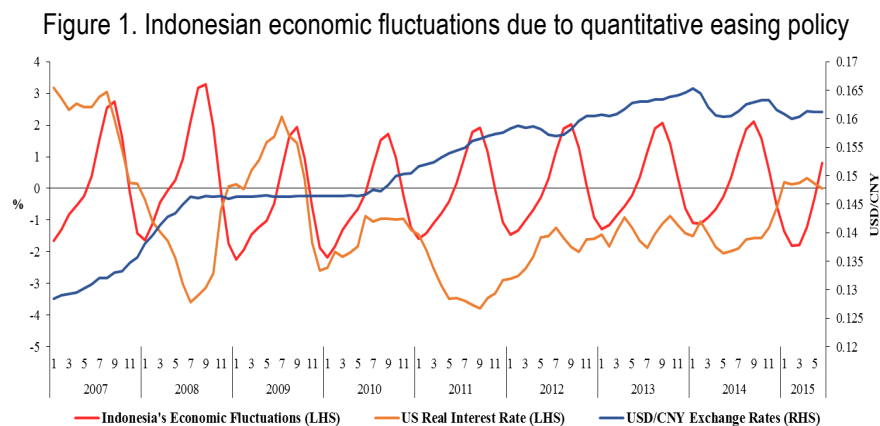
Source: CEIC database, 2015

Research done by Kim (2001) tried to explain the international transmission of the US monetary policy shocks by testing the basic Mundell-Fleming-Dornbusch (MFD) model and the intertemporal model. Based on that previous research, this study seeks to explain the US monetary policy shocks conducted through QE by using both basic models used in the study of Kim (2001). This study will examine both the basic model above and use the best model to estimate the effect of QE policy to the economic fluctuations in Indonesia. In addition, the existing empirical gap also raises some questions, such as whether the QE policy generates positive or negative spillover effects for developing countries like Indonesia? Then, through which transmission channels does QE affect the level of output in Indonesia? And whether the US monetary policy shocks give effect to the fluctuations, a recession or expansion, for the Indonesian economy?"

1. Literature review and research method

1.1. Literature review

QE refers to changes in the composition and/or the size of central bank balance sheets that is designed to improve the liquidity of the economy and/or credit. QE is done by purchasing large amounts of long-term securities, including government bonds (treasuries), agency bonds, and agency mortgage backed securities. The goal is to lower the interest rates faced by companies and households as well as create new money in the economy. Purchase of securities in large numbers conducted by the Fed will cause asset prices to increase and yield or interest rates to decrease. Hence, with the availability of cheaper loan, the central bank is expected to be able to re-stimulate demand in the economy and pull it out of recession.

On the other hand, QE policy does not only affect US economic indicators but also economic indicators of other countries, especially along with the increasingly integrated market condition. Currently, countries in the world have been very open, so that foreign policies and changes may affect domestic economic conditions. QE policy and its impact have become discussion and heated debate among policymakers and academics associated with the post-crisis economic conditions. There are controversies about the effectiveness and potential global spillover of non-conventional monetary policy measure such as QE. Rafid (2015) studied the response of US unconventional monetary policy on a group of frontier developing countries (FDEs) in Asia. His paper showed that the US policy to FDEs in Asia might be small. Barroso *et al.* (2016) showed that unconventional monetary policy in the US influenced capital inflows to Brazil and its overall economic outlook and financial stability. The US QE might lead to capital inflow, appreciation of exchange rate, increases in stock market price, credit growth and expansion of domestic activity. Kryzanowski *et al.* (2017) explored a spillover effects of QE on the international financial markets and showed that the correlation between bond markets, stock markets and currency forward may differ by QE period across emerging and developed countries. D'Avino (2018) investigated the existence of an international bank lending channel stimulated by QE, and could induce foreign lending during the implementation of the QE policy in the US. Fratscher *et al.* 2018, investigated the effects of the Fed's QE on portfoloio flows in the US and globally. The results of their study prevailed that a heterogenous effects of capital flows following QE rounds. It was argued that the heterogenous responses may be explained by variation in macroeconomic uncertainty. However, discussion about whether US monetary expansion leads to a recession or a boom in other countries and whether

monetary expansion improves or worsens the trade balance has long been debated, but it remains a controversial matter.

1.2. Research framework

In the theoretical domain, there are two sources of ambiguity related to the effects of monetary expansion. The first ambiguity is the predicted outcome generated by each model. The traditional Mundell-Fleming-Dornbusch (MFD) developed by Mundell (1963), Flemming (1962), and Dornbusch (1976) has ambiguous predictions related to the effects of monetary expansion. On the other hand, application of intertemporal models (with a fixed price or wage) described by Svensson and Van Wijnbergen (1989) and Obstfeld and Rogoff (1995) for the international monetary transmission mechanism also gives different perspective.

There are two main consequences of the international transmission of monetary policy shocks which still create ambiguity:
- the effect on the trade balance (or current account);
- the effect on foreign output (Indonesia).

First, the basic MFD model predicts that monetary expansion will cause a decline in terms of trade or generate real exchange rate depreciation, and will encourage the improvement of trade balance (expenditure switching effect). However, the increase in domestic revenue as a result of monetary expansion will increase the demand for imports and can worsen the trade balance (income absorption effect) (Dornbusch 1980, 125). Intertemporal model emphasizes on forward-looking intertemporal decision of economic agents (Svensson and Van Wijnbergen 1989, and Obstfeld and Rogoff 1995). Monetary expansion leads to a temporary increase in income, so that the current account balance may increase as a result of consumption smoothing. Nevertheless, the current account could deteriorate if investment increases substantially (due to lower real interest rates) (Betts and Devereux 2000). Nielson (1991) and Risager (1988) stated that the devaluation of the exchange rates could worsen the trade balance if the devaluation substantially increase consumption and investment.

Second, related to the foreign output (Indonesia), the MFD model predicts that domestic monetary expansion leads to a worsening of foreign trade balance through expenditure switching effect and a decrease in foreign output (beggar-thy-neighbor policy). The side effects on foreign output may be overcome if foreign trade balance increases through income absorption effect. Intertemporal model also contains expenditure switching effect, so that foreign output may drop. However, the decline in the world real interest rates in general especially because the country of origin is a large open economy like the US - may increase world aggregate demand for goods and services, including goods produced abroad (Indonesia). As the result, the foreign output (Indonesia) may grow.

Figure 2 provides an illustration of the impact of monetary expansion assessed using two basic theories, *i.e.* the traditional MFD model and the intertemporal model. Both give different detailed explanation of monetary policy transmission mechanism. Both models also yield different predictions about the effects of monetary expansion on the trade balance and foreign output (Indonesia). Furthermore, the focus of this research is on the effect of monetary stimulus on foreign output (the economic fluctuation in Indonesia) analyzed using the MFD model and the intertemporal model.

Figure 2. Transmission mechanism of monetary expansion
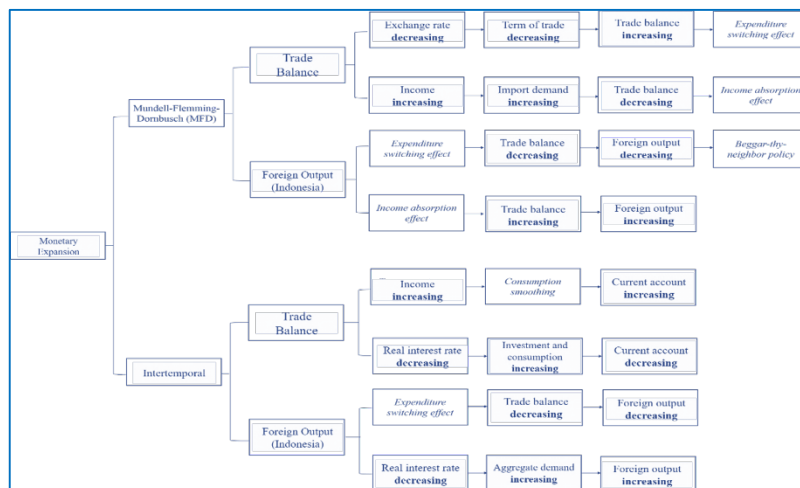
1.3. Structural Vector Autoregressive identification

The model used in this study is a modification of the research model of Kim (2001) – which documents empirical evidence by using minimum identification restriction and not overly dependent on any particular theoretical model. However, in contrast to study of Kim (2001), this study involves a restriction that is used as the basis of model development. Thus, the relationship between the macroeconomic variables is not merely the result of a statistical test, but has included adjustment based on economic theoretical framework and empirical assumptions.

The method used to answer the research problem is Structural Vector Autoregression (SVAR). Restrictions in SVAR model is developed using economic theoretical framework and empirical assumptions, and can be tested using Granger causality. Furthermore, this model describes the impulse response function – a property of SVAR model to examine the shock of innovative variables on other variables.

The main objective of SVAR estimation is to obtain non recursive orthogonalization error term in order to analyze the impulse response, while the alternative recursive orthogonalization of Cholesky requires the inclusion of sufficient restriction to identify orthogonal (structural) components of error term. A vector of endogenous variables with k-element is denoted by y_t and residual covariance matrix $\sum = \mathrm{E}\left[e_t e_t{'}\right]$, then SVAR model can be written as follows:

$$Ae_t = Bu_t \tag{1}$$

where: e_t and u_t are vectors with length k, e_t is a residual that can be observed (reduced form), u_t is a structural innovation that is not observed (unobserved), A and B are $k*k$ matrices that are estimated.

Structural innovation is assumed orthonormal, that is when the covariance matrix is an identity matrix, $\mathrm{E}\left[u_t u_t{'}\right] = \mathrm{I}$. Additionally, assumption of orthonormal u_t innovation holds identification restriction on A and B as $\mathrm{A}\sum \mathrm{A'} = \mathrm{BB'}$ (Enders 2015, 213-322).

Identification restriction in $Ae_t = Bu_t$ generally indicates short-term restriction. Blanchard and Quah (Enders 2015, 325-3331) explain an alternative identification method based on impulse response restriction. Accumulation of long-term response C towards structural innovations is as follows:

$$C = \widehat{\Psi}_\infty A^{-1} B \tag{2}$$

This study will use two SVAR models to explain economic fluctuations in Indonesia, namely (1) by using the Mundell-Fleming-Dornbusch model and (2) by using the intertemporal model. Both models can be explained as follows:

(1) Indonesian economic fluctuations with the Mundell-Flemming-Dornbusch (MFD) Model

$$FGDP_t^{INA} = f(\Delta r_t^{US}, \Delta ER_t^{US}, \Delta X_t^{US}, \Delta M_t^{US}, \Delta CA_t^{US}, \Delta X_t^{INA}, \Delta M_t^{IA}, FGDP_t^{INA})$$

(2) Indonesian economic fluctuations with the Intertemporal Model

$$FGDP_t^{INA} = f(\Delta r^{US}, \Delta INC_t^{fUS}, \Delta I_t^{fUS}, \Delta C_t^{fUS}, \Delta CA_t^{US}, \Delta X_t^{INA}, \Delta M_t^{INA}, FGDP_t^{INA})$$

where: r^{US} is the US real interest rates (FFR – CPI:2010); ER^{US} is the exchange rates of the US dollar (USD) against Yuan (CNY); X^{US} is the level of US exports; M^{US} is the level of US imports; INC^{US} is the United States level of personal income; C^{US} is the level of US consumption; I^{US} is the level of US investment; CA^{US} is the level of US current account balance; X^{INA} is the level of Indonesian exports; M^{INA} is the level of Indonesian imports; $FGDP^{INA}$ is the Indonesian economic fluctuations

Data of the variables mentioned above, both in the MFD model and the intertemporal model, are in the form of percentage change (except for $FGDP^{INA}$) which is $\Delta X_t = X_t - X_{t-1} = (1 - L)X_t$. While the data of $FGDP^{INA}$ are the result of $\frac{Y_t - Y_t^P}{Y_t^P}$ where Y_t is the value of actual GDP and Y_t^P is the value of potential GDP. The value of Y_t^P is calculated using the trend of Hodrick-Prescott filter estimation.

In addition, intertemporal model is a forward looking model, therefore some of the variables in the intertemporal model, such as variable of the level of the US personal income (INC^{US}), the level of the US consumption (C^{US}), and the level of the US investment (I^{US}), are assumed to emphasis on forward looking intertemporal. Hence, the data of these variables at time *t* equal at time *t + 1* because individual's decisions at time *t* are based on the expectation *t + 1*.

2. Data analysis

2.1. Data

This study uses monthly data from 2000:1-2015:6. The data which are not available monthly are adjusted using data interpolation – the method to generate new data points within a range of discrete set of known data. The interpolation method used is the cubic spline method. This method uses cube polynomial (power of three) that is assumed to be applicable for points located between two known data points (Bartels *et al*. 1992, 9-17).

There are eleven endogenous variables used in this study, namely (1) the United States real interest rates (FFR – CPI:2010) (r^{US}), (2) the exchange rates of the US dollar (USD) against Chinese yuan (CNY) (ER^{US}), (3) the level of US export (X^{US}), (4) the level of US import (M^{US}), (5) the level of US personal income (INC^{US}), (6) the level of US consumption (C^{US}), (7) the level of US investment (I^{US}), (8) the United States current account balance (CA^{US}), (9) the level of Indonesian exports (X^{INA}), (10) the level of Indonesian imports, and (11) the Indonesian economic fluctuations ($FGDP^{INA}$). Data for variable (1) to (10) are in the form of percentage change, $\Delta X_t = X_t - X_{t-1} = (1 - L)X_t$. While the data of Indonesian economic fluctuations ($FGDP^{INA}$) used in the model are the computed result of $\frac{Y_t - Y_t^P}{Y_t^P}$ where Y_t is the value of actual GDP and Y_t^P is the value of potential GDP. The value of Y_t^P is calculated using the trend of Hodrick-Prescott filter estimation.

2.2. Stationarity

Important issue in the analysis of time series data is the problem of stationarity. Before estimating the model, the data used should be tested using unit root test to determine whether the data are stationary or not. The testing procedures to test stationarity are Augmented Dickey-Fuller test (ADF) and Phillips-Peron test (PP). Table 1 reports the results of the unit root test using ADF and PP test. The unit root test results show that all variables are stationary at level or I(0).

Table 1. ADF and PP Unit Root Test (*t-statistic*)

No	Variable	ADF Test (Level)	PP Test (Level)
1	Δr^{US}	-7.336502***	-9.185591***
2	Δe^{US}	-6.538350***	-6.545668***
3	ΔINC^{US}	-16.00709***	-16.08903***
4	ΔC^{US}	-2.204665**	-15.45325***
5	ΔI^{US}	-2.104241**	-2.639855***
6	ΔX^{US}	-4.636493***	-12.21898***
7	ΔM^{US}	-4.076978***	-13.26659***
8	ΔCA^{US}	-4.450668***	-2.789840***
9	ΔX^{INA}	-19.44682***	-19.39200***
10	ΔM^{INA}	-16.88678***	-16.51974***
11	FGD^{INA}	-3.251750***	-3.313378***

Note: The symbol (*) denotes a variable was stationary on the critical value of 10%(**) at the critical value of 5%, and (***) at the critical value of 1%.

2.3. Mundell-Flamming-Dornbusch (MFD) model versus intertemporal model

As mentioned above, this research focuses on the effect of US monetary stimulus towards the economic fluctuations in Indonesia analyzed using the basic MFD model and the intertemporal model. Both theoretical basis provide different detailed explanations for each of the transmission mechanism of monetary policy. Both models also produce different predictions about the impact of monetary expansion to Indonesian economic fluctuations. Therefore, predictive performance analysis is conducted for both models by observing the value of bias proportion, variance proportion, and covariance proportion explained by Pindyck and Rubinfeld (1998, 387-388).

The value of bias proportion and variance proportion is expected to be near to zero, while the value of covariance proportion is expected to be close to unity. The high value of bias proportion (exceeding 0.20) shows that the model fails to produce robust prediction as it indicates the existence of systemic error in the model. In addition, the model that has good predictive performance is the one that has lower mean absolute error and mean absolute percentage error.

Table 2 reports the results of predictive performance for both models: the MFD model and the intertemporal model. By observing the values of root mean squared error, mean absolute error, mean absolute percentage error, bias proportion, variance proportion, and covariance proportion, predictive performance tests show that there is no

best predictive model between those two models because each carries strength and weakness. MFD model has higher covariance proportion which is 0.716446. However, MFD model brings high bias proportion which is 0.733243 (greater than 0.20). As mentioned before, the high value of bias proportion indicates systemic error resulting in a predictive failure of the model. On the other hand, intertemporal model has low bias proportion which is 0.001174 (less than 0.20). Nevertheless, intertemporal model experiences low covariance proportion.

Based on the informal analysis conducted in Table 2, it may be concluded that both models can not perform encompassed predictions individually. Thus, it requires an alternative approach that combines the variables of both models (MFD and intertemporal) to analyze the influence of US monetary policy stimulus towards Indonesian economic fluctuations.

Table 2. Predictive performance

Criterion	Mundell-Flemming-Dornbusch (*Backward Looking*)	Intertemporal Model (*Forward Looking*)
Root Mean Squared Error	1.451415	1.412961
Mean Absolute Error	1.229940	1.206845
Mean Absolute Percentage Error	160.6252	129.9017
Theil Inequality Coefficient	0.733243	0.884077
Bias Proportion	0.733243	0.001174
Variance Proportion	0.017027	0.619951
Covariance Proportion	0.716446	0.378875

2.4. Combination of Mundell-Flemming-Dornbusch and intertemporal

After conducting informal analysis to test the predictive performance, it is found that between both models (MFD and intertemporal model), there is no best or encompassed model to generate predictions. Therefore, an alternative model which is a combination of both models is developed to analyze the influence of US monetary policy stimulus towards the economic fluctuations in Indonesia. Below is the model of Indonesian economic fluctuations due to the effect of QE policy by using combination of the basic MFD model and the intertemporal model:

$$FGDP_t^{INA} = f(\Delta r_t^{US}, \Delta ER_t^{US}, \Delta INC_t^{fUS}, \Delta I_t^{fUS}, \Delta C_t^{fUS},$$

$$\Delta X_t^{US}, \Delta M_t^{US}, \Delta CA_t^{US}, \Delta X_t^{INA}, \Delta M_t^{INA}, FGDP_t^{INA})$$

To determine whether an alternative model (combination of MFD and intertemporal model) is better model than either MFD or intertemporal model individually, another informal analysis should be carried out which again includes observations on the value of root mean squared error, mean absolute error, mean absolute percentage error, bias proportion, variance proportion, and covariance proportion.

Table 3 shows the results of predictive performance of the combination model of MFD and intertemporal. This combination model has low bias proportion which is less than 0.20. This result indicates that there is no indication of systemic errors. In addition, this model also has high value of covariance proportion which is close to unity. Thus, this combination model is found to be the most optimal (encompassed) model that can fix the weaknesses of each basic model.

Table 3. Predictive performance of the combination model

Criterion	Combination Model (MFD and Intertemporal)
Root Mean Squared Error	1.518295
Mean Absolute Error	1.279376
Mean Absolute Percentage Error	171.6506
Theil Inequality Coefficient	0.728463
Bias Proportion	0.014645
Variance Proportion	0.176741
Covariance Proportion	0.808614

2.5. Structural Vector Autoregressive estimation of combination model

Having determined the best model to estimate the effect of monetary expansion through QE policy towards Indonesian economic fluctuations then an estimation using SVAR may be conducted. Determination of the optimal lag length is important in modeling SVAR. If the optimal lag length entered is too short, the model may not be able

to explain the dynamism of the model as a whole. However, if the optimal lag length is too long, this may result in inefficient estimation because of reduced degree of freedom (especially for model with small samples). There are several methods that can be used to determine the optimal lag structure in the SVAR model in this study, among others, by observing Akaike Information Criterion (AIC), Schwartz Criterion (SC), Hannan-Quinn Information Criterion (HQ), Likelihood Ratio (LR), and Final Predictor Error (FPE). Based on the results of test conducted, the lag length of five is chosen to be the optimal lag length.

The result of SVAR model estimation to see the effect of long-term QE proxy variables (R^{US}, ER^{US}, INC^{US}, C^{US}, I^{US}, X^{US}, M^{US}, CA^{US}, X^{INA}, M^{INA}) towards Indonesian economic fluctuations is shown by each variable's coefficient (in the form of matrix). Estimation of long-term relationship of the SVAR model in this study is as follows:

$$
\begin{bmatrix}
\Delta r^{US} \\
\Delta ER^{US} \\
\Delta INC^{fUS} \\
\Delta I^{fUS} \\
\Delta C^{fUS} \\
\Delta X^{US} \\
\Delta M^{US} \\
\Delta CA^{US} \\
\Delta X^{INA} \\
\Delta M^{INA} \\
FGDP^{INA}
\end{bmatrix}
=
\begin{bmatrix}
0.715 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-0.370 & 1.064 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
-0.027 & -0.319 & 0.459 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0.013 & -0.473 & 0.226 & -0.338 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0.155 & -1.546 & 0.924 & -1.531 & 1.119 & 0 & 0 & 0 & 0 & 0 & 0 \\
-1.245 & 0.872 & 0.552 & -1.909 & 0.578 & 1.626 & 0 & 0 & 0 & 0 & 0 \\
-1.593 & -0.596 & 0.850 & -2.322 & 0.992 & 1.416 & 0.592 & 0 & 0 & 0 & 0 \\
-0.884 & -5.273 & 2.535 & -2.908 & 1.032 & 0.306 & 2.196 & 1.539 & 0 & 0 & 0 \\
-3.115 & 1.477 & 0.001 & -2.771 & 0.413 & 3.081 & 0.974 & 0.724 & 2.157 & 0 & 0 \\
-5.601 & 3.960 & -0.269 & -3.480 & 0.604 & 5.228 & 1.245 & 0.038 & -0.183 & 3.886 & 0 \\
-0.169 & 0.259 & -0.045 & 0.225 & -0.163 & -0.191 & -0.061 & 0.053 & -0.086 & 0.116 & 0.333
\end{bmatrix}
\begin{bmatrix}
\Delta r_t^{US} \\
\Delta ER^{US} \\
\Delta INC_t^{fUS} \\
\Delta I_t^{US} \\
\Delta C_t^{fUS} \\
\Delta X^{US} \\
\Delta M^{US} \\
\Delta CA_t^{US} \\
\Delta X_t^{INA} \\
\Delta M_t^{INA} \\
FGDP_t^{INA}
\end{bmatrix}
+
\begin{bmatrix}
u_t^{r^{US}} \\
u_t^{ER^{US}} \\
u_t^{INC^{fUS}} \\
u_t^{C^{fUS}} \\
u_t^{I^{fUS}} \\
u_t^{X^{US}} \\
u_t^{M^{S}} \\
u_t^{CA^{t}} \\
u_t^{X^{INA}} \\
u_t^{M^{INA}} \\
u_t^{FGDP^{INA}}
\end{bmatrix}
$$

The purpose of this study is to observe the effect of QE policy towards Indonesian economic fluctuations. Hence, the main focus of the estimated SVAR model is on the last line of the matrix with the following equation:

$$
\begin{aligned}
FGDP_t^{INA} = & -0.169\Delta r_t^{US} + 0.259\Delta ER_t^{US} - 0.045\Delta INC_t^{US} + 0.225\Delta C_t^{US} - 0.163\Delta I_t^{US} \\
& - 0.191\Delta X_t^{US} - 0.061\Delta M_t^{US} + 0.053\Delta CA_t^{US} - 0.086\Delta_t^{INA} + 0.116\Delta M_t^{INA} \\
& + 0.333 FGDP_t^{INA} + u_t^{FGDP^{INA}}
\end{aligned}
$$

Although the coefficients can be generated, interpretation of the coefficients of each variable is difficult to be done. SVAR methodology allows interpretation of each of the endogenous variables to determine the relationship between variables, not the parameter estimation. The coefficients of the US real interest rates, the level of the US personal income, the US investment, the US exports, the US imports, and the level of Indonesian exports show negative correlations towards Indonesian economic fluctuations. While the coefficients of the USD/CNY exchange rates, the level of the US consumption, the US current account balance, and the level of Indonesian imports show positive correlations towards Indonesian economic fluctuations. However, to conclude the influence of the QE proxy variables towards Indonesian economic fluctuations requires further analysis using the Impulse Response Function (IRF) and Forecast Error Variance Decomposition (FEVD).

2.6. Diagnostic test

2.6.1. Residual stationary test

The residual (error term) unit root test is carried out to determine the presence of autocorrelation (serial correlation) in the residuals and heteroscedasticity. If the results of unit root test state that the residuals are stationary at level then there is no autocorrelation and heteroscedasticity. Procedures undertaken to conduct this test are by estimating the SVAR model and then obtaining the residuals. Furthermore, the unit root test for residual stationarity can be done by using ADF test and PP test. The results of the unit root tests of the residuals using ADF test and PP test (Table 4) show that all residuals are stationary at level or I(0). Residual stationarity explains that the residual

distribution has average of zero or $E(e_i) = 0$, there is no correlation between residuals $E(e_t e_{t-1}) = 0$, and residuals have constant variance or $Var(e_i) = \sigma^2$. Hence, it can be concluded that there is no autocorrelation and heteroscedasticity in the model estimated.

Table 4. ADF and PP Unit Root tests *(t-statistic)* on residuals

No	Variable	ADF Test (Level)	PP Test (Level)
1	Δr^{US}	-13.57461***	-13.58188***
2	Δe^{US}	-13.21972***	-13.21941***
3	ΔINC^{US}	-10.71422***	-15.05969***
4	ΔC^{US}	-10.73768***	-7.125924***
5	ΔI^{US}	-14.07092***	-14.13420***
6	ΔX^{US}	-14.77138***	-14.73273***
7	ΔM^{US}	-14.00333***	-14.00577***
8	ΔCA^{US}	-5.460943***	-7.440204***
9	ΔX^{INA}	-13.49684***	-13.62514***
10	ΔM^{INA}	-13.76490***	-13.80632***
11	FGD^{INA}	-3.315925***	-5.784218***

Note: The symbol (*) denotes a variable was stationary on the critical value of 10% (**) at the critical value of 5%, and (***) at the critical value of 1%.

2.6.2. Normality test

Normality can be detected by looking at the histogram of the residuals. Figure 3 shows that the histogram demonstrates a normal distribution pattern, thus it can be concluded that the regression meets the assumption of normality. Secondly, normality test can be done by performing a statistical test known as the Jarque-Bera test. Jarque-Bera test is a goodness of fit normality test which measures whether the skewness and kurtosis of samples are in accordance with the normal distribution. The results represented at Figure 3 shows that the test result is not significant. Thus, H_0 stating normal distribution cannot be rejected

Figure. 3. Jarque-Bera Normality test

Series: Residuals
Sample 2000M01 2015M06
Observations 186

Mean	-0.058626
Median	-0.132596
Maximum	3.118435
Minimum	-2.992201
Std. Dev.	1.302745
Skewness	0.139251
Kurtosis	2.373444
Jarque-Bera	3.643553
Probability	0.161738
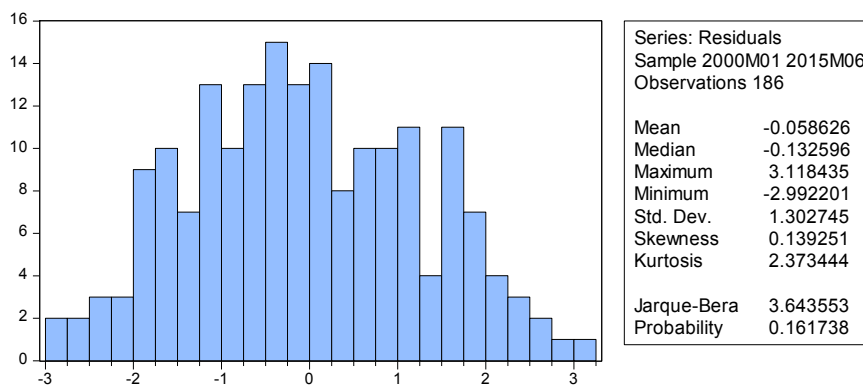
2.6.3. Stability of vector autoregression (VAR) system

Stability test of VAR system is required in order to ensure that the estimation results have high validity. Stability testing was conducted using VAR model of stability condition check called roots of characteristic polynomial in which all variables used are multiplied by the amount of lag of each variable. A VAR system is considered to have high stability if the inverse roots of AR polynomial characteristic have modulus of not more than one and all of them are within the unit circle. If most of the modulus is within the circle, it can be said that the model used is stable. Figure 4 shows that the inverse roots are in the unit circle, so then it can be concluded that the SVAR model estimated is stable and produce valid impulse response function (IRF) and forecast error variance decomposition (FEVD).

Figure. 4. Stability test of vector autoregression (VAR) system

Inverse Roots of AR Characteristic Polynomial
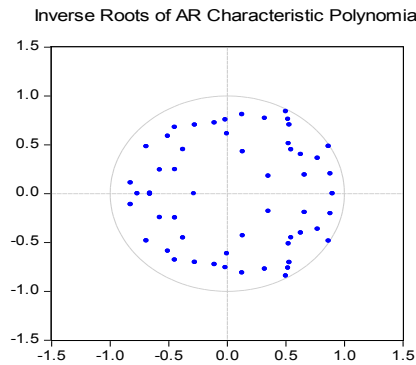
3. Results and discussion

3.1. Impulse response function (IRF) analysis

Impulse response analysis of SVAR model reveals the response of economic fluctuations (output gap) in Indonesia due to shocks of other variables in the model, i.e. the real interest rates, the exchange rates of US dollar against Chinese yuan, the level of the US personal income, the level of the US consumption, the level of the US investment, the level of the US exports and imports. This study tries to see the effect of QE towards the economic fluctuations in Indonesia. Therefore, the variables used in this study is assumed to be the approach (proxy) of the US monetary policy shocks conducted through QE. Impulse response function shows response of a variable due to shocks of other variables for some period of time after the shock. If the movement of impulse response is getting closer to the equilibrium (convergence) or return to the previous equilibrium point, it means that the response of variable as a result of shocks of other variables will gradually disappear so that the shock does not leave a permanent effect on the variable of interest.

Figure 5. Response of the economic fluctuations in indonesia due to shocks of the US real interest rates and the US exchange rates

Response of FLUKTUASI to Cholesky
One S.D. Innovations
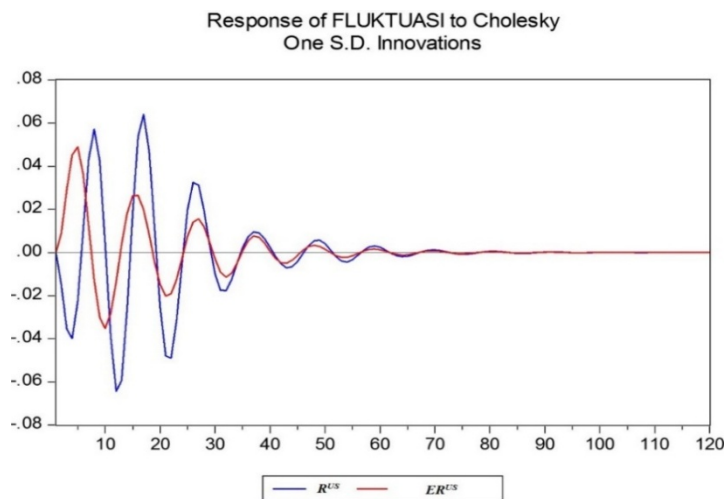
Note: R^{US} is the level of the US real interest rates (FFR– CPI: 2010), ER^{US} is the exchange rates of US dollar (USD) against Chinese yuan (CNY).

Figure 5 shows response of the changing economic fluctuations due to Cholesky one standard deviation of the US real interest rates and the US exchange rates. The graph shows that shock at the US interest rates is responded negatively (located below the balance) by economic fluctuations at the beginning of the period. Later, it shows that the response fluctuate around the equilibrium line and gets closer to the equilibrium line. Since impulse response function captures positive shock of the interest rates, so if it is to be interpreted by using negative shock from the real interest rates (lower interest rates), the interpretation of the response of Indonesian economic fluctuations should be inversed from the result generated. Thus, the negative shock of interest rates result in a positive response of Indonesian economic fluctuations, which is above the equilibrium line. This result is consistent with the intertemporal model prediction, in which a decrease (negative shock) of real interest rates in general, especially because the country of origin is a large open economy like the US, it will increase world aggregate

demand for goods and services, including goods produced in Indonesia. As the result, the output of Indonesia could grow.

Next, impulse response function in Figure 5 also captures positive response (above the equilibrium line) of Indonesian economic fluctuations from the exchange ratesshock (depreciation of the US exchange rates) at the beginning of the period. This shows that the US exchange rates depreciation shock is responded positively by economic fluctuations. The graph also notes that the US exchange rates shock at the beginning of the period is responded by generating substantial magnitude and gradually experiencing convergence as it returns to the equilibrium line. This condition indicates the existence of anomalies of the MFD basic model where there is discrepancy between the result of impulse response function and the MFD prediction– stating that depreciation of the US currency as a result of monetary expansion leads to a worsening of the trade balance in Indonesia through the expenditure switching effect. This anomaly can be explained by interpreting the US dollar depreciation as Chinese yuan appreciation[3], which then leads to depreciation of Indonesian rupiah. Furthermore, the rupiah depreciation will enhance Indonesian export competitiveness and increase its output. In addition, this anomaly may be caused by less dependent Indonesian export and import on the United States economy, so then the US exchange rates depreciation shock does not lead to a decrease in Indonesian output (beggar-thy-neighbor).

Figure 6. Response of the economic fluctuations in Indonesia due to shocks of the US income, consumption, and investment
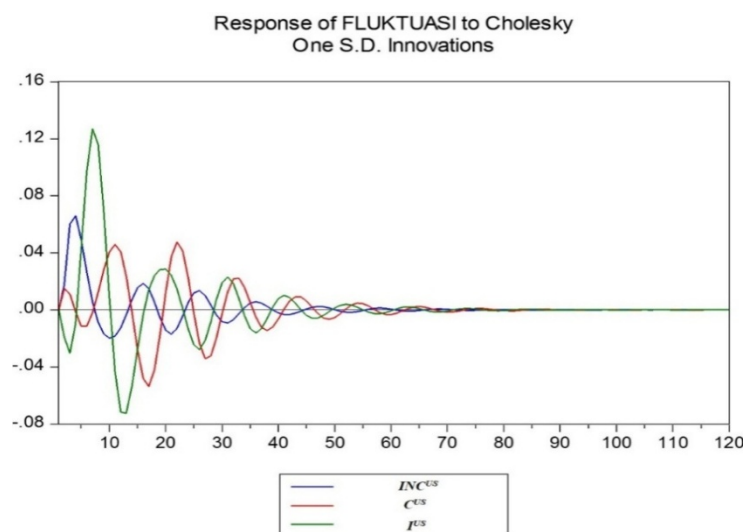
Note: INC^{US} is the level of US personal income, C^{US} is the level of US consumption, I^{US} is the level of US investment.

Figure 6 shows the response of economic fluctuations due to Cholesky one standard deviation of the level of US income, investment, and consumption. The graph shows that the response of impact received by economic fluctuations as a result of shock from the US personal income is positive (above the equilibrium line) at the beginning of the period and has large magnitude indicated by the distance from the equilibrium line. Subsequently, the graph pictures volatility on the response of economic fluctuations as it moves around the equilibrium line and becomes smaller when it enters the period of eighty. This shows that there is temporary income absorption effect on the increase in the US personal income – where the increase in domestic income that follows the monetary expansion will increase the demand for imports in the country, it then may worsen the trade balance in the country (US) (Dornbusch 1980,125). On the other hand there is the income absorption effect so that Indonesian trade balance may rise.

Next, still in Figure 6, the response of economic fluctuations in Indonesia due to Cholesky one standard deviation of the US consumption level gives positive response (above the equilibrium line) at the beginning of the period. Later, it shows fluctuating response around the equilibrium line and the distance becomes smaller and experiences convergence by returning to the equilibrium. In line with the impulse response generated by shock from the level of US income, this result indicates that the empirical evidence shows compatibility or consistency with the MFD theory on income absorption effect, in which the increase in domestic income that follows the monetary expansion will boost demand of import (consumption) in the country, it can then worsen the trade balance in the country (US). However, at the other place there is income absorption effect that pushes up Indonesian trade

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[3] China's economy may explain Indonesia economic fluctuation because of the high intensity of trade between Indonesia and China.

balance. In addition, this condition can also be explained using intertemporal theory where the decline in real interest rates in general (worldwide), especially because the country of origin is a large open economy like the US, can increase world aggregate demand (consumption) of goods and services, including those produced in Indonesia. As the result, the output of Indonesia could grow.

The response of the economic fluctuations in Indonesia due to shock of Cholesky one standard deviation from the level of US investment in the beginning of the period results in negative response (located below the balance), but then followed by a significant positive response in the subsequent periods, and goes back down generating negative response (see Figure 6). Later, it shows fluctuating response and the distance becomes smaller and experiences convergence as it enters the eightieth period. This condition indicates the presence of lagging factor between the shock from the level of US investment and positive response of Indonesian economic fluctuations.

Figure 7. Response of the economic fluctuations in Indonesia due to shocks of the US exports and imports

Note: X^{US} is the level of US exports, M^{US} is the level of US imports
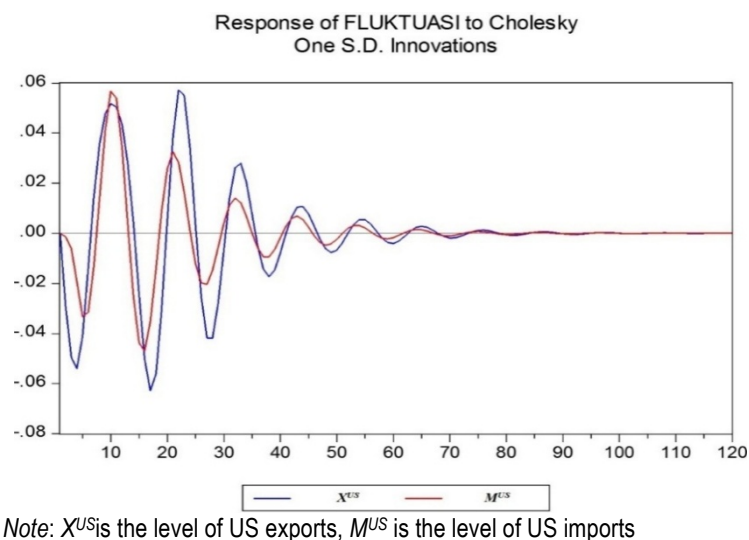
However, this condition can explain the intertemporal theory where the decline in real interest rates in general (worldwide), especially because the country of origin is a large open economy like the US, can increase world aggregate demand for goods and services, including level of investment in Indonesia.

Description Figure 7 reports the response of the economic fluctuations in Indonesia due to shock of Cholesky one standard deviation from the US exports and imports. The graph shows that the response of impact received by economic fluctuations as a result of shock from the US exports is negative (below the equilibrium line) at the beginning of the period and has large magnitude indicated by the distance from the equilibriumline. In the subsequent periods, the response fluctuates around the equilibrium line and the distance becomes smaller and experiences convergence by returning to the equilibrium. This condition explains consistency with the basic MFD model that predicts domestic monetary expansion lead to deterioration in foreign trade balance through expenditure switching effects and a decrease in foreign output (policy of beggar-thy-neighbor).

The response of the economic fluctuations in Indonesia due to shock of Cholesky one standard deviation (Cholesky One SD) from the US imports shows a negative response (located below the equilibrium line) at the beginning of the period (see Figure 7). In the subsequent periods, the response fluctuates around the equilibrium line and the distance becomes smaller and experiences convergence by returning to the equilibrium. This suggests the presence of anomalous basic MFD model stating that an increase in domestic income following the monetary expansion will increase demand for imports in the country which then boost foreign (Indonesia) trade balance (Dornbusch 1980, 125). This condition may be caused by less dependent Indonesian trades on the United States economy, so then shocks from the increase in US imports do not result in the increase of output in Indonesia

3.2. Forecast Error Variance Decomposition (FEVD) analysis

In the VAR method, analysis of variance decomposition (VD) is used to examine which shocks of variables that most influence the variation of the variable of interest. VD in the VAR model aims to separate individual effect of each innovative variable, including the innovation of the variable of interest itself. The fundamental of this analysis is the magnitude of the relative proportion of each variable in explaining the variable of interest, including how the

variable of interest explains itself. In other words, VD is the arrangement of the error variance forecasting of a variable. Table 5 is the result of VD responded by economic fluctuations for the first 20 period.

The VD results in Table 5 reveal that the variation of the economic fluctuations in Indonesiais dominated by the shock of itself ($FGDP^{INA}$) followed by the level of US exports (X^{US}), the level of US consumption (C^{US}), the level of US income (INC^{US}), the level of US interest rates (R^{US}), the level of US investment (I^{US}), and so on. These results indicate that the level of US exports and the level of US consumption are the dominant factors influencing Indonesian economic fluctuations. Thus it can be said that the export transmission channel described by the theory MFD with the expenditure switching effect and the consumption transmission channel described by the theory of intertemporal are the dominant transmission channels to explain the influence of US monetary stimulus towards the economic fluctuations in Indonesia.

The export transmission channel described by the MFD theory predicts that the monetary expansion would produce a decrease in terms of trade conditions or generate real exchange rate depreciation, which then lead to the improvement of the domestic trade balance (expenditure switching effect). However, US monetary expansion leads to a worsening foreign trade balance through the expenditure switching effect and a decrease in foreign output (beggar-thy-neighbor policy). Thus, through export transmission channel, the monetary expansion in the US results in a decline in Indonesian economic fluctuations (the economy is in recession).

The consumption transmission channel explained by the intertemporal theory contains the expenditure switching effect, so that foreign output may drop. However, the decline in real interest rates in general (worldwide), especially because the country of origin is a large open economy like the US, can increase world aggregate demand for goods and services, including those produced in Indonesia. As the result, the output of Indonesia could grow. Thus, through the consumption transmission channel, the monetary expansion in the US results in the enhancement of economic fluctuations (the economy in a state of expansion).

Conclusion and recomendation

Conclusion

After conducting informal analysis by using predictive performance test, it is found that between the two models – the basic MFD model and intertemporal model – there is no best model to generate predictions. Therefore, an alternative model which is a combination of both models is developed to analyze the effect of US monetary policy stimulus towards Indonesian economic fluctuations. The combination of the MFD model and the intertemporal model uses all variables contained in both basic models. This combination model has low value of bias proportion which is less than 0.20. This result indicates that there is no indication of systemic errors in the model which lead to predictive failure. In addition, this model also has high value of the covariance proportion which is close to unity. Thus, this combination model is concluded as the most optimal and encompassed model as it can fix the weaknesses of each basic model.

Based on the results of impulse response function of Indonesian economic fluctuations due to monetary policy shocks, it is found that, (1) innovation ofthe US real interest rates is responded negatively by the economic fluctuations in Indonesia, (2) innovation of the US exchange rate is generally responded positively by economic fluctuations, (3) innovation of the level of US income is responded positively by economic fluctuations, (4) innovation of the level of US consumption responded positively by economic fluctuations, (5) innovation of the level of US investment is responded negatively by economic fluctuations, (6) innovation of the US exports is responded negatively by economic fluctuations, and (7) innovation of the US imports is responded negatively by economic fluctuations. Positive and negative responses given by economic fluctuations as results of the QE policy innovations are temporary as indicated by the convergence of impulse response function (return to the equilibrium line).

The results given by the impulse response analysis indicate consistency of this study with the combination model of the MFD and the intertemporal. Nevertheless, as has been previously explained that both basic models have ambiguity associated with the predicated results of the US monetary expansion, empirical research shows that QE produce mixed effects or results towards Indonesian economic fluctuations. In other words, QE could cause recession and expansion in Indonesia depends on the transmission channels that are affected. This study finds that there are two dominant transmission channels to analyze the effect of QE towards economic fluctuations, *i.e.* (1) the export transmission channel described by the MFD theory and (2) the consumption transmission channel described by the intertemporal theory. The export transmission channel – with the presence of expenditure switching effect – predicts that monetary expansion in the US results in a decrease in Indonesian economic fluctuations (the economy is in a state of recession). On the other hand, the consumption transmission channel – through the income effect absorption and decrease in real interest rates – predicts that monetary expansion in the US results in enhancement of economic fluctuations (the economy in a state of expansion).

Recommendation

Overall, the combination of the basic model of the Mundell-Fleming-Dornbusch (MFD) and the intertemporal models can explain the effects of US monetary expansion which was conducted through QE towards the economic fluctuations in Indonesia. However, in this study, the analysis on whether QE cause a recession or expansion in Indonesia still produces mixed effects or results. Therefore, the development of the more detailed transmission mechanism needs to be done. In addition, it would be useful if the transmission model is built on a large multi-states scale by considering the possibility of international dependence or interdependence that may not be caught in SVAR models developed in this study.

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APPENDIX

Table 5. Variance decomposition of Indonesian economic fluctuations

Period	S.E.	$FGDP^{INA}$	R^{US}	ER^{US}	INC^{US}	C^{US}	I^{US}	X^{US}	M^{US}	CA^{US}	X^{INA}	M^{INA}
1	0.336624	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.640428	99.46579	0.052215	0.018182	0.076573	0.089932	0.055117	0.204816	0.000498	0.001959	0.033588	0.001325
3	0.842773	98.26573	0.207493	0.130558	0.554138	0.182518	0.049012	0.464148	0.005539	0.096491	0.041119	0.003257
4	0.918764	96.64963	0.362473	0.351871	0.983220	0.163851	0.041509	0.736227	0.048851	0.619608	0.039663	0.003099
5	0.931984	94.20103	0.411067	0.618090	1.238832	0.360876	0.055310	0.910417	0.174860	1.956634	0.059549	0.013337
6	0.974274	91.74503	0.387799	0.703457	1.207755	1.329089	0.064045	0.853154	0.264573	3.251305	0.147989	0.045809
7	1.063562	90.78355	0.490342	0.603557	1.016010	2.543198	0.054071	0.733831	0.238004	3.206437	0.253587	0.077410
8	1.147551	90.56234	0.669332	0.530885	0.878400	3.209891	0.057804	0.726546	0.218929	2.773356	0.287489	0.085030
9	1.193410	89.46944	0.744861	0.554566	0.831799	3.312942	0.107900	0.831235	0.320570	3.478424	0.268425	0.079835
10	1.214002	87.06627	0.720915	0.619807	0.830646	3.206960	0.215904	0.985057	0.528208	5.444883	0.298775	0.082578
11	1.234803	84.70492	0.795906	0.651627	0.825056	3.224238	0.346753	1.118923	0.701108	7.108073	0.421967	0.101429
12	1.263142	83.80675	1.019727	0.634043	0.798495	3.403355	0.434784	1.186370	0.741996	7.315861	0.536973	0.121648
13	1.291599	83.81789	1.185415	0.607284	0.764431	3.570318	0.450120	1.181735	0.710670	7.026276	0.557423	0.128436
14	1.314750	83.21951	1.183721	0.605300	0.740630	3.612667	0.434513	1.141504	0.722220	7.676486	0.538448	0.125001
15	1.332668	81.61328	1.171359	0.627953	0.734457	3.558041	0.468054	1.145155	0.810972	9.174175	0.573077	0.123474
16	1.346262	79.97381	1.307076	0.654154	0.738848	3.487078	0.586979	1.261353	0.916174	10.29042	0.655262	0.128848
17	1.356666	79.18107	1.510141	0.665313	0.739562	3.444509	0.735112	1.456713	0.969312	10.45312	0.709172	0.135973
18	1.366565	79.01562	1.604910	0.659377	0.730516	3.425601	0.820197	1.603966	0.965725	10.32615	0.709190	0.138755
19	1.377885	78.70476	1.585372	0.649627	0.720300	3.412283	0.822445	1.626875	0.954004	10.68457	0.702604	0.137156
20	1.389104	77.96095	1.593092	0.650621	0.719434	3.399888	0.817512	1.602161	0.972945	11.42157	0.726655	0.135173

Cholesky Ordering: $r_t^{US} \rightarrow ER_t^{US} \rightarrow INC_t^{US} \rightarrow I_t^{US} \rightarrow C_t^{US} \rightarrow X_t^{US} \rightarrow M_t^{US} \rightarrow CA_t^{US} \rightarrow X_t^{INA} \rightarrow M_t^{INA} \rightarrow FGDP_t^{INA}$

Note: R^{US} is the United States real interest rates (FFR – CPI:2010), ER^{US} is the exchange rates of the US dollar (USD) against Chinese yuan (CNY), INC^{US} is the level of US personal income, C^{US} is the level of US consumption, I^{US} is the level of US investment, X^{US} is the level of US export, M^{US} is the level of US import, CA^{US} is the United States current account balance, X^{INA} is Indonesia level of exports, M^{IN} is Indonesia level of imports, and $FGDP^{INA}$ is Indonesian economic fluctuations.

Econometric Analysis of the Determinants of China's Foreign Direct Investment in Oil/Minerals Exporting Countries in Africa

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Abstract:

The unprecedented rise in China's Foreign Direct Investment (FDI) stocks to resource-endowed countries in Africa from the beginning of the new millennium has generated considerable debate on the motive. Most of the existing studies on the determinants of China's bilateral foreign investment in Africa are qualitative. While the quantitative analyses studies are limited due to data availability. We use longer time span disaggregate FDI data to empirically examine the extent to which exports, institutional quality and other explanatory variables determine China's FDI in oil/minerals exporting African countries. We find out that, of all the exports variables, oil and agricultural exports, facilitate most of China's foreign investment. Moreover, the institutional quality variable (political instability) has an overall negative and significant impact on FDI. This indicates that a strong political stable region has a discernible effect on Chinese FDI.

Keywords: foreign direct investment; disaggregate exports; institutional driver; China; Africa.

JEL Classification: F21; F10; E02; O53; O55.

Introduction

Foreign direct investment (FDI) is one of the most salient features of today's globalization drive and helps as a source of outside finance in stimulating economic growth. It is associated with cross-border investments of multi-national corporations (MNCs). Unlike portfolio equity investment, FDI is less volatile and offers a channel through which investment and employment can be generated, and exports and technological upgrading be stimulated. This is most probably because FDI is an amalgamation of capital, technology, marketing and management (Nunnenkamp and Spatz 2003; Rasiah, Gammeltoft and Jiang 2010). For these reasons, several developing countries in Africa have attempted to attract FDI and long-term bilateral trade relations with both Western countries and Southern countries (Ayanwale 2007). In which China is one of such country from the South that has begun investing and trading strongly with Africa (Alden and Davies 2006, Edwards and Jenkins 2014, Gold *et al.* 2017, Murtala, Mansur, and Gold 2017, Hanusch 2012, Jian-Ye 2007, Carmody and Owusu 2007, Taylor 2006, Gold and Devadason 2018, Muhammad *et al*. 2018). These China's investments are mainly from State Owned Enterprises (SOE) that are motivated by Beijing's interest in the minerals and oil sectors (Anyu and Ifedi 2008, Gold and Devadason 2018, Hanson 2008, Shen and Fan 2014, Taylor 2015). Thus, in Table 1, we show the 18 African oil and mineral exporting nations selected for this study. Their selection is on the basis of being, the beneficiaries of about 40% of China's FDI stocks from 2001-2014 (UNCTAD 2017).

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Table 1. Values and shares of China outward FDI stocks in 18 oil-exporting Africa countries (US$ millions)

Region/Country	2001-2005	2006-2010	2011-2014	Total	% Share
Algeria	211.4	2,838.6	6,313.56	9,363.56	10.12%
Angola	8.79	731.89	4,494.47	5,235.15	5.66%
Cameroon	20.58	139.97	467.28	627.83	0.68%
Chad	2.71	208.24	1,028.11	1,239.06	1.34%
Congo, Dem. Rep.	40.80	1304.5	4,940.18	6,285.48	6.80%
Congo, Rep.	18.97	454.77	2,331.49	2,805.23	3.03%
Cote d'Ivoire	51.26	145.02	174.00	370.28	0.40%
Egypt, Arab Rep.	68.37	985.17	2,030.6	3,084.14	3.33%
Ethiopia	42.47	982.43	2,719.8	3744.7	4.05%
Equatorial Guinea	35.41	263.44	972.37	1,271.22	1.37%
Gabon	90.68	420.40	604.46	1,115.54	1.21%
Ghana	20.24	495.02	2,666.95	3,182.21	3.44%
Libya	34.79	255.86	350.73	641.38	0.69%
Mauritania	6.35	137.19	390.09	533.63	0.58%
Nigeria	201.7	3,878.98	7,834.56	11,915.24	12.88%
Tunisia	4.99	15.85	40.40	61.24	0.07%
South Africa	215.92	10,378.45	19,189.22	29,783.59	32.20%
Zambia	451.76	3,136.25	7,634.26	11,222.27	12.13%
Africa	2,986.02	37,196.88	96,509.87	136,692.77	100.00%

Sources: UNCTAD (2017) and MOFCOM (2017).

Figure 1. China's outward FDI stocks to Africa (1992-2014)
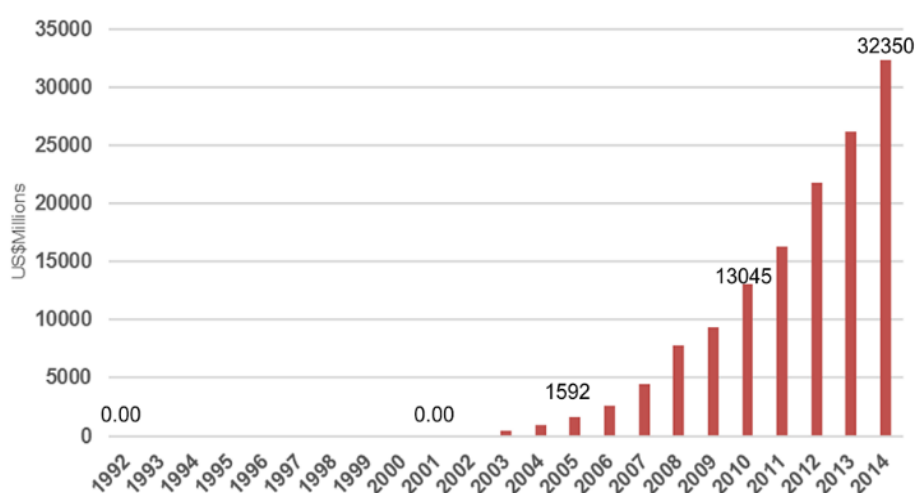
Source: UNCTAD (2017) and MOFCOM (2017).

As observed in Figure 1, China's bilateral FDI stocks data were not available prior to the beginning of the millennium, because China's FDI data sets were termed as sometimes unreliable, and they are not easily accessible or conform to international classification standards. This accounts for the zero values of Chinese FDI stocks in Africa from 1992-2002 as shown in Figure 1. However, there has been a substantial increase in China's FDI stocks into Africa beginning from the year 2003, which coincides with China's pursuit of 'going global strategy' (Alden 2005, Biggeri and Sanfilippo 2009). The going global strategy is largely driven by its industrial and FDI outflow promotion drive, that raised the demand for oil and mineral inputs (Hanson 2008) and promote increase imports to China from abroad (Kolstad and Wiig 2011). Despite the increasing inflows of China's FDI stocks into Africa, critics are undermining Chinese investments into the region as a quest to seek oil and mineral supplies (Gold and Devadason 2018, Mohan 2013), to fuel its economic growth (Alabi, Adetunji, and Ogunkola 2011, Alden and Davies 2006, Bing and Ceccoli 2013, Taylor 2006, Zafar 2007, Jauch 2011, Eisenman 2012, Oyejide, Bankole, and Adewuyi 2009, Alden 2012, Alden 2005). This notion about China incessant demand for oil and minerals has led to scholars divided opinions, partly to evaluate the developmental consequences and, the dangers inherent in their engagement with Africa (Hanusch 2012, Mawdsley 2008).

Although most of the existing studies on China's FDI into Africa are qualitative due to the unavailability of long span disaggregated FDI stocks data (Rasiah, Gammeltoft, and Jiang 2010; Zafar 2007, Renard 2011, Tang and Gyasi 2012, Whalley and Weisbrod 2011, Alabi, Adetunji, and Ogunkola 2011, Gold and Devadason 2018). While the econometric study of Cheng and Ma (2010) used UNCTAD FDI stocks data from 2003-2006 to examine the determinants of China's FDI. However, their study neither considered natural resources nor oil as one of the determinants. Kolstad and Wiig (2011); Kolstad and Wiig (2012)[2] empirical studies used UNCTAD inflows FDI data from 2003-2006, only to find out that, Chinese investment is driven by natural resources and weak institutions. While these studies are undoubtedly important, the estimated results of Kolstad and Wiig (2011) and Kolstad and Wiig (2012) according to Cheng and Ma (2010, 565) may not be reliable due to the short duration of the data used. Also, these studies focus on China's FDI to both developing and developed countries and not on oil and mineral exporting African countries that are the major beneficiary of Chinese investment. Therefore, this act of pooling both developed and developing nations is inappropriate because they are not characterized by the same economic conditions, hence, the results are likely to be biased (Blonigen and Wang 2004).

On this premise, this paper aims to fill the void by using proper econometric analysis to examine how Chinese investment in oil/minerals exporting African region could help shed some light on the question of whether weak institutions and exports of natural resources determine or facilitates more foreign investment. To achieve this objective, we use the share of disaggregate oil/minerals, manufacturing and agriculture imports that is obtained from UN-Comtrade (2016*)* and UNCTAD. The disaggregate imports and bilateral China's FDI stocks data allow us to address the issue of whether oil/minerals solely spurs China's investment and to identify how sectoral trade can influence FDI. We consider the political instability of the host countries as the institutional quality determinant. This choice does not resolve the debate around China's engagement with politically weak countries, but to find out the importance of stable polity in generating FDI. The paper is structured as follows. Section 2 reviews the relevant literature on China-Africa FDI. Section 3 is methodology, it describes the model specification, estimation techniques and empirical strategy, and the data used and summary statistics. Section 4 presents the empirical results and discussion for the analysis of China's FDI stocks, and Section 5 concludes with avenues for future research.

1. Literature review

The advent of China as a major importer of crude oil began in 1993 (Downs 2007, Hanson 2008). Prior to this period, China depended primarily on coal as its primary source of energy (Hanson 2008). In 1996, China's became the second largest importer of oil in Asia with 4.2 million barrels of oil consumed domestically daily (International-Energy Agency 2016). The rising demand for oil and gas resulted in China becoming a net importer of crude oil and petroleum products since 2009 (Quigley 2014), as oil consumption surged to 7.9 million barrels daily in 2012 before falling to 6.2 million barrels daily in 2014. Indeed, the United States of America and China are the two world's largest oil consumers (Taylor 2015, Anyu and Ifedi 2008, Carmody 2009, Hanson 2008). If existing estimations hold, China's demand for oil will increase to 16.6 million barrels daily in 2030, which will amount to the entire output of oil from Africa and twice that from Saudi Arabia (Kelley 2012). While China's imports are expected to rise to 12.6million barrels per day in 2030, indicating that 75% of its consumption will be derived from imports (Downs 2007).

At present, China's major imports from Africa are 70% crude oil, and 15% other mineral resources (Alabi, Adetunji, and Ogunkola 2011, Biggeri and Sanfilippo 2009, Hanson 2008, Kelley 2012, Kolstad and Wiig 2011, Gold and Devadason 2018). The demand for resources from Africa is partly for security reasons[3] targeted at diversifying its sources of energy away from the Middle East. Also, to secure energy to sustain its domestic and 'meteoric' rise in the numbers of private automobiles, which rose to 100 million units in 2015, and projected to surpass that of the United States by 2030 (Kelley 2012, 38; Hurst 2006, Pegg 2012). For these reasons, Chinese SOE has invested billions of dollar in engineering and construction resources to develop the infrastructure that will ease the transportation of resources from African countries *(*Alabi, Adetunji, and Ogunkola 2011, Gold *et al.* 2017; Bosshard 2008, Mohan and Tan-Mullins 2019). The One Belt One Road (OBOR) initiative is directly related to this (Johnston 2019, Du and Zhang 2018). In most of the African nations, China Petroleum and Chemical Corporation (SINOPEC), China National Petroleum Corporation (CNPC) and China National Offshore Oil Corporation (CNOOC) are the main investors in the extractive industry (Gold and Devadason 2018).

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[2] These studies were among the pioneer attempt carried out with China's data that are in accordance with OECD and IMF guidelines.

[3] China's energy demand is beyond the present consumption, but rather sceptical for future energy security, preparing for a day it will find itself in a situation when money is available but no oil in the international market due to war or other political turmoil (Downs 2007).

To Tull (2006), Alden (2005), Moyo (2012), Sanfilippo (2010), Bing and Ceccoli (2013), China's relations with the resources endowed African countries may continue to be strengthened as long as there is a need for oil and mineral resources. Unlike Western investors, who interferes and attach conditionality in dealings with Africa, China's approach in Africa is to access unexploited resources considered to be insignificant in size, geographically too remote or politically risky (Bosshard 2008, Gold *et al.* 2017). This approach has been criticized on the basis that it could create the problem of Dutch Disease (Zafar 2007), due to dependency on oil and energy from the continent, and the resultant impact of the boom and bust on prices. As well, Xu, state that the presence of the Chinese SOE in Africa is not necessarily favorable as they act as agents for adverse changes in the form of corruption, human rights violations and crimes (Xu 2014).

Zafar (2007), Alden (2012), Alden and Davies (2006), Oyejide, Bankole, and Adewuyi (2009) argue that it is the typical characteristics of the Chinese firms to rely on cheap labor for most construction work in Africa to avoid investing in training and education of personnel. Similarly, China imports equipment and materials from home to use in most African states. Invariably they trade in goods and labor, which is a form of re-terrorising the Africa States (Bräutigam 2009). To illustrate using a case-study Jauch (2011) find out that there is evidence of tensed working environment, hostile attitudes towards local employees, poor working condition, labor exploitation, industrial negligence and violation of workers right characterized the Chinese firms'. In contrast, Renard (2011) study revealed that the impact of Chinese FDI has been beneficial and its presence has enabled the building of local industries, industrial linkages and transfer technology to many African countries. Nevertheless, Renard (2011) agrees that China's trade and FDI intensity with Africa may limit the continent to raw materials producers, with limited opportunity in developing high manufactures, and goods processed industries. Kaplinsky and Morris (2009), assert that FDI inflows into SSA from China can be positive or negative depending on the development policy put in place by the host economy.

More specifically, Aguilar and Goldstein (2009), analyze China's role in the development of Angola, the second largest exporter of oil in Africa and the third largest energy trading partner of China. They note that although the Asian tiger is emerging as a major actor in the oil exploitation business as their relations with unstable economies in Africa increases, they pose no threat to the Angolan entrepreneurs and jobs. Instead, they finance, give technical support, invest in the war-torn country's infrastructure, agriculture, give unconditional loans with long-term benefits and objectives and no interference with the internal government. Therefore, the benefits of their relationship outweigh the costs. However, Alden (2012, 706), points out that the highly propagated 'Angola Mode' is not the typical characteristics of the Chinese investment in all the African states. Citing examples of Zambia's copper mines, South Africa's iron ore, Nigeria, DRC, Gabon and Zimbabwe; and question the sustainability of replicating the 'Angola Mode' in other parts of the continent, as well as the validity of its cherished 'principle of non-interference'.

Chipaike and Bischoff (2018), use conventional wisdom to assess how Angola a country that is in the Southern part of Africa and Ghana that is situated in West Africa benefit from China's engagement. They argue that although Ghana and Angola have a different kind of government, yet they both have enormous resources (oil) that attract China to their respective nations. From their findings, Ghana, due to better democratic governance, political stability and its ability to allow civil society participation in its polity, bargain for more economic benefits and development assistance from China. While Angola, due to its authoritarian form of leadership, debars civil society from participating in political space and prohibit any form of negotiation for beneficial economic engagement with international partners and China in specific. Therefore, the influences of Chinese engagement with the two African countries differ as a result of the political structures put in place.

Other studies by Buckley *et al.* (2009) and Cheung and Qian (2008), use approved China's FDI outward flows data to analyze the determinants of Chinese FDI in Africa. Biggeri and Sanfilippo (2009), examine the determinants of China's move into Africa (1998-2005) using FDI stocks as one of the dependent variables, their results show that Africa's potential markets and natural resource endowments are part of the pull factors. As Dupasquier and Osakwe (2006), note Chinese FDI data that conform to international organizations standards was in non-existent before the year 2000, therefore, the actual Chinese FDI stocks or flows has not been measured. Kolstad and Wiig (2011), Kolstad and Wiig (2012), carried out an empirical study of China's outward FDI flow from 2003-2006 using UNCTAD data and ordinary least square (OLS) estimation technique. However, the results may not give the actual estimates due to the short duration of the study. Cheng and Ma (2010), examines China's outward FDI stocks and flows with panel data of 90-98 countries for flows and a sample of 125-150 host economies for stocks from 2003-2006. In their gravity model results, neither the institutional variable nor the natural resource variable was measured to show whether there is any significant relationship between FDI, natural resources and

the role of host country's institutions. It is glaring from the empirical review that qualitative studies dominate and give the direction on China-African FDI engagements.

On the theoretical analysis of FDI and trade, the theory of factor mobility and comparative advantage in production and trade has been used to analyze their inter-temporal relationship. Trade literature also proves that the basis of cross-border factor mobility is the differences in factor endowment, technology, capital, labor that can be acquired or attracted from abundant economy abroad (Todaro 1994, MacDougall 1960, Kemp 1964, Dunning 1988). Based on factor mobility and comparative advantage theory, African countries need to export their resources to China in exchange for the foreign exchange. China, on the other hand, needs to import natural resources from Africa to sustain its growth process. As well, the presence of multinational corporation helps to extract the resource since Africa lack the required capacity in terms of capital and knowledge. Therefore, global capital mobility through multinational enterprises is seen as channels for foreign capital flows or foreign investments (Dunning 1988, Krugman and Obstfeld 2000). Indeed, the literature review points out to the fact that China-Africa relations vary from one African country to another, depending on the production, resources therein and the general economic structures of the state in question. Hence, the need for carrying out an econometric analysis based on the similarity of resources endowed in the selected countries.

2. Methodology

2.1. Model specification

To formalize the intuitions of the previous section, we modify slightly Kolstad and Wiig (2011), Kolstad and Wiig (2012), Cheng and Ma (2010), Anwar and Nguyen (2011) models, and specified a panel model to bring out which variable(s) influence the decision of China to invest in the oil regions. As simple as the model looks, first, it enables us to know which African exports share and the institutional structure variable that determines FDI. Second, the use of this model allows us to know which other parameters that increase the attractiveness of FDI from China. In the model, China's trade import to Africa is used to avoid missing data that is peculiar with Sub-Saharan African countries trade data. The importing country trade data is more accurate as it includes cost, insurance and freight (CIF) that are omitted if exporting countries data is used (He 2013). Hence, the panel equation to be estimated for the trade determinants of China's outward FDI stocks for the 18 African countries is as follows:

$$\ln ChineseFDIstock_{it} = \beta_0 + \beta_1 \ln GDP_{jt} + \beta_2 Infl_{jt} + \beta_3 \ln AGRICShr_{jt} + \beta_4 \ln OILShr_{jt} +$$
$$\beta_5 \ln MANUShr_{jt} + \beta_6 \ln FixPhone_{jt} + \beta_7 \ln OPENSS_{jt} + \beta_8 \ln GDPperk_{jt} + \beta_9 \ln Schenrol_{jt} +$$
$$\beta_{10} POLSTAB_{jt} +$$
$$\varepsilon_{ijt} \tag{1}$$

where: ln represents natural logs of variables in the model, *j* is the individual African country, *i* represent China, *ChineseFDIstock_i* is China's FDI stocks in *country_j, GDP_j* represents gross domestic product (GDP) for *country j* and *Infl_j* is inflation rate of *country j*. The *Polstab_j* is political instability in *country j, AGRICShr_j* is the share of agriculture exports in *country j, exports share of oil/minerals in country_j* is *OILShr_j* is the manufacturing share in *country_j. FixPhone_j* is fixed telephone subscriptions per 100 people in *country_j* and *OPENSS_j* is the degree of trade openness, that is, a ratio of exports and imports to GDP of *country_j.* The income *per capita* of *country_j* is *GDPperk_j,* school enrolment per 1,000 of *country_j* is $Schenrol_j$, β are regression coefficients, t is time and ε_{ij} is the error term.

However, China-Africa bilateral FDI data are unavailable prior to 2003, so to find consistency level for all the variables since our study duration is from 2000-2015, we start to find valid proxies for it from the year 2000 by pooling the data. Also, to minimize skewness of the model distribution and improve the model fit, all variables in the model including the dependent variable are lagged except for the institutional quality variable which is an index and inflation that is in rate.

2.2. Estimation techniques and empirical strategy

An econometric approach of pooled Ordinary Least Squares (OLS), Random effects (RE) and Generalised Least Square (GLS) is deployed to systematically estimate China's outward FDI stocks to Africa. The choice between OLS and RE for our model was based on the outcome of the Breusch and Pagan Lagrangian multiplier test, which is statistically insignificant, so, the decision of GLS over OLS. Hence, GLS is used to correct heteroskedasticity and autocorrelation in regression. We consider the possible endogeneity in our regression, with the belief that all explanatory variables are exogenous except for GDP and GDP *per capita* that may be endogenous to FDI. To

correct these potential errors, we instrumentalised GDP, GDP *per capita*, GDP growth, population, land area, and geographical dummy variables (common-language, landlock and colony). Then, following Biggeri and Sanfilippo (2009) we resort to Two-Stage Least Squares (2SLS) estimation technique for consistency check and Two-Stage Least Squares with robust standard errors (2SLS) to correct endogeneity. Furthermore, to validate the instrumental variable (IV) strategy, we carry out tests of overidentifying restrictions and heteroskedasticity test(s) using levels and cross products of all IVs, which the Pagan-Hall general test statistic *p-value* is significant at 1%.

The expected estimated coefficient of oil/minerals on FDI will be positive (Asiedu 2006, Kolstad and Wiig 2011, Kolstad and Wiig 2012) manufacturing is supposed to be negative, as China has a comparative advantage over Africa's manufacturing and agriculture coefficient may be mixed since this sector represents 3% of China's total imports from Africa (Renard 2011). Other control variables such as GDP, GDP *per capita*, trade openness, inflation, fix telephone that is used as the proxy for infrastructure and human capital (school enrolment) are added to examine their influence on FDI. The decision to include these variables in our model is in line with the studies of Asiedu (2006), Kolstad and Wiig (2011), Kolstad and Wiig (2012), Buckley *et al*. (2009) and Cheng and Ma (2010). The *aprior* expectation for market size which is the proxy for GDP, infrastructure development of the selected African countries and school enrolment, which measures human capital of a nation is positive and significant. Although the coefficient of infrastructure (proxy by fixed telephone per 100 people) is significant and negative due to inadequate infrastructure which plagued most of the African states (Bing and Ceccoli 2013, Renard 2011). The inflation rate is used as a measure of macroeconomic instability (which deters investments) and is expected to be negative and statistically significant because inflation and FDI are inversely related. Therefore, if a country experiences high inflation, then, investors would prefer to withhold a significant fraction of their FDI. Furthermore, the estimated coefficient of GDP *per capita* (economic development) and trade openness which measures the degree of liberalization policies for foreign investment is expected to have a positive and significant relationship with FDI. We envisage that this may not be visible, since the study sample is developing African countries, then mixed results are expected.

Also, existing studies argue that host countries institutional quality are determinants of FDI (Asiedu 2006, Rasiah and Gachino 2004, Rasiah, Gammeltoft, and Jiang 2010, Kolstad and Wiig 2011, Kolstad and Wiig 2012, Chipaike and Bischoff 2018, Neumayer and Spess 2005). Therefore, we employ measures to test the relative importance of this argument. The proxy used to measure institutional factor is political stability and absence of violence/terrorism index. This proxy measures the likelihood of political instability and politically-motivated violence, including terrorism (Grechyna 2017, Kaufmann and Kraay 2008). The index varies from -2.5 (worst possible political instability) to 2.5, and high index signifies better institution (Harymawan and Nowland 2016). Therefore, a significant and negative relationship is expected between political instability and China's FDI stocks, because unstable political climate makes potential foreign investor lose confidence in the host country. However, if China's FDI is found to be attracted to Africa due to political instability, that is, if the coefficient is positive and significant. Though, it may not necessarily confirm the argument of China been attracted to African countries with elite and tyrannical leaders (Cheru and Obi 2011, Giovannetti and Sanfilippo 2009, Zafar 2007, Jauch 2011), but, a determinant of Chinese FDI.

2.3. Data and summary statistics

Based on the endowed natural resources deposited in Africa, 18 oil/minerals exporting countries (International-Energy Agency 2016, He 2013) were selected in the region (see Table 1 for the sampled countries). Given the availability of Chinese bilateral FDI data, we were able to run the analysis only for recent years from 2000 to 2015. We take China's bilateral FDI stocks by geographical destination as the dependent variable and the data is sourced from UNCTAD (2017) and MOFCOM (2017) database. The choice of these variables is based on Biggeri and Sanfilippo (2009) and Anwar and Nguyen (2011) opinion that stock of FDI in the host country by the investing nation is a superior estimate of FDI, whereas, Cheng and Ma (2010) estimated both China's FDI flows and stocks. For the trade variable, we divide imports into agriculture, oil/minerals and manufacture individual sectors. This helps to identify whether exports of a sector attract more FDI than the other and to determine the importance of various exporting sectors. As well as this strategy allows us to know if economic policies, economic size, institutional quality and other fundamental explanatory variables determine foreign investments.

The trade explanatory is disaggregated China's imports-by-products obtainable from UN-Comtrade Harmonized System (HS) 1-99 nomenclature. The UN-Comtrade (2016) database contains the reporting values of cross-importation and exportation by country, products and year (He 2013), where HS 1-24 is agriculture, HS 25-27 is oil/minerals, and HS 28-99 represents manufacturing. Following Edwards and Jenkins (2014), research on China crowding out manufacture in Africa, we employ the HS data classification to measure the intensity and

ascertain whether African countries endowed with resources are important considerations for China's investments. Other control variables such as GDP, income *per capita*, trade openness, inflation, fix telephone that is used as the proxy for infrastructure and human capital (school enrolment) data are taken from the World Bank's World Development Indicators. The political instability index variable is obtained from the World Bank's Institute (WBI) Governance Indicators. Thus, Table 2 presents the summary statistics of the variables used in the analysis.

Table 2. Descriptive statistics summary

Variables	Obs.	Mean	Std. Dev.	Min.	Max.
Foreign Direct Investment (Chinese FDI stock)	216	428.156	861.116	0	5954.02
Market size (GDP)	287	7.49e+10	1.07e+11	2.70e+09	4.64e+11
Inflation (Infl)	279	12.545	43.594	-9.798	513.907
Political Stability (POLSTAB)	270	-0.750	0.836	-2.581	0.814
Share of Agriculture (AGRICShr)	288	2.89e+07	7.55e+07	0	4.56e+08
Share of Oil/minerals (OILShr)	273	1.61e+09	4.55e+09	0	3.35e+10
Share of Manufacture (MANUShr)	288	8.99e+08	4.24e+09	0	3.86e+10
Infrastructure (FixPhone)	288	3.768	4.727	0	20.334
Trade openness (OPENSS)	268	87.984	44.365	25.042	351.106
GDP *per capita* (GDPperk)	287	2,943.486	2,911.965	194.169	11,933.800
Human Capital (Schenrol)	148	0.901	0.130	0.563	1.106

3. Results and discussion

Tables 3, 4 and 5 report the econometric results for an unbalanced panel sample of 18 oil-exporting African countries from 2000-2015. We report pooled OLS and RE estimation results in Table 3 as a reference to the main GLS estimator results. In the pooled OLS results, the variance inflation factors mean (VIF) is 2.84; it indicates the absence of multicollinearity in our regression (Kutner, Nachtsheim, and Neter 2004, Neter *et al.* 1996, Wang and Seidle 2017). While the Breusch-Pagan/Cook-Weisberg test for heteroskedasticity and Wooldridge test for autocorrelation in panel data results are both significant at 1% level. Confirming the presence of heteroskedasticity and serial correlation in the OLS results. Therefore, we carry out the Hausman test to determine the choice between random effects and fixed effects. The results of the Hausman test accepts the equality between the coefficients estimated using RE and FE, suggesting that RE estimation should be preferred.

The GLS results in Table 4, is expected to correct for heteroskedasticity and first-order autocorrelation issues in the cross-section. The moderate Wald Chi^2 value and the R^2 values signify the strong individual effects of the host countries and confirm the reliability of the GLS estimation technique. For consistency check, we took the natural logarithm (ln) of both the dependent and all explanatory variables in monetary values by one period, except for the political instability index and inflation rate. We expect, however, that endogeneity problem is unlikely to matter since Chinese FDI stocks are still relatively small in Africa to affect our model fit. Nevertheless, we adopted instrumental variable 2SLS estimation technique proposed by Anderson and Hsiao (1982) to tackle more adequately the naïve aspect of this endogeneity belief. This approach is consistent with the study of Biggeri and Sanfilippo (2009). Therefore, we present in Table 5, 2SLS and 2SLS with robust standard error regression results.

Starting with Table 3, the main variables included in the model are oil/minerals, agriculture, manufacturing, GDP, human capital and political instability. However, the results of both GLS and pooled OLS estimators are similar and robust across the two specifications, except for the variable $\ln GDP$, where their level of significance varies. This reflects a slight action in the temporal dimension in the data set (Kolstad and Wiig 2012). As expected, we observe that the GLS results in Table 4 indicate the strong impact between FDI stocks and oil/minerals imports is positive and significant at 1% level. Hence, a 1% increase in oil/minerals will improve FDI stocks by 0.31%. Interestingly, we find that agriculture tends to generate some FDI stocks, with a 5% positive and significant coefficient associated with this variable, indicating 16% magnitude of FDI from the 5% increase in its demand. These findings seem to confirm the important role of oil/minerals for the development of Africa as it serves as an FDI attraction to their respective economies (Renard 2011).

Table 3. OLS and RE regressions results for China-Africa outward FDI stocks

Dependent Variable: *ln Chinese FDI stock* - Explanatory Variables	Coefficients (OLS)	*P*-value	Coefficients (Random effects)	*P*-value
lnGDP	0.518** (2.88)	0.005	0.964*** (2.75)	0.006
Infl	0.013 (0.46)	0.643	0.010 (0.35)	0.725
POLSTAB	-0.628** (-2.06)	0.043	-0.397** (-1.04)	0.297
lnMANUShr	0.073 (1.08)	0.285	0.105 (1.28)	0.202
lnOILShr	0.308*** (5.36)	0.000	0.207*** (3.45)	0.001
lnAGRICShr	0.161** (2.41)	0.018	0.299** (3.50)	0.000
lnFixPhone	-0.504** (-2.43)	0.017	-0.731** (-2.61)	0.009
lnOPENSS	0.168 (0.31)	0.756	1.028 (1.05)	0.199
lnGDPperk	0.023 (0.09)	0.929	0.460 (1.05)	0.295
lnSchenrol	3.645** (2.03)	0.046	5.282** (1.84)	0.066
Constant	-18.535*** (-3.46)	0.001	-36.564 (-3.90)	0.000
No. of Observations	87		87	
R-sq			0.648	
Adjusted R-sq	0.674			
Wald chi^2 (Prob > chi^2 in parentheses)			106.04 (0.000)	
LM test: X^2			0.3867	

Notes: The OLS estimated t-values and RE t-statistics are in parentheses. Wald chi test p-values in bracket; all estimates are rounded up to three significant figures *p < 0.1; **p < 0.05; ***p < 0.01.

The GDP of the host economies, human capital and infrastructure yielded significant coefficients at 5% level or better to support their relationships with FDI stocks. In fact, Asiedu (2006) and Dupasquier and Osakwe (2006), view that a nation with substantial human capital will encourage investors because the transaction cost will be low. The positive and significant relationship between human capital and Chinese FDI stocks negates Biggeri and Sanfilippo (2009), view that Chinese SOE pays little or no attention to local outsourcing. Similarly, Cheng and Ma (2010), Kolstad and Wiig (2011), Kolstad and Wiig (2012), Biggeri and Sanfilippo (2009) and Buckley *et al.* (2009), studies find a significant and positive relationship between Chinese FDI and host country GDP. Although the coefficient of infrastructure has a substantial negative and significant 5% impact on FDI. The result is in contrast with Asiedu (2006), and it indicates that the infrastructure has a significantly negative -0.50% on FDI. This we do not find strange, as our study is on developing oil-exporting countries in Africa with relatively weak infrastructure (Biggeri and Sanfilippo 2009, Dupasquier and Osakwe 2006). Mainly due to the rent-seeking political elites in some of the oil-exporting states who will delay infrastructural development projects for cash benefits on oil blocs (Mthembu-Salter 2009, Gold *et al.* 2017).

Table 4. GLS Regression results for the determinants of Chinese outward FDI stocks

Dependent Variable: *lnChineseFDIstock* – Explanatory Variables	Coefficients (GLS)	*P*-value
lnGDP	0.517*** (3.08)	0.002
Infl	0.012 (0.50)	0.619
POLSTAB	-0.627** (-2.20)	0.028
lnMANUShr	0.073 (1.15)	0.249

Dependent Variable: *lnChineseFDIstock* – Explanatory Variables	Coefficients (GLS)	*P*-value
lnOILShr	0.308*** (5.74)	0.000
lnAGRICShr	0.161** (2.58)	0.010
lnFixPhone	-0.503** (-2.60)	0.009
lnOPENSS	0.168 (0.33)	0.739
lnGDPperk	0.022 (0.10)	0.924
lnSchenrol	3.644** (2.17)	0.030
Constant	-18.53476*** (-3.70)	0.000
No. of observations	87	
Adjusted R-sq		
Wald chi² (Prob > chi² in parentheses)	215.40 (0.000)	
LM test: X^2	0.3867	

Notes: The GLS estimated *z* statistics are in parentheses. Wald chi test *p*-values in bracket; all estimates are rounded up to three significant figures *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

For political instability, the result shows a negative coefficient of -0.63 at 5% significant level, suggesting the importance of political stability in generating better socioeconomic conditions, determining more investment allocation and higher bureaucratic quality. An indication that Chinese SOE attraction to oil/minerals exporting countries in Africa may not necessarily be due to the unstable polity. The sign and coefficient of the political instability result are consistent with Asiedu (2006), Biggeri and Sanfilippo (2009), Chipaike and Bischoff (2018) and Büthe and Milner (2008) findings. In a further sensitivity analysis, we follow Kolstad and Wiig (2011), Kolstad and Wiig (2012) and Asiedu (2006), and include the Rule of Law index and Corruption index to account for other institutional quality factors as determinants of FDI stocks in a non-reported analysis. These two measures are highly correlated with no statistically significant or positive coefficients. Instead, it reduces the robustness of the results. Therefore, we exclude these variables in the regression model to avoid the problem of multicollinearity in the estimation.

Other explanatory variables included in our model such as manufacturing, trade openness, inflation and GDP *per capita*, has no significant impacts on outward FDI stocks. A potential justification for these findings of no significant relationship between FDI stocks and variables above relate to the development stage of the sampled countries which is likely to play in the opposite direction of that of developed nations. For instance, in the case of manufacturing, Edwards and Jenkins (2014) empirically find that Chinese manufactured goods are crowding out South Africa's manufacture exports to African countries. Therefore, China's dominance justifies its development status and the comparative advantage it has in manufacturing over Africa whose exports is majorly natural resources. Inflation, trade openness and GDP *per capita* are expected to influence the choice of location for Chinese SOE investment in Africa, but the results negate the conventional view. It shows that the degree of liberalization, investment policies put in place, the macroeconomic stability of the host country and the level of economic development do not have any effect on Chinese FDI stocks. The insignificance of the latter (GDP *per capita*) is more surprising but it is likely to be determined by two contrasting effects: on the one hand, higher income *per capita* is associated with higher costs, which makes the cost of exporting high. On the other hand, high *per capita* is associated with higher efficiency in handling internal logistics such as administrative procedures and transportation that reduces the cost.

In tackling the issue of endogeneity in our regression, we instrument GDP and income *per capita* from the explanatory variables. Although, we expect stronger results from the 2SLS, yet we carry out the Hansen *J-statistics t*ests of over identifying restrictions reported in Table 5. With the additional IV 2SLS (robust standard error) regressions presented in Table 5. However, the GLS results as contained in Table 4 are almost similar with few exceptions. First, infrastructure has a negative, but insignificant relationship with FDI; this result is similar to Biggeri and Sanfilippo (2009), findings. Second, the human capital variable ceased to have any significant relationship with China's FDI. Also, the estimated coefficient of trade openness and manufacturing (both are not significant in Table 4 results) is correctly signed and consistent with theoretical predictions. However, the estimated coefficient of GDP

per capita is negatively significant at the 5% level. This means that China's FDI stocks are negatively correlated with economic development, suggesting that the stage of economic development of African countries seemed not an essential consideration for China's FDI stocks.

Table 5. Estimation of 2SLS and 2SLS (robust standard error) results for China-Africa outward FDI stocks

Dependent Variable: *lnChineseFDIstock* - Explanatory Variables	Coefficients (2SLS)	*P*-value	Coefficients (2SLS robust error)	*P*-value
lnGDP	0.684** (2.60)	0.009	0.684** (2.51)	0.012
lnGDPperk	-1.565** (-2.38)	0.017	-1.565** (-2.30)	0.021
Infl	0.048 (1.44)	0.151	0.048 (1.40)	0.163
POLSTAB	-1.543*** (-3.23)	0.001	-1.543*** (-3.22)	0.001
lnMANUShr	-0.165 (-1.31)	0.189	-0.165 (-1.17)	0.242
lnOILShr	0.361*** (5.26)	0.000	0.361*** (5.00)	0.000
lnAGRICShr	0.196** (2.51)	0.012	0.196** (2.32)	0.020
lnFixPhone	-0.172 (-0.65)	0.517	-0.172 (-0.82)	0.409
lnOPENSS	-0.044 (-0.07)	0.944	-0.044 (-0.08)	0.935
lnSchenrol	1.851 (0.84)	0.399	1.851 (0.92)	0.359
Constant	-8.169395 (-1.11)	0.266	-8.169395 (-1.36)	0.172
No. of observations	87		87	
Uncentered R^2	0.9151		0.9151	
Sargan/Hansen J statistic	5.386		3.337	
Chi-sq. (^{2}) P-val	0.06768		0.18855	
Wu-Hausman	6.305 (0.003)		6.30516 (0.003)	
Durbin-Wu-Hausman	12.667 (0.002)		12.667 (0.002)	

Notes: The estimated *z* statistics for 2SLS and 2SLS (robust) are in parentheses; Hausman tests *p*-values in brackets; all estimates are rounded up to three significant figures *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

Conclusion

The study somewhat extends previous literature on natural resources as the determinant of China's FDI to a more specific oil/minerals sector. It becomes important with the currently available longer duration of Chinese bilateral outward FDI stocks data obtained from UNCTAD (2017). Also, we use disaggregates UN-Comtrade (2016) imports to identify the specific trade sectors that determine China's FDI in resource-exporting countries in Africa. We applied pooled OLS, RE, GLS estimator, instrumental variable 2SLS and 2SLS with robust standard error to achieve our objective. The results presented in this study is consistent with the notion that oil/minerals, market size, human capital and political stability are a stronger influence in making a foreign investment decision. However, the results of our analysis of political instability provide substantial empirical evidence against the notion that China does not relate well with countries more democratic than itself (Zafar 2007).

Therefore, our study suggests some policy actions that African governments might implement in this era of rapidly growing economic integrations to maximize the benefit of China's appended interest in their region. The policy includes creating an enabling environment that will effectively promote both public and private FDI, which will bring in new technology and provide capital to foster economic development. Secondly, African oil/minerals exporting countries need to formulate and implement transparent liberal economic policies that will facilitate partnership and strengthen linkages between local and foreign investors. Thirdly, respective African leaders should as a matter of urgency improve the quality of infrastructure in the region, this can be achieved through investing natural resources proceeds on development projects. By giving out crude oil as a concession in exchange for the

needed infrastructure (like Beijing's strategy of 'Angola Mode') to spur development (Gold *et al.* 2017). Fourthly, African leaders should maintain stable polity and uphold other institutional structures that will reinforce foreign investors' confidence in the region. Lastly, we observe that the estimation model and empirical research can be extended to cater for the more complex aspect of what determines China's FDI to Africa. For instance, we ignore China's FDI flows and the role of the financial sector in facilitating investment. These considerations need rigorous research, hence, are left for further study.

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Determinants of Account Receivable and Its Optimal Level: An Empirical Test on Vietnamese Companies

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Abstract:

This paper analyzes factors that affect account receivable management and it impact on business performance of Vietnamese listed companies. The research result shows that the introduction of a new variable for bad debts provision positively affects accounts receivable. As such, when the provision for bad debts increases and the profit of the company is reduced, the company intensifies the implementation of trade credit policy, leading to an increase in both receivables as well as revenue and profit. In addition, the research results show that there is an optimal level of account receivables for business performance. Specifically, if accounts receivables accounted for 24.98% of total assets, return on assets reaches the highest value and if receivables accounted for 25.15% of total assets, the Return on Equity achieves its highest value.

Keywords: receivables; payables; provision; bad debt; trade credit.

JEL Clasiffication: G32; M41.

Introduction

Control of receivables to improve performance and corporate value has always been of great concern of firms. Trade credit granted to customers accelerates sales, reduces inventory and increases revenue (Emery 1984). At the same time, buyer trade credit provides the source of goods for production and business without having to pay. advance payment. However, a large value receivables, increases credit risk, particularly the risk of capital loss if the customer refuses to make payment upon maturity (Cheng and Pike 2003). Meanwhile, trade credit is usually financed by short-term bank loans. Moreover, financing sources for the business from suppliers will be very expensive if the trade credit policy of businesses for customers is inefficient.

This has also been of interest to researchers such as Petersen and Rajan (1997), Danielson and Scott (2004), Niskanen and Niskanen (2006), Garcia-Teruel and Martinez-Solano (2010).The research context has been centered upon economically developed countries including the United States (Petersen and Rajan 1997); (Danielson and Scott 2004), small businesses in Finland (Niskanen and Niskanen 2006), and small firms (García-Teruel and Martínez-Solano 2010), *etc*. There have been a few studies on transitional economies such as China. For instance, Shi, Zhu and Yang (2016) focus on customer receivables in one particular industry, which is the

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manufacturing industry in China. However, focus on the impact of customer receivables on the performance of firms is limited.

The purpose of this paper is to identify factors that affect the receivables of firms in Vietnam, and then to examine the impact of receivables on the performance of listed companies in Vietnam. This research uses data from listed companies on Hanoi Stock Exchange (HNX) and Hochiminh Stock Exchange (HOSE) in the period of 2013-2017. This is the period when Vietnam was recovering from the 2007-2008 global financial crisis. Vietnam is a developing country whose state intervention in the economy is still relatively high. After a period of crisis, the Central Bank of Vietnam (SBV) has implemented a tight monetary policy. Moreover, the bad debt rate (NPL rate) of commercial banks is high, so the ability of banks to access capital from firms is difficult (Dat 2016). Therefore, businesses will actively seek other sources of capital and one of them is to use trade credit from suppliers. In addition, the economic legal system of Vietnam is not known for transparency, consistency, uniformity, feasibility and effectiveness. Demirguc-Kunt and Maksimovic (2001) find that businesses use trade credit more than the use of bank debt in countries with poor legal protection. Moreover, in order to boost sales, businesses often bear their trade policy. Therefore, the role of trade credit should be considered in a transitional country such as Vietnam.

Also, firms need to identify the impact of trade credit on performance and the optimal amount of accounts receivables to maximize performance of firms. There have been few studies on trade credit and firm value, an exception being Martínez-Sola, García-Teruel and Martínez-Solano (2012). In terms of factors affecting receivables, there have been quite a few studies, most of which focus on developed countries. In addition, there is one factor that is likely to affect accounts receivable but has not been tested by any researcher, this is provision for bad debt. Size of firms, age of firms, assets, revenue and characteristic firm were tested. Furthermore, there has been no study that verifies the effects that accounts receivable have on business performance and whether there is an optimal level of customer acquisition on the business performance of large firms. This is a significant gap in the research.

Followed by Martínez-Sola, García-Teruel and Martínez-Solano (2012), we used the model to test two hypotheses including:

- whether there is a non-linear relationship (inverted-U) between account receivables and business performance to estimate the optimum level of account receivables;
- to verify the consistency of the nonlinear relationship between receivables and business performance.

Our research shows that there are many factors that positively affect customer receivables, such as bad debt reserve, revenue growth, short-term finance, and total asset turnover. In addition, factors such as company size, net cash flow, inventory ratio and short-term solvency have a negative impact on customer turnover. In particular, the new variable introduced into the model is the provisioning ratio which has the greatest impact on customer turnover. In addition, the research results indicate that there is a non-linear U-shaped relationship between customer acquisition? and business performance. At the same time, the optimal level of customer acquisition is required to maximize business performance. That is, the efficiency of the business will increase as the customer receivables increase, optimal customer demand is reached, afterwards customer receivables will reduce the efficiency of business operations.

The paper consists of 5 parts: the introduction, the literature review, the methodology and data discussion, with regression results discussed in the fourth section. In the fifth part we form policy recommendations.

1. Literature review

1.1. Factors that affect customer receivables

The number of years of operation or the age of the company. The number of years a company operates indicates that the company has overcome the difficulties to survive for a long time. In addition, Petersen and Rajan (1997) believe that older businesses will provide more trade credit to customers as they have better access to bank credit than a small start-up company. Meanwhile, Schwartz (1974) claims that older companies have better credibility to pay off loans. Longer-established businesses, therefore, provide more trade credit to customers, meaning that there is a positive relationship between the age of the company and receivables. This finding is reported in papers by Petersen and Rajan (1997), Niskanen and Niskanen (2006), Bougheas, Mateut and Mizen (2009), Khan, Tragar and Bhutto (2012). Similarly, in China, when analyzing the determinants of receivables in manufacturing companies, Shi, Zhu and Yang (2016) find that firms whose longevity is high can provide more credit to their customers. However, this is not consistent across all studies. Garcia-Teruel and Martinez-Solano (2010) argue that the relationship between the number of years of operation and receivables is negligible in some countries in the sample. As a result, the number of years of operation does not affect managers who make the decision to provide trade

credit to customers. In their paper the reason may be that their study is based on European countries. Thus, different financial situations and systems may affect the results of the analysis.

Firm size: Petersen and Rajan (1997) argue that large-scale firms are more likely to have access to bank credit, thus providing more trade credit to customers. Schwartz (1974) argues that large companies have better creditworthiness to pay off loans, so they are more likely to offer trade credit. That means there is a positive relationship between the size of the company and receivables. This is evidenced by the results of Nadiri (1969), Petersen and Rajan (1997), Ng, Smith and Smith (1999), Danielson and Scott (2004), Niskanen and Niskanen (2006), Bougheas, Mateut and Mizen (2009), Garcia-Teruel and Martinez-Solano (2010), Khan, Tragar and Bhutto (2012), Shi, Zhu and Yang (2016). Large-scale companies will finance more customers than small-scale companies, as large companies can get financed more easily so they can operate as medium-sized companies in financial time.

Net cash flow or internal financing generation: Garcia-Teruel and Martinez-Solano (2010) believe companies capable of generating large net cash flows are able to provide financing to customers through trade credit. However, the results show that net cash flow affects trade credit differently in different countries. Although the effect is positive for Finland, France and Greece, this means that if businesses have large net cash flows, they will provide more trade credit to customers. However, this relationship is a drain in Belgium. In Spain, Sweden and England, no relationship was found. According to Niskanen and Niskanen (2006), the relationship between net cash flow and receivables is not statistically significant.

Short-term financing: Measures a company's ability to access outside financing. Short-term finance has a positive effect on receivables (Petersen and Rajan 1997). According to the research, Petersen and Rajan (1997) claim that companies with high short-term finances are more likely to offer trade credit to their clients. Similarly, Niskanen and Niskanen (2006), Garcia-Teruel and Martinez-Solano (2010) also argue that firms that are able to attract capital from large capital markets will provide more trade credit to their customers. However, among Indian manufacturing companies, Vaidya (2011) find that firms with good credit exposure will reduce trade credit for customers.

Financial cost: Financial cost has a negative impact on receivables (Petersen and Rajan 1997), (García-Teruel and Martínez-Solano 2010). When companies face high financial cost, they will reduce the amount of debt and have less incentive to finance customers and reduce trade credit.

Revenue growth: Emery (1984) demonstrates that a company with low turnover could grant more trade credit as a marketing tool to increase sales. Therefore, Petersen and Rajan (1997) suggest that firms that want to achieve higher sales must adopt more trade credit transactions and point to a positive relationship between revenue growth and receivables growth. In line with Petersen and Rajan (1997), Niskanen and Niskanen (2006) argue that companies that pursue high growth strategies offer more trade credit and longer repayment periods to overtake rivals. As a result, revenue growth has a positive impact on receivables. In the case where? companies may not achieve their goals, in order to increase revenue, companies will adopt a more trade credit strategy. Similarly, through empirical research, Vaidya (2011) demonstrates that in order to increase sales, companies have increased trade credit to customers with the goal of increasing corporate profits. up and not face the drop in demand of customers. However, Garcia-Teruel and Martinez-Solano (2010) find evidence opposite to that of Petersen and Rajan (1997). Unlike American small and medium firms, there is a negative relationship between revenue growth and receivables in Europe. This indicates that higher turnover growth rates will reduce the financial supply to customers through trade credit.

Turnover: According to Long, Malitz and Ravid (1993), trade credit can also be used for companies to communicate product quality information through the trade credit they provide. The results of Long, Malitz and Ravid (1993) show that this variable has a negative relationship with receivables, as companies with low turnover generate higher quality products. This is because the company controls the quality of the product carefully and preferably prolongs the production cycle. Therefore, these companies will provide more trade credit to their customers so that they can evaluate the quality. Garcia-Teruel and Martinez-Solano (2010) argue that the relationship between total assets turnover and receivables is the same.

Gross profit margin. This factor is used to determine the effect of revenue turnover on trade credit. Emery (1984) finds that companies will increase revenue by granting more trade credit in order to increase revenues. The findings of Petersen and Rajan (1997) and Garcia-Teruel and Martinez-Solano (2010) support the theory that trade credit that is provided to customers when the suppliers are highly profitable. In order to make higher profits, the suppliers should be made to accept lower income or even loss on the terms of the credit with which they are provided.

Inventory ratio: Bougheas, Mateut and Mizen (2009) note that inventory includes finished and semi-finished products. As such, the relationship between inventories and receivables is reversed. This is explained by the fact

that companies use trade credit, which allows buyers to postpone payment to increase sales, thus reducing inventory (Bougheas, Mateut and Mizen 2009). Continuing research on inventory factors, Vaidya (2011) uses the share-weighted gross margin ratio and shows a negative relationship with receivables. When inventory is divided into raw materials, semi-finished products and finished products, the relationship between the finished product and the receivable item is inversely related. The relationship between the raw materials and receivables is positive but this does not make sense. This shows that companies with lower inventories have higher receivables balances, as the companies offering more trade credit to increase sales reduces inventories. Thus, inventory management is an important motive for companies to offer trade credit to other companies (Vaidya 2011).

Liquidity: Ng, Smith and Smith (1999) and Vaidya (2011) demonstrate that liquidity and receivables are related in the same way, ie when liquidity is high, the business will provide additional trade credit to customers. In contrast, Nadiri (1969) and Bougheas, Mateut and Mizen (2009) suggest that there is a negative correlation between liquidity and receivables.

Finally*, Petersen and Rajan (1997) and Niskanen and Niskanen (2006)* argue that the level of receivables is determined not only by the financial situation of the supplier, but also on the needs of the customers. They also find it difficult to measure demand, as each customer will have different trade credit needs.

1.2. Impact of accounted receivables on firm performance

Lewellen, McConnell and Scott (1980) argue that inadequate market conditions lead to the existence of trade credit policy. The existence of imperfect market competition can affect the company's trade credit decisions and facilitate trade credit policies that affect the performance of the firm.

Regarding Research on the impact of receivables on the performance of, firms, there are two schools of thought. It is the receivables that have a positive impact on the efficiency of the business, which means that increasing the number of sales days will lead to higher profit margin, thereby improving the efficiency of the business according to studies such as Akinlo (2011), Sharma and Kumar (2011). Alternatively, most of the other studies suggest that the higher the number of sales days, the lower the profit margin, which reduces business efficiency. The number of days of sales is inversely related to the ability profitability. Studies such as Deloof (2003), Lazaridis and Tryfonidis (2006), Padachi (2006), Garcıa-Teruel and Solano (2007), and Gill, Biger and Mathur (2010), Mansoori and Muhammad, (2012), Vahid *et al.* (2012), Gul *et al.* (2013), Makori and Jagongo (2013), and Ukaegbu (2014) show this. Only one study by Martínez-Sola, García-Teruel and Martínez-Solano (2012) shows that there is a non-linear relationship between the receivables and the value of the firm. Accordingly, when account receivables are kept below the optimum receivables, the benefits of trade credit will prevail, and an increase in receivables will result in a rise in corporate value. Conversely, when receivables are held above the optimal level it will reduce the value of the company.

Therefore, businesses need to balance the benefits and costs of granting trade credit. The benefits of trade credit may include the following: The main motivation for trade credit granting to customers is through the granting of trade credit that will help the company increase sales, thereby bringing higher profits. In addition, the incremental cash flow resulting from the decision to extend credit may be a valuable asset to the company (Schwartz 1974), (Kim and Atkins 1978).

Furthermore, granting trade credit can help companies strengthen long-term relationships with customers (Ng, Smith and Smith 1999), (Wilner 2000). This can be explained by the fact that trade credit reduces asymmetric information between buyers and sellers, thereby reducing ethical dangers between the company and its customers because it provides customers with the ability to verify the product quality before payment (Smith 1987); (Long, Malitz and Ravid 1993), (Pike *et al.* 2005). Trade credit can also be as part of a firm's price policy to stimulate demand (Pike *et al.* 2005). Companies can extend credit terms or increase cash discounts, thereby lowering prices to stimulate sales and allowing companies to implement price discrimination policies.

Trade credit can be considered an investment strategy in order to find customers. In other words, when trade credit is provided, it is a signal to customers that suppliers are seeking a mutually beneficial long-term business relationship (Cheng and Pike 2003). Moreover, from an investment standpoint, trade credit can generate interest income for late payments by buyers. It is common in credit terms that the seller can be charged a higher price if the buyer fails to pay in time. Therefore, companies should invest in trade credit if the net present value of earnings from receivables is greater than the net present value when not using it (Ferris 1981).

Due to these benefits, we can expect a positive relationship between receivables and the performance of the business. However, investments in receivables are also costly: granting trade credit raises financial risks. Businesses (liquidity providers) may face the risk of delinquency, will have to renegotiate in the event of default, and the worst is the increase of overdue debt. It increases the cost of the business in the face of financial hardships.

Martínez-Sola, García-Teruel and Martínez-Solano (2012) report that, according to the European Payment Index Report (2011), 25% of all bankruptcies were due to customer delays or unpaid purchase invoices. On the other hand, when granting trade credit to customers, the company must give up the money that can be earned from interest rates if deposited. This approach implies the opportunity cost of granting trade credit (Nadiri 1969). In practice, the trade credit granted will depend on the level of credibility of the supplier and access to capital markets (Schwartz 1974), (Emery 1984), (Smith 1987), (Mian and Smith 1992), (Petersen and Rajan 1997).

Moreover, trade credit expansion causes the seller to bear the cost of credit management. The seller must spend time and effort to assess credit risk and bear some costs to collect money from the buyer. According to Ng, Smith and Smith (1999), transaction costs related to trade credit monitoring and information arise when there is information disparity between buyers and sellers. Reputation is difficult to verify.

Thus, it can be argued that the relationship between trade credit and corporate value will become negative at high levels of account receivables as trade credit costs will surpass the benefits of increasing the required amounts. (Martínez-Sola, García-Teruel and Martínez-Solano 2012). Is there a non-linear relationship between the receivables and the performance of the business? If so, it is necessary to test two different effects of trade credit on the performance of the business and determine the optimal level of receivables. Therefore, the business needs to determine the optimal level of receivables to maximize the efficiency of the business. Answering these questions will contribute to the literature.

2. Methodology

2.1. Sample and data

Data are from 326 non-financial companies listed on the HNX and HOSE, which were provided by the General Statistics Office of Vietnam for the period from 2013 to 2017 with approximately 1,630 observations. The most commonly used industry benchmark is ICB (Industry Classification Benchmark). After collecting data, all missing data observation are deleted in the sample. Statistics describing the ratio of customer receivables and business performance are presented in Table 1.

Table 1. Customer receivables and business performance

Variable	Companies	Observations	REC	ROA	ROE
Infrastructure services	27	135	0.1155	0.0871	0.1559
Technology	19	95	0.3129	0.0413	0.0851
Industrial manufacturing	113	565	0.2293	0.0568	0.1199
Consumer Service	39	195	0.1286	0.0586	0.0964
Consumer goods	56	280	0.1418	0.067	0.1297
Basic materials	58	290	0.1656	0.0586	0.1222
Medical	14	70	0.2391	0.0921	0.1524
All industries	326	1,630	0.1868	0.0622	0.1215

Source: Authors's statistics.

The proportion of customer receivables to total assets of Vietnamese companies (REC) averages 18.68%. This is low when compared with Garcia-Teruel and Martinez-Solano (2010), who found the ratio of receivables to total assets in other countries, to be 39.28% in Spain, 36.55% in Greece, 35.55% in France, and 19.18% in Finland. In Vietnam the Technology sector was the largest with (31.29%), followed by the health sector (23.91%), manufacturing (22.93%), and the smallest one was infrastructure services (11.55%).

2.2. Research model and hypothesis

To answer the research question, we used 3 models. The first model to test the influence of factors on receivables is based on the study by Garcia-Teruel and Martinez-Solano (2010). In addition, in order to answer the question of the impact of receivables on the performance of Vietnamese companies, we used the model of Martínez-Sola, García-Teruel and Martínez-Solano (2012) to test two hypotheses including: whether there is a non-linear relationship (inverted-U) between receivables and business performance to determine the optimum level of accounts receivable; and to verify the consistency of the nonlinear relationship between receivables and business performance, which provides evidence to support the hypothesis that the performance of Vietnamese firms would decrease if the receivables move outside the optimal value at which the performance of Vietnamese companies is the greatest, thereby assuring effective commercial credit policies to maximize business efficiency.

On the basis of Garcia-Teruel and Martinez-Solano (2010) and Vaidya (2011), as well as the addition of bad debt reserve ratio to the model with a view to testing the factors affecting the receivables account, we have the first model:

Model 1: Examine the factors that affect the receivables of the business

$$\text{REC}_{it} = \beta_0 + \beta_1 \text{PROVI}_{it} + \beta_2 \text{GROWTH}_{it} + \beta_3 \text{SIZE}_{it} + \beta_4 \text{LAGE}_{it} + \beta_5 \text{STLEV}_{it} + \beta_6 \text{FCOST}_{it} + \beta_7 \text{CFLOW}_{it} + \beta_8 \text{TURN}_{it} + \beta_9 \text{GPROF}_{it} + \beta_{10} \text{INVEN}_{it} + \beta_{11} \text{LIQ}_{it} + \varepsilon_{it} \qquad (1)$$

Dependent variables are constructed according to Niskanen and Niskanen (2006); Martínez-Sola, García-Teruel and Martínez-Solano (2012); Khan, Tragar and Bhutto (2012). REC - The receivable rate is defined as the ratio of receivables on assets (REC). This ratio indicates the amount of capital misappropriated by the customer in the total assets of the business.

Based on previous research by Nadiri (1969), Emery (1984), Long, Malitz and Ravid (1993), Petersen and Rajan (1997), Ng, Smith and Smith (1999), Danielson and Scott (2004), Niskanen and Niskanen (2006), Bougheas, Mateut and Mizen (2009), Garcia-Teruel and Martinez-Solano (2010), Vaidya (2011), Khan, Tragar and Bhutto (2012), Shi, Zhu and Yang (2016) presented in Table 1, we have the following hypothesis for the research model.

PROVI - Provision for bad debts. This indicator measures the amount of bad debt reserve in total assets, which is a factor that contributes significantly to the business receivables that have not been studied but should be verified experimentally. Managers need to make sure they have a guaranteed plan when there are risks such as increased costs or reduced revenues to reduce damage as much as possible (Healy 1985). In common with Healy (1985), when the firm has unstable (high or low) incomes, provisions are required (McNichols and Wilson 1988, DeAngelo 1988). If no deduction is made before the risk occurs, the inability to recover receivable debt will affect the financial situation of companies, so the deduction will make for more secure financial position, due to fluctuations in the market. In addition, the provision for bad debts is also a cost of the company and reflects the risk that the business might encounter. If the provision for bad debts increases, the profit of the business will decrease.

In Vietnam, provision for questionable debts is made in accordance with Circular 228/2009/TT-BTC dated from December 7th, 2009 by the Ministry of Finance, guiding the deduction and use of the provision for impairment, inventory prices, losses of financial investments, bad debts and warranty for products, as well as goods and construction works in the company. Clause 2 of Article 3 defines "bad debt reserve" as a reserve for the lost value of overdue receivable debts and receivable debts but may not be recovered by debtors (The_Finance_Ministry 2009). Circular 228/2009/TT-BTC also stipulates conditions and methods of provisioning in Article 6. However, the issue of financial transparency in Vietnam is not guaranteed so, the provision depends on many other factors. Provisions are considered as expenses of the company, as such will reduce part of the amount of corporate income tax payable. However, for many listed joint stock companies, provisioning will reduce the profitability of the business, affecting the market value of the stock. As a result, they may reduce their provisioning, accepting higher taxes to cover losses or potential losses so as not to affect the market value of the stock.

If the provision for questionable receivables increases indicating that the business risk is likely to increase, the business will limit the granting of commercial credit to customers. However, the provision for questionable receivables increases can also increase the receivables. Because the provision for bad debts increases, thus reducing the profitability of the company, the company intensifies the implementation of the trade credit policy, leading to increased receivables and the increase in revenue and profit. Therefore, we do not provide a clear forecast for the relationship between the provision for doubtful receivables and receivables. This must be verified empirically.

H1: The impact of bad debt provisioning rates on receivables can be of either sign???

GROWTH - Sales growth is calculated by (current year sales minus the previous year) and divided by the previous year (García-Teruel and Martínez-Solano 2010). When companies pursue high growth strategies, they will provide more commercial credit and longer repayment periods to overtake competitors to increase sales (Petersen and Rajan 1997, Niskanen and Niskanen 2006, Vaidya 2011). However, Garcia-Teruel and Martinez-Solano (2010) argue that there is a negative relationship between sales growth and receivables cannot be forcasted. Therefore, the ambiguous relationship between sales growth and receivables. This must be verified empirically.

H2: The impact of sales growth on the receivables ratio can be the same or of either sign.

SIZE – (Scale) SIZE is determined by the logarithm of the total turnover (Martínez-Sola, García-Teruel and Martínez-Solano 2012). Larger companies provide more commercial credit to customers, meaning that there is a positive relationship between the size of the company and receivables (Nadiri 1969; Petersen and Rajan 1997;

Niskanen and Niskanen 2006; Bougheas, Mateut and Mizen 2009; García-Teruel and Martínez-Solano 2010; Khan, Tragar and Bhutto 2012; Shi, Zhu and Yang 2016). Since large companies tend to have greater financial resources, they can act as financial intermediaries, thereby providing more commercial credit to their customers. Therefore, it's expected a positive relationship between the size of the company and receivables.

H3: The impact of scale on the rate of receivables is the positive.

LAGE - Years of operation. LAGE is defined as the logarithm of (1+ years of business activity), or the number of years since the company was established (García-Teruel and Martínez-Solano 2010). Longer-established companies are more likely to have access to other sources of capital, thus providing more funding to their customers through commercial credit policies (Petersen and Rajan 1997; Niskanen and Niskanen 2006; Bougheas, Mateut and Mizen 2009; Khan, Tragar and Bhutto 2012; Shi, Zhu and Yang 2016). Therefore, it's estimated that a positive relationship between the number of years of operation and receivables of the company.

H4: The effect of the number of years of operation on the ratio of receivables is positive.

STLEV – Short-term finance measures a company's ability to access external finance and is measured by the ratio of short-term debt to total revenue (García-Teruel and Martínez-Solano 2010). This indicator reflects how much short-term debt a firm need to create revenue share. Short-term debt increases the company's ability to expand its business, boosting sales through consumer credit policy, so receivables will increase (Petersen and Rajan 1997, Niskanen and Niskanen 2006, García-Teruel and Martínez-Solano 2010). In addition, if co-financing is funded by several short-term debtors, it will trigger an increase in receivables because of the suitability of short-term debt and short-term assets as receivables. Meanwhile, Vaidya (2011) argues that businesses with good credit access would reduce commercial credit for customers. Therefore, the relationship between short-term finance and receivables must be verified empirically.

H5: The short-term financial impact on the receivables ratio can be the positive or negative.

FCOST - Financial expenses is determined by the financial cost divided by (total debt minus liabilities) (García-Teruel and Martínez-Solano 2010). This indicator shows the financial cost for the use of external funding but does not include the seller's appropriation of capital. With high financial costs, the company will reduce the amount of debt and discourage companies from financing their customers through commercial credit policies, so receivables will fall (Petersen and Rajan 1997, García-Teruel and Martínez-Solano 2010). It is therefore expected this variable to be negatively correlated with receivables.

H6: The impact of financial expenses on the receivable ratio is negative.

CFLOW - Net cash flow is defined as the profit that a company can generate for itself over a period of time and is determined by (net profit plus depreciation) divided by gross sales (García-Teruel and Martínez-Solano 2010). This indicator shows how net cash flows result from sales revenue. According to Garcia-Teruel and Martinez-Solano (2010), net cash flow affects commercial credit in different countries. In Finland, France and Greece, businesses with large net cash flows provide more commercial credit to customers, while in Belgium the relationship is negative. In the remaining countries, no relationship was found. So, the relationship between net cash flow and receivables should be verified empirically.

H7: The effect of net cash flow on the receivable ratio can be positive or negative.

TURN - Total asset turnover is determined by the sales divided by (total assets minus customer receivables) (García-Teruel and Martínez-Solano 2010). This measure helps to assess the effectiveness of the company's asset use and indicates how much business assets it will produce to generate revenue. Companies with low sales turnover, implying that the quality of the product is higher due to the company's careful and better quality control, thus prolongs the production cycle. At the same time, in order for customers to evaluate the quality of their products, they will provide more commercial credit (Long, Malitz and Ravid 1993). However, Garcia-Teruel and Martinez-Solano (2010) point out that the relationship between total assets turnover and receivables is the same. Thus the relationship between total asset turnover and receivables will be verified empirically in this paper.

H8: The impact of the total asset turnover on the receivable ratio can be positive or negative.

GPROF - Gross profit margin is calculated by gross profit divided by sales (García-Teruel and Martínez-Solano 2010). This indicator shows how much gross profit is generated from sales. When a company makes a high gross margin, it will provide more commercial credit to its customers (Petersen and Rajan 1997, García-Teruel and

Martínez-Solano 2010). Thus, it's expected the relationship between gross profit margin and receivables to be positive.

H9: The effect of gross profit margin on the receivables ratio is positive.

INVEN - Inventory ratio is determined by inventory divided by sales revenue. This indicator reflects the proportion of inventory to sales (Vaidya 2011). Research generally shows this index to have a negative relationship with receivables. To reduce inventories, companies must find ways to increase sales through a variety of means. One of the means adopted by many companies to attract customers is to increase the use of commercial credit policy, gradually increasing the amount of customer receivables (Bougheas, Mateut and Mizen 2009; Vaidya 2011).

H10: The impact of the inventory ratio on the receivable ratio is negative.

LIQ - Liquidity is denominated in money and short-term financial investment divided by short-term debt (Nadiri 1969). This indicator indicates a short-term debt secured by short-term money and stock, so this is the greatest indicator of the ability to convert assets into cash to pay off short-term debt to equity. When the company has good liquidity, the company will be ready for customers to defer payment, resulting in increased receivables (Ng, Smith and Smith 1999; Vaidya 2011). However, Nadiri (1969) and Bougheas, Mateut and Mizen (2009) states that when the company has good liquidity, it will reduce receivables from customers. Therefore, the relationship between liquidity and receivables will be empirically verified.

H11: The effect of liquidity on the receivables ratio can be positive or negative.

Table 2. Summary of factors affecting the receivables of previous studies and expected research results

Factors that affect account receivables	Experimental results of previous studies	Expectations of our research
Provision for doubtful receivables (PROVI)		+/-
Revenue growth (GROWTH)	(+) Emery (1984) (+) Petersen and Rajan (1997) (+) Niskanen and Niskanen (2006) (-) Garcia-Teruel and Martinez-Solano (2010) (+) Vaidya (2011)	+/-
Size (SIZE)	(+) Nadiri (1969) (+) Petersen and Rajan (1997) (+) Ng, Smith and Smith (1999) (+) Danielson and Scott (2004) (+) Niskanen and Niskanen (2006) (+) Bougheas, Mateut and Mizen (2009) (+) Garcia-Teruel and Martinez-Solano (2010) (+) Khan, Tragar and Bhutto (2012) (+) Shi, Zhu and Yang (2016)	+
Years of Operation (LAGE)	(+) Petersen and Rajan (1997) (+) Niskanen and Niskanen (2006) (+) Bougheas, Mateut and Mizen (2009) (Meaningless) Garcia-Teruel and Martinez-Solano (2010) (+) Khan, Tragar and Bhutto (2012) (+) Shi, Zhu and Yang (2016)	+
Short-term finance (STLEV)	(+) Petersen and Rajan (1997) (+) Niskanen and Niskanen (2006) (+) Garcia-Teruel and Martinez-Solano (2010) (-) Vaidya (2011)	+/-
Financial cost (FCOST)	(-) Petersen and Rajan (1997) (-) Garcia-Teruel and Martinez-Solano (2010)	-
Cash flow (CFLOW)	(Meaningless) Niskanen and Niskanen (2006) (+/-) Garcia-Teruel and Martinez-Solano (2010)	+/-
Total assets turnover (TURN)	(-) Long, Malitz and Ravid (1993) (+) Garcia-Teruel and Martinez-Solano (2010)	+/-
Profits (GPROF)	(+) Emery (1984) (+) Petersen and Rajan (1997) (+) Garcia-Teruel and Martinez-Solano (2010)	+

Factors that affect account receivables	Experimental results of previous studies	Expectations of our research
Inventory Ratio (INVEN)	(-) Bougheas, Mateut and Mizen (2009) (-) Vaidya (2011)	-
Liquidity (LIQ)	(-) Nadiri (1969) (+) Ng, Smith and Smith (1999) (-) Bougheas, Mateut and Mizen (2009) (+) Vaidya (2011)	+/-

Source: Authors proposed

Model 2: Verify the nonlinear relationship between receivables and performance of the business

The underlying theory for the hypothesis is based on theories of commercial credit studied by Nadiri (1969), Lewellenet, McConnell and Scott (1980), Emery (1984) and shows the existence of an optimal receivables.

Martínez-Sola, García-Teruel and Martínez-Solano (2012), examine the impact of receivables on corporate value, using two dependent variables representing corporate value; Tobin's Q and MBOOK, with two independent variables REC (receivables divided by total assets) and REC_1 (receivables divided by total revenue). In this case, the independent variable REC_1 in all four models was not satisfactory due to the inadequate model (AR (2) <0.1). Only one model using Tobin's Q as dependent variable and REC as the independent variable is consistent and has an inverted-U shape as expected. Thus, Martínez-Sola, García-Teruel and Martínez-Solano (2012) demonstrated that there is an optimum margin when the marginal revenue of commercial credit is equal to the marginal cost generating an optimal level of credit. For that reason, credit managers should try to keep the accounts receivable at a target level to avoid undermining the company's value by selling it without recovering money (Pike and Cheng 2001). Thus, it is expected that there is a non-linear relationship between customer receivables and operating performance determined by the tradeoff between the cost and benefits of credit granting. There is a level of receivables where the performance of the business is the highest.

Thus, from the point of view of benefits costs spent on providing commercial credit, we need to test the relationship between receivables and performance of Vietnamese companies. Is this a nonlinear relationship? If so, the following hypothesis is proposed:

H12: The relationship between receivables and performance of Vietnamese companies will not be monotonic; In particular, there is a positive relationship when the receivables are low and have a negative relationship when the receivables are high and at the same time there is an optimal level of receivables where the performance of Vietnamese companies is the highest.

Table 3. Summarize previous research on the impact of receivables on enterprise value and expect research results on the impact of receivables on business performance

Dependent variable			Independent variable					Verification of the fit of the model
			REC	REC^2	GROWTH	SIZE	LEV	
Martínez-Sola, García-Teruel and Martínez-Solano (2012)	Company value	Tobin's Q	+	-	+	Meaningless	Meaningless	AR(2)>0.1 and Hansen test > 0.1 so the model is fit
		MBOOK	+	-	+	Meaningless	+	AR(2)<0.1 and Hansen test > 0.1 should have autocorrelation
Expectations of our research	Business performance	ROA	+	-	+	+/-	-	AR(2)>0.1 and Hansen test > 0.1
		ROE	+	-	+	+/-	-	AR(2)>0.1 and Hansen test > 0.1

Source: Authors proposed

In Table 3, based on the use of Martínez-Sola, García-Teruel and Martínez-Solano (2012), we set up a model with dependent variable ROA and ROE representing business performance. Because REC_1 as independent variable was not significant in all 4 models of Martínez-Sola, García-Teruel and Martínez-Solano (2012), we chose only the REC variable as independent variable for our study model. This model is used to test whether there is the non-linear relationship (inverted-U) between receivables and business performance with a view to maximizing business efficiency. Then, we use a quadratic function to examine nonlinear correlation and regression of business performance based on REC and REC^2. At the same time, following Martínez-Sola, García-Teruel and Martínez-Solano (2012), we add more control variables: GROWTH, SIZE, and LEV to control potential effects and business performance.

$$V_{it} = \beta_0 + \beta_1 REC_{it} + \beta_2 REC_{it}^2 + \beta_3 GROWTH_{it} + \beta_4 SIZE_{it} + \beta_5 LEV_{it} + \varepsilon_{it} \qquad (2)$$

Dependent variable is V represents the performance of the company, measured by two variables ROA and ROE. The ROA and ROE have been used in a number of studies to assess performance *e.g.* Shin and Soenen (1998) *etc*.

The main independent variable in the model is the Receivable Ratio (REC). This variable is defined as in the first model. It indicates the amount of capital by the customer in total assets, or it reflects the business credit policy of the business. According to the analysis of the two aspects of credit granted to customers:

- commercial credit granted to customers will have an impact on the buyer to increase the purchase of goods. Revenue growth results in increased profits, thereby increasing operational efficiency (Akinlo 2011, Sharma and Kumar 2011);
- when commercial credit provided is at a high level, the higher the cost to the company, the higher the risk for the company when the company is not able to collect money from the buyer, thereby reducing business performance (García-Teruel and Martínez-Solano 2007, Gill, Biger and Mathur 2010, Mansoori and Muhammad 2012, Vahid *et al.* 2012, Makori and Jagongo 2013).

Therefore, we cannot predict clearly the relationship between receivables and the performance of the business, which must be empirically verified. In addition, since the research objective is to test the non-linear relationship between receivables and business performance, the squared receivable (REC^2) is included in the research model. Based on Martínez-Sola, García-Teruel and Martínez-Solano (2012), we expect to find a non-linear relationship (U-shaped) between receivables and performance of Vietnamese companies, which represents the balance the benefits and costs to maximize business performance. In other words, when receivables are kept at a level below the optimum amount of receivables, the benefits of commercial credit will prevail; an increase in receivables will result in increased efficiency of the business operation. Conversely, when receivables are kept at a level higher than the optimal amount, profitability and liquidity will decrease, increasing business risk because the business may not collect money from buyers. The increased amount of receivables will reduce the efficiency of the business. Thus, we observe a positive sign for the REC variable ($\beta_1 > 0$) and negative for the REC^2 variable ($\beta_2 < 0$). If this non-linear relation is validated, as is the expectation of the sign for the REC and REC^2 variables, it indicates that there exists an inverted-U relationship of the quadratic equation between the levels the performance and efficiency of the company, which means that the company's performance will peak at the inflection point when receivables reach the optimal level. Specifically, when the increase in receivables will increase efficiency of the company to an optimal point, the relationship will reverse, then increased receivables will reduce the company's performance. This reversal point is the optimal receivable amount and is equal to $-\beta_1/2\beta_2$. Control variables included in the model include revenue growth, company size, and company leverage.

GROWTH - Sales growth. This variable is defined as in the first model and indicates the growth rate of sales in a year. The study expects this to have a positive impact on the company's performance, as companies with good sales growth will provide a better foundation for business continuity and future development (Scherr and Hulburt 2001). The company grows with better investment opportunities so profitability increases, resulting in increased company performance (Niskanen and Niskanen 2006). In other words, the higher the growth of sales, the more efficient the performance of the business is (Geroski, Machin and Walters 1997; Claver, Molina and Tari 2002; Samiloglu and Demirgunes 2008; Yazdanfar 2013). Therefore, we expect that the relationship between revenue growth and business performance should be tested.

SIZE - Scale. This variable is defined as the first model. The issues firm performance is the same (Hall and Weiss 1967, Fiegenbaum and Karnani 1991, Serrasqueiro 2008, J. Lee 2009, Yazdanfar 2013, Doğan 2013, Bagh *et al.* 2016). The larger the size of the business, the better the business performance. In contrast, there is a view that it is the relationship between firm size and business performance (Shepherd 1972, Jensen and Murphy 1990, Pi and Timme 1993, Goddard, Tavakoli and Wilson 2005). Therefore, the relationship between firm size and company performance should be tested.

LEV - Leverage. LEV is measured by total debt divided by equity (Martínez-Sola, García-Teruel and Martínez-Solano 2012). This indicator indicates the debt to equity ratio of the company. Goddard, Tavakoli and Wilson (2005) and Doğan (2013) argue that the relationship between company leverage and company performance is inversely related. The higher the debt-to-equity ratio, the less effective the company's performance. Therefore, we expect a negative relationship between the leverage and the performance of the firm.

Model 3: Verify the impact of the change in receivables on the performance of the firm

The goal being to test the hypothesis that the business performance will decrease as the commercial credit policy deviates from the optimal value at which the performance of firm is highest, thereby helping business executives to implement effective commercial credit policy to maximize business performance. According to Table 3, followed by Martínez-Sola, García-Teruel and Martínez-Solano (2012), the research model is proposed as:

$$V_{it} = \beta_0 + \beta_1 DEVIATION_{it} + \beta_2 GROWTH_{it} + \beta_3 SIZE_{it} + \beta_4 LEV_{it} + \varepsilon_{it} \qquad (3)$$

V is the dependent variable - The operating efficiency of company is in year t, represented by two variables ROA_{it}, ROE_{it} and is calculated as above.

DEVIATION: represents the deviation from the optimal receivable level, calculated by taking the absolute value of the residual in the first model. DEVIATION is used to determine whether deviations from target receivables affect the performance of Vietnamese firms. We removed the two REC and REC^2 variables from the second model and replaced them with the DEVIATION, then regressed the dependent variable DEVIATION in the third model.

In the third paradigm, we continued to use the control variables including GROWTH, SIZE, LEV which represent revenue growth, firm size, and financial leverage respectively in the first and second models.

Our priors are that $\beta_1 < 0$, *i.e.* there is a negative relationship between deviations from the target receivable and the efficiency of the firm. In other words, we find that when receivables are higher or lower than the target receivables, they reduce the efficiency of Vietnamese firms.

Table 4. Summarizing previous research on testing the impact of changes in receivables to enterprise value and expecting research results on testing the impact of changes in receivables to business performance

Dependent variable			Independent variable					Verification of the fit of the model
			REC	REC²	GROWTH	SIZE	LEV	
Martínez-Sola, García-Teruel and Martínez-Solano (2012)	Company value	Tobin's Q	+	-	+	Meaningless	Meaningless	AR (2)> 0.1 and Hansen test> 0.1 so the model is fit
		MBOOK	+	-	+	Meaningless	+	AR (2) <0.1 and Hansen test> 0.1 should have autocorrelation
Expectations of our research	Business performance	ROA	+	-	+	+/-	-	AR(2) > 0.1 and Hansen test > 0.1
		ROE	+	-	+	+/-	-	AR(2) > 0.1 and Hansen test > 0.1

2.3. Empirical methodology

Based on the data collected, to analyze the factors affecting receivables, we used the Ordinary Least Squares (OLS) regression, the Random Effects Model (REM), and the Fixed Effects Model (FEM).

The OLS regression model is as follows:

$$Y = \beta_0 + \sum_{j=1...p} \beta_j X_j + \varepsilon \qquad (4)$$

where: Y is the dependent variable, β_0, is the intercept of the model, X_j corresponds to the explanatory variable of the model (j= 1 to p), and e is the random error with expectation 0 and variance σ^2.

However, the limitation of the OLS regression relates to some problems from the autocorrelation matrix. Some variables are unknown and therefore excluded from the model or the possibility of interdependence of the variables, resulting in multi-conllinearity.

Therefore, Breusch-Pagan tests were chosen between REM and OLS models. Hausman tests were chosen between FEM and REM models. At the same time, with two FEM and REM models, we used the Wald test (for FEM model), Breusch-Pagan test (for REM model) and use Wooldridge test to detect autocorrelation. With respect to the REM and FEM, the results exhibit heteroscedasticity. Heteroscedasticity often arises in volatile high-frequency time-series data such as daily observations in financial markets. Heteroscedasticity also arises in cross-section data where the scale of the dependent variable and the explanatory power of the model tend to vary across observations. Microeconomic data such as expenditure surveys are a typical example (Hurlin 2013). Thus, the FGLS model (Feasible Generalized Least Squares) was used to overcome the heteroscedasticity and the correlation of two FEM and REM models (Amemiya 1985). We use GLS to test the population multiple linear regression model. *(see equation 1)*

According to equation 1, X_i is a matrix of fixed or random regressors, β and the error term ε satisfies:

$$E(\varepsilon|X) = 0_{Nx1} \tag{5}$$

$$V(\varepsilon|X) = \Sigma = \sigma^2\Omega \tag{6}$$

where: Ω and Σ are symmetric positive definite matrices.

The heteroscedastic arrived when they have different independent variances. GLS run to overcome the disturbances. In addition, to test the robustness of the first model, we used the Generalized Method of Moments (GMM) model (Arellano and Bond 1991). The GMM helps to overcome not only the defects in the model as the variance of change error, and as to auto-correlation but also the endogenous phenomena in the model. The Hansen test applied to verify the validity of the model.

Application of the instrumental variables (IV) estimator, using it as an appropriate instrument to face heteroskedasticity. For unbalance panel data, the first equation is:

$$Y = X \quad \delta \quad + v$$
$$nxl \quad nxk \quad kxl \quad nxl \tag{7}$$

where: n = $\sum_i(T_i - 2)$. It assumes that the x_{it}^* are all potentially correlated with μ_i.

The n x 1 vector of residuals is given by:

$$\hat{v} = y - X(\hat{\delta} - \delta) \tag{8}$$

where: $\hat{\delta}$ can be any estimator for a particular choice of Z and A_N. Let $\hat{v}$ -2 be the vector of residuals lagged twice, of order q = $\sum_i(T_i - 4)$, and let v* be a q x 1 vector of trimmed v to match v-2 and similarly for X*.

Since the vit are first differences of serially uncorrelated errors, E(vitvi(t-l)) need not be zero (Arellano and Bond 1991) (Christopher, Mark and Steven 2003) The estimator is the generalized instrumental variables. After correcting for autocorrelation of disturbances and heteroscedasticity, the influential factors of receivables were examined, the next step, to verify the nonlinear relationship between receivables and the performance of the business *(To test the model 2)*, the study uses the generalized method of moments (GMM) to test the second model to control heterogeneity, unobservability and prevent endogeneity inherent problems in commercial credit decisions (Hansen 1982). Heteroscedasticity often arises from disturbance of time-series data such as daily observations in financial markets. Therefore, there are always factors affecting the performance of the business that are difficult to measure or identify (Himmelberg, Hubbard and Palia 1999). An example of this endemic potential is the unusually high level of sales that lead to higher returns and greater commercial credit policies. Furthermore, profitable businesses tend to mediate and borrow more from financial institutions to lend to their clients (Nilsen 2002). This estimation assumes that there is no quadratic correlation in the first distinct error. For this reason, the study examines the absence of second-degree correlation proposed by Arellano and Bond (1991). The study also uses the Hansen test to determine the suitability of tools of GMM. This is an over-identifying measure of the model.

To apply GMM, "moment conditions" need to have, that is, a vector value function g(Y,θ) such that $m(\theta_0) \equiv E[g(Y_t, \theta_0)] = 0$ need to define, where E shows expectation, and Y_t is a generic observation. The function $m(\theta)$ must differ from zero for θ ≠ θ₀. The value of θ₀ was used to compute this matrix. θ₀ is precisely the quantity we do not know and are trying to estimate. GMM regression is run in two steps:

Step 1: If W = I (the identity matrix), the model computes preliminary GMM estimates. Although the regression is not efficient, the estimator is consistent for θ₀.

Step 2: If the estimator converges in probability to Ω^{-1} and estimate the weighting matrix, the estimator will be asymptotically efficient. After estimating the second regression model, if the results show that there is a nonlinear relationship between the holding of receivables and the performance of the company, this proves the existence of the optimal amount of receivables at which business performance is maximized. To increase the accuracy of the results, we will have to demonstrate that business performance will decrease if the receivables are lower or higher than the optimal level.

Martínez-Sola, García-Teruel and Martínez-Solano (2012) argue that deviation of receivables is considered a standard receivable. Tong (2008) develops an approach to the relationship between the two-sided deviations of optimal ownership and company value. Research will follow this approach to analyze the relationship between the deviation of the optimal receivable and the performance of the business. Therefore, we continue to use the GMM estimation method to verify the impact of the change in receivables on the performance of the business. If the relationship between receivables and the performance of the business is non-linear as confirmed by the second

model, the firm's efficiency is highest at the level of optimum collection and deviation from this optimal receivable level, will result in the the efficiency of the business to decrease.

3. Results and discussions

3.1. Statistic of variables

The regression of variables by each sector, descriptive statistical results are as follows:

Table 5. Variable statistical results by sectors

Variables	Infrastructure service	Technology	Manufacturing	Consumer service	Consumer goods	Basic material	Medical	All industries
reca	0.1421	0.4076	0.2698	0.0981	0.1287	0.1435	0.2559	0.1965
recb	0.1134	0.3121	0.2245	0.1256	0.1386	0.1614	0.234	0.1814
paya	0.1083	0.1681	0.1475	0.0759	0.0777	0.0974	0.0746	0.1116
payb	0.1200	0.1397	0.1175	0.1154	0.0911	0.1146	0.0935	0.1123
ntc	0.0286	0.2377	0.1179	0.0229	0.0501	0.0475	0.1800	0.0812
provia	0.0036	0.0228	0.0231	0.0083	0.0098	0.0071	0.0215	0.0136
provib	0.0031	0.013	0.0159	0.0099	0.009	0.0061	0.0153	0.0105
growth	0.0857	0.1881	0.1149	0.0712	0.1034	0.083	0.0926	0.1011
sizea	27.4326	26.4349	26.7649	26.1218	27.5271	27.4488	27.2071	26.9915
lage	2.3443	2.5171	2.4719	2.3964	2.433	2.2985	2.5469	2.4251
stlev	0.3552	0.589	0.6047	0.2571	0.4158	0.3533	0.2982	0.4314
fcost	0.0439	0.0487	0.046	0.0718	0.0546	0.0565	0.0808	0.0524
cflowa	0.2588	0.0649	0.0994	0.0573	0.078	0.1007	0.1058	0.0993
turn	1.4132	1.5466	1.5843	2.286	1.6185	1.7089	1.6719	1.6580
gprof	0.3023	0.1825	0.1581	0.1854	0.1878	0.1548	0.3319	0.1851
inven	0.0454	0.1919	0.2761	0.1332	0.2466	0.1926	0.2033	0.1935
liq	2.2368	1.9898	1.6275	2.4796	1.6781	1.757	2.2684	1.8543
stfind	0.069	0.1423	0.1533	0.12	0.2599	0.2146	0.1510	0.1699
curras	0.4377	0.7622	0.6116	0.6028	0.6475	0.5878	0.6711	0.61
lev	1.0501	1.3891	1.7367	0.8959	1.4165	1.5247	0.7859	1.3909
provirec	0.075	0.0564	0.0952	0.0973	0.0841	0.0611	0.0575	0.0803
roa	0.0855	0.0433	0.0567	0.0606	0.0658	0.0591	0.1045	0.0623
roe	0.1531	0.0913	0.1237	0.1029	0.1353	0.1248	0.1698	0.1263
mb	1.3958	0.7643	0.8818	0.9945	1.1999	0.9493	1.7124	1.0265
tobinq	1.2503	0.8713	0.9605	0.9643	1.1068	0.9808	1.4692	1.0255
No of obs.	135	95	565	195	280	290	70	1,645
No. of firms	27	19	113	39	56	58	14	326

The ratio of receivables to sales accounts for about 22%, while the ratio of payables to sales accounts for only 12.71%, proving that companies in Vietnam have been occupied more their capital by their customers, leading to a net commercial credit ratio of 9.19%. In general, the net commercial credit of all industries is positive, indicating that all industries are granting more commercial credit than being funded by commercial credit. In particular, the net commercial credit rate of technology is the highest (24.04%), followed by the medical sector (18.16%), manufacturing (12.37%) ... and the lowest is consumer service (1.95%).

Although the results prove the ratio of receivables on total assets of Vietnamese companies accounted for 18.68%, the ratio is lower than other countries (García-Teruel and Martínez-Solano 2010), for instance, in Spain the ratio is 39.28%, in Greece the ratio is 36.55%, in France is 35.55%, and the lowest rate of 19.18% is in Finland.

Besides, the ratio of payables to the total assets is 11.60%. This rate is still small. In Garcia-Teruel's study and Martinez-Solano (2010), the highest ratio is in France with the rate of 28.52%, in Belgium is 27%, in Spain is 24.88%, and lowest is in Finland with the rate of 13.17%. In which, in Vietnam, the highest ratio of technology is 14.44%, followed by the infrastructure services sector is 12.34% and the health sector at least is 9.39%.

In addition, there is also a difference in the provision for bad debts among sectors. The rate of provision for bad debts on the total assets of all industries is 1.49%, the highest ratio of the health sector is 4.46% and the lowest ratio of the infrastructure services sector is 0.36%. Considering the rate of provision for bad debts to receivables, all industries is about 112.87%, of which this rate has a sudden increase in the infrastructure services sector of 1201.98%, the rest of all sectors are from about 6.11% to 24.96%.

The profitability to total assets of all industries was positive. The rate of profitability is 6.22%; the highest ratio of the health sector is 9.21% and the lowest ratio of the technology sector is 4.13%. Regarding profitability on equity, the ratio of all industries is 12.15%, of which the highest ratio of infrastructure services is 15.59% and the lowest ratio of the technology industry is 8.51%.

3.2. Results

Here we discuss the results of the factors affecting receivables through various methods. In the Hausman test, the FEM model was more suited to the data set than the REM model. Thus, the independent variables in the model explained 22.42% of the variation of the dependent variable. However, with the Wald test and the Wooldridge test, we found that there was a variance of variance and autocorrelation. To overcome this, we used the FGLS model. In general, the results obtained by the three estimation methods do not differ much. However, in order to increase the robustness of the model of factors affecting the receivables, we used the estimation method with the GMM model. Through the GMM model, we have the results as shown in Table 6.

Table 6. Factors that affect receivables

Dependent variable	REC			
Measurement method	FEM	REM	FGLS	GMM
PROVI	0.1859***	0.2019***	0.3313***	1.1562**
GROWTH	-0.0071**	-0.00669**	-0.0063***	0.0538
SIZE	-0.0135**	-0.0157***	-0.0109***	-0.0134**
LAGE	0.0163	0.0152*	-0.0040	-0.0030
STLEV	0.0036	0.0052	0.0104***	0.0420
FCOST	-0.0493**	-0.0527***	-0.0252**	-0.0462
CFLOW	-0.0187	-0.0299**	-0.0250***	-0.0943**
TURN	0.0283***	0.02934***	0.0325***	0.0233***
GPROF	-0.0338	-0.0368*	-0.0215*	-0.0039
INVEN	-0.0078*	-0.0092**	-0.0127***	-0.0333*
LIQ	-0.0058***	-0.0064***	-0.0046***	-0.0045

Note: (*), (**) and (***) correspond to the significance level of 10%, 5% and 1%

First, the new factor is the provision for doubtful receivables provision (PROVI) which has the strongest impact and is in line with customer receivables. As such, provision for doubtful receivables increases, resulting in increased receivables. Cause is explained by the increase in bad receivables compensation, which makes the cost of enterprises increase, profit decreased. Therefore, in order not to reduce profitability, companies must increase revenue by accelerating sales by offering more commercial credit to customers.

Second, size (SIZE) is considered to be a determinant of receivables and has a negative effect on receivables. Smaller companies will provide more trade credit to their customers. This is a new finding in the market of a transition economy country like Vietnam. This result is opposite to the previous results. The relationship between firm size and receivables is similar to (Nadiri 1969), (Petersen and Rajan 1997), (Niskanen and Niskanen 2006), (Bougheas, Mateut and Mizen 2009), (García-Teruel and Martínez-Solano 2010), (Khan, Tragar and Bhutto 2012), (Shi, Zhu and Yang 2016). This can be explained that, in the Vietnamese market, small-scale companies do not have a firm foothold in the market so it is harder to find customers than large companies.

Third, net cash flow (CFLOW) has a negative relationship with receivables. This means that if the net cash flow increases, it will reduce the level of trade credit for customers. This is consistent with the results of Garcia-Teruel and Martinez-Solano (2010) when studying the Belgian market. But its results are in contrast of other countries like Finland, France and Greece.

Fourth, total assets turnover (TURN) has positive effect on receivables. This result supports for the views of Garcia-Teruel and Martinez-Solano (2010), that is, in case of an increase in asset turnover, which demonstrates the efficiency of asset utilization of firms is good, business results should be favorable. Firms create conditions for customers to purchase on deferred payment, resulting in increased receivables. However, this finding is in contrast to Long, Malitz and Ravid (1993) who claim that receivables are a tool for quality assurance with clients.

Fifth, inventory turnover (INVEN) is inversely related to receivables. This finding is consistent with Bougheas, Mateut and Mizen (2009) and Vaidya (2011). We find that, in Vietnamese market, when inventories are still abundant, in order to release inventories, firms implement trade credit policies in order to encourage customers to buy goods, speed up the sale of goods, and increase customer acquisition.

The remaining factors in the GMM model are GROWTH, LAGE, STLEV, FCOST, revenue (GPROF), liquidity (LIQ), all of which are not statistically significant. The results on the impact of customer receivables on business performance are presented in Table 7.

Table 7. The regression results of the non-linear relationship between receivables and performance

Dependent variable	ROA		ROE	
REC	0.4295	**	0.9869	*
REC^2	-0.8597	**	-1.9625	*
GROWTH	0.0223	***	0.0728	***
SIZE	0.0082	*	-0.0031	
LEV	-0.0254	***	-0.0141	
Observations	1304		1304	
AR (2)	0.256		0.761	
Hansen test	0.149		0.766	

Note: (*), (**) and (***) correspond to the significance level of 10%, 5% and 1%; Measurement method: GMM

The regression results show that the expectation of a non-linear relationship between receivables and business performance is perfectly reasonable. The regression coefficient of the REC and REC^2 variables are statistically significant. For the dependent variable ROA, the mean of both REC and REC^2 is 5% and when the dependent variable is ROE Mean levels of both REC and REC^2 significant at the 10% level.

In the two cases where the dependent variable is ROA and ROE, the coefficients of variable REC is positive and REC^2 is negative as expected, indicating a non-linear relationship between receivables and business performance. It is an inverted-U, which implies that an increase in receivables will increase the efficiency of the business operation, to a certain level of receivables, after which the increased receivables will reduce the efficiency of business operation. The ratio of receivables to total assets at the reverse business performance point is the ratio of receivables to total assets, which is maximized. For the case where the dependent variable represents the performance of the company as ROA, the ratio of receivables to total assets is determined by the two coefficients of the REC and REC^2 variables as follows: $(-\beta_1 / 2\beta_2) \approx 0.2498$. This result shows that when receivables account for 24.98% of total assets, the return on total assets is the highest. Similarly, for the case where the dependent variable represents the performance of the business as ROE, the ratio of receivables to total assets is determined by the two coefficients of the REC and REC2 variables as follows: $(-\beta_1/2\beta_2) \approx 0.2515$. This result shows that receivables account for 25.15% of total assets when the return on equity is the highest.

Regarding control variables, in the case of dependent variable ROA, the GROWTH variable has a positive effect on the ROA at a significance level of 1%. This means that the higher the revenue growth rate, the higher the profitability of the asset. This finding is consistent with Geroski, Machin and Walters (1997), Claver, Molina and Tari (2002), Samiloglu and Demirgunes (2008) and Yazdanfar (2013). For size (SIZE), as well as Hall and Weiss (1967), Fiegenbaum and Karnani (1991), Serrasqueiro and Nunes (2008), Lee (2009), Yazdanfar (2013), Doğan (2013), the study also shows a positive impact on ROA at a 10% significance level. Thus, the larger the scale, the higher the profitability of assets. However, the results are in contrast to those of Shepherd (1972), Jensen and Murphy (1990), Pi and Timme (1993), Goddard, Tavakoli and Wilson (2005). Finally, leverage (LEV) has a negative impact on ROA at a 1% significance level. This means that the higher the debt-equity ratio, the lower the return on assets (Goddard, Tavakoli and Wilson 2005), (Doğan 2013). For a dependent variable ROE, the empirical results show that GROWTH changes in the same direction as ROE and is significant at 1%. The greater the increase in revenue growth, the greater the return on equity is. The scale variables (SIZE) and leverage (LEV) are not statistically significant.

To test the robustness of the research results and how the performance of the business will change if the receivables ratio on the asset deviates from the optimal value, we removed the two variables REC and REC^2 in the

second model and replaced with the DEVIATION variable, followed by the DEVIATION regression following the second model. The results of which presented in Table 8.

Table 8. The regression results that verify the change in receivables to efficiency

Dependent variable	ROA		ROE	
DEVIATION	-0.1296998	*	-0.3664975	***
GROWTH	0.0338579		0.0723001	
SIZE	-0.014179	**	-0.0255614	**
LEV	0.0061579		0.0127692	**
Observations	1304		1304	
AR (2)	0.370		0.669	
Hansen test	0.977		0.972	

Note: (*), (**) and (***) correspond to the significance level of 10%, 5% and 1%; Measurement method: GMM.

Regression results show that the expectation of firm's performance will decrease as the ratio of receivables on assets deviates from the optimal value and is perfectly reasonable. Specifically, the coefficient of the DEVIATION variable is negative in both cases where the dependent variable is ROA and ROE, where the DEVIATION variable has a significance level of 10% for the dependent variable model, ROA, 1% for the dependent variable model with ROE. As a result, the test results show that when the receivables ratio is out of the optimal value will reduce the efficiency of business operations. For the control variables in the model, the coefficient of variation (SIZE) has a negative impact on the firm's performance and is significant at 5% in both cases where the dependent variable is ROA and ROE. Leverage has a positive effect on ROE at a significance level of 5%.

Besides, it is seen that characteristics of industries are difference. Therefore, it is meaningful regression results for each industry, the data set has been added to a control variable as an industry variable. Since then, testing the relationship between account receivables and operational efficiency of each industry, as well as testing the receivables deviated from the optimal receivables level, the operational efficiency of companies will be decreased. Deviation of beta must be negative and the shape of chart is U shape.

The results show that, if testing for each industry, there is a relationship between account receivables and the performance of listed companies of the services, industry, health, technology and basic materials.

Table 9. Impact of industry variable to the relationship between receivables and performance of the company

REC	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
Consumer_Service	-0.0529	0.00803	-6.6	0	-0.068657	-0.0372
Consumer_goods	-0.0148	0.00774	-1.91	0.056	-0.029932	0.00039
Manufacturing	0.05124	0.00744	6.89	0	0.036662	0.06583
Infrastructure_services	-0.016	0.00932	-1.72	0.086	-0.03426	0.00227
Medical	0.07267	0.01266	5.74	0	0.047858	0.09748
Technology	0.14025	0.01626	8.62	0	0.108374	0.17213
Basic materials	0.46361	0.04574	10.14	0	0.373955	0.55326

However, the results show that the receivables are deviated from the optimal level of receivables, business performance of enterprises decreases, beta coefficient of deviation is positive. Therefore, when testing the residue of the model estimated the impact of the right to the performance of the company to eliminate endogenous factors with GMM testing is not meaningful. Estimating the impact of industry variable on the results of the relationship between receivables and the performance of listed companies. The impact of receivables on the performance of basic materials listed companies are as follows:

Table 10. The impact of receivables on the performance of basic materials listed companies

	ROA				ROE			
	FEM	REM	FGLS	GMM	FEM	REM	FGLS	GMM
REC	0.0287	0.0553	-0.0321	1.1602*	0.205	0.2981	0.1065	0.5596*
REC^2	-0.2124	-0.3162	-0.0736	-3.3159*	-0.7607	-1.0555*	-0.5583	-1.7292*
GROWTH	0.0226**	0.0320***	0.0248***	-0.0067	0.0647***	0.0864***	0.0607***	0.0651**
SIZE	0.0365***	0.0131***	0.0120***	-0.0355	0.0829***	0.0313***	0.0320***	0.0527**
LEV	-0.0167***	-0.0203***	-0.0172***	0.003	-0.0142	-0.0172***	-0.0114**	-0.0338**
No of obs.	290	290	290	232	290	290	290	232
R2	0.1998	0.1682			0.2021	0.1738		
Hausman test	0.0163				0.0452			
Wald test	0				0.0004			
Wooldridge test	0.0004				0			
AR (2)				0.888				0.771
Hansen test				0.218				0.342

Note: (*), (**) and (***) correspond to the significance level of 10%, 5% and 1%.

The results in Table 10 show it is a relation between receivables and performance of basic materials firms. F-test is run to estimate suitable model with research sample. Breusch-Pagan test and Hausman test with p-value values are less than 0.05, showing the FEM model is the most suitable.

Next, testing by Wooldridge test and Wald test (p-value <0.05) show that there is auto-correlation and heteroskedasticity for FEM. FGLS regression is tested to overcome auto-correlation and heteroskedasticity. The results show that $\beta 1 <0$ and $\beta 2> 0$, so the shape of equation is U-shaped, contrary to the expectation of an inverted-U. It proves that the ratio of receivable to revenues is increasing, ROA will decrease. ROA is the lowest at the point (- $\beta 1/ 2\beta 2 \approx 0{,}3046$). This result shows that the ratio of customer receivables is 30.46% of the revenue, ROA is the lowest.

The results show the larger the size of firms is, the greater the impact of receivables on ROE is. The results are supported by the results of Bougheas, Mateut and Mizen (2009), Garcia-Teruel and Martinez-Solano (2010), Khan, Tragar and Bhutto (2012) and Shi, Zhu and Yang (2016).

Table 11. Residual testing and suitable model testing

	GMM			
	ROA		ROE	
Deviation	-0.1351	**	-0.3211	**
Growth	0.0444	***	0.0931	***
Size	-0.0035		-0.0041	
Lev	0.0083	**	0.0094	
Number of obs.	232		232	
AR (2)	0.114		0.814	
Hansen test	0.772		0.661	

Note: (*), (**) and (***) correspond to the significance level of 10%, 5% and 1%

Results in Table 11 show that GMM testing for ROA with AR (2)> 0.1 and Hansen test> 0.1 and GMM testing for ROE with AR (2)> 0.1 and Hansen test> 0.1. The results show that the graph shows the relationship between receivables and ROA, ROE in the standard form and is consistent with the studies of Martínez-Sola, García-Teruel and Martínez-Solano (2012). Accordingly, when the receivables ratio deviates from the optimal level, the performance of firm will decrease.

Conclusions

In conclusion, from empirical results of listed companies in Vietnam, trade credit policy is important. It can help businesses expand their market share and accelerate the sale of goods and increase customer receivables. The results show, when provision for bad debts increases, profit is reduced; to increase sales, businesses must encourage customers to buy goods through the granting of customer trade credit. Moreover, the special feature in the Vietnamese market is that the smaller the size of the company is, the more trade credit it grants. This is in contrast of previous studies by Nadiri (1969), Petersen and Rajan (1997), Niskanen and Niskanen (2006), Bougheas, Mateut and Mizen (2009), Garcia-Teruel and Martinez-Solano (2010), Khan, Tragar and Bhutto (2012),

Shi, Zhu and Yang (2016). Because in the Vietnam market, small companies do not have a strong foothold and reputation, if they want to compete with big companies, they must use trade credit policy to attract customers. In addition, the higher the net cash flow in the business, the more businesses do not have the need to increase trade credit for customers. In addition, the use of trade credit is a means of transmitting information about product quality. Long, Malitz and Ravid (1993) is not correct in the case of Vietnam. In Vietnam, the larger the turnover of assets is, the more favorable conditions for customers to buy on deferred payment. Finally, in response to rising inventories, we observe that businesses have expanded their trade credit policies to reduce inventory and increase receivables.

Through this research, the authors have identified the relationship between customer receivables and business performance. In particular, there is an optimal level of exposure to the performance of the business, or the profitability of the asset and the return on equity are greatest. This contributes to the argument by Lewellen, McConnell and Scott (1980), that in imperfect competition, firms would incur expenses related to credit assessments and contingency expenses, thus creating a premise for trade credit policy affecting the efficiency of business operations. Thus, granting trade credit can bring benefits such as increased revenue, expanded market share, but at the same time cause losses to businesses such as increased financial costs and opportunity costs when customers do not pay or pay late. If these costs exceed the benefits, they will reduce the efficiency of business operation. Thus, it could be concluded that the relationship between customer receivables and business performance is inverted-U, there is an optimal level of receivability at which the activity of the business is the greatest. At a low level, when the performance of the business increases and the optimal level of receivables is reduced, the efficiency of the business will decrease. Moreover, the deviation from the optimal value reduces the efficiency of the business.

Thus, from this study, the implication for researchers and business managers is that managing trade credit policies is critical to business operations in order to increase operational performance through the profitability of assets and profitability of equity. Firms should strive to ensure the optimum level of customer acquisition to maximize business performance. In the Vietnamese market, the average customer receivable margin of industry is about 25% of total assets.

However, the limitation of the research is the cases for each industry with different characteristics and for different sizes of firms (large firms, small and medium firms) has not been studied. Therefore, it would be worthwhile to examine the factors that affect receivables and analyze whether there is a non-linear relationship between receivables and business performance among different industries and firm size.

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Managerial Overconfidence, Audit Committee Characteristics, and Audit Fees

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Abstract:

The aim of this research was to analyze the relationship between managerial overconfidence and audit fees. Furthermore, this study also examined the effect of audit committee characteristics on the relationship between overconfident managers and audit fees. This study used 527 observations from 218 firms listed on the Indonesian Stock Exchange for the period 2014 to 2016. We used univariate and multivariate analyses to examine the testable hypotheses. This study found that auditors perceive managerial overconfidence to be a factor that increases audit risk, for which they will charge additional fees to compensate for the increased audit effort. The existence of an audit committee in the case of companies with managerial overconfidence was characterized by having an accounting background, having more than one member serving as an independent commissioner, and conducting meetings more than four times a year; this has a positive impact on audit fees. For companies, this study provides the insight that having a good quality audit committee is a good way to reduce the risk of overconfident managers. However, this will significantly increase the audit fee. This study has provided a further understanding of how the corporate governance mechanism, through the characteristics of the audit committee, mitigates the risk of overconfident managers.

Keywords*:* managerial overconfidence; audit fee; audit committee characteristics.

JEL Classification: G32; M41.

Introduction

Overconfidence was first studied in the field of psychology in the literature of "better than average" effect, referring to the tendency of a person to judge that they have the ability to exceed the average of others (Svenson 1981). Roll's (1986) research initiated a study that examined the effect of overconfidence on managerial action. In Roll's study (1986), the overconfidence of managers demonstrates that overconfidence is able to strategically influence a manager's policy and affect the value of the firm in turn. A real example of the influence of overconfidence on corporate decision is seen in investment action. Malmendier and Tate's (2005) study showed that managerial overconfidence tends to overstate the expected returns on their decisions but makes the managers pay less attention to any adverse impacts that may occur. This feeling arises from a manager when they feel that they possess the knowledge and skills that qualify him and make him feel better than others (Larrick, Burson and Soll 2007).

In the financial and accounting research on managerial overconfidence, there have been found to be various relationships between a managers' overconfidence and the corporate activities. Previous research has analyzed the existence of overconfidence in terms of its effect on company investments, mergers and acquisitions, corporate expansion, innovation, financing policy and the value of cash (Aktas *et al.* 2019, Hirshleifer, Low, and Teoh 2012,

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Malmendier and Tate 2005, 2008). The research of Hirshleifer *et al.* (2012) showed that a manager's overconfidence tends to lead to them investing more in innovation through any research and development and achieving greater innovative success. On the other hand, research on overconfidence also shows that management overconfidence is associated with adverse actions in terms of corporate financial reporting such as earning management actions (Hsieh, Bedard, and Johnstone, 2014), low levels of accounting conservatism (Ahmed and Duellman 2012), the restatement of financial statements (Presley and Abbott 2013), and the increasing tendency to commit fraudulent acts in financial reporting (Schrand and Zechman 2012). The rises of actions that caused inaccurate financial statements is done to cover up the fact that the projection and expectations of the revenue that has been made previously have not been adequately realized (Schrand and Zechman 2012).

The auditor, as an independent party providing assurance services for the company's financial statements, will conduct an audit risk assessment prior to conducting the audit work itself. An established evaluation on the "tone at the top" that concerning executive attitudes is an important thing since executive attitudes can influence the risk of the company through the shaping of the moral, ethical, and social cultures of the organization (COSO 2017). The appearance of managerial overconfidence in the firm can be interpreted by the auditor as something of concern. This may be the case when the auditor considers the impact of overconfidence to be an additional audit risk. Johnson *et al.* (2013) mentioned that a narcissistic attitude in a manager increases the audit risk assessment related to client fraud. The risk assessment for the audit is the initial stage when beginning the audit work. When the auditor considers that there is a high audit risk, the auditor will increase the audit effort in an effort to reduce the risk; the increased audit effort will then make the auditor file a higher audit fee in the expectation of the auditor needing to be capable of bearing increased audit efforts to reduce the detection risk in the audit work (Simunic 1980).

Through the existence of Sarbanes-Oxley (SOX) section 301, the roles and responsibilities of audit committees are increasing within companies. Furthermore, based on the legal framework in Indonesia, public companies are required to establish audit committees. The purpose of establishing an audit committee, according to the Indonesian Financial Services Authority (OJK) regulation number 55 year 2015, is to assist the board of commissioners or supervisory board in ensuring the effectiveness of the internal control system and the effectiveness of the external and internal auditor's duties. Its role includes making recommendations to the board on the appointment of the auditor, agreeing on any audit fees, reviewing the scope of the audit work, and reviewing the external auditor's independence. It is therefore necessary to also consider the association of the audit committee intervention with the effect between managerial overconfidence and audit fees.

In this research, we used 527 observations from 218 companies listed on the Indonesian Stock Exchange (IDX) for the 2014-2016 period. The data were then analyzed using univariate and multivariate analysis. The univariate analysis showed that a group of firms with an overconfident manager has significantly higher audit fee compared to a group without an overconfident manager. The regression results also support the prediction that managerial overconfidence has a positive association with audit fees. Furthermore, this study also demonstrates that a higher quality of audit committee members strengthens the relation between managerial overconfidence and audit fees. These findings are robust enough to be an alternative proxy of managerial overconfidence and robust standard error. Our results indicate that the auditor perceived managerial overconfidence as a factor that increased audit risk, resulting in imposing additional fees to compensate for the increased audit effort. Furthermore, the existence of a good quality audit committee in relation to managerial overconfidence will require a higher audit quality that results in higher audit fee.

This research contributes to the literature on managerial overconfidence in developing countries, especially Indonesia. The investigation in this study provides an understanding of how the aspects of biased behavior can affect audit costs. Not only that, in this literature, the importance of an audit committee's role in the company in relation to strengthening the relationship between managerial overconfidence and audit fee has also been highlighted. This study has the following structure: Section 2 describes the literature review; Section 3 details the methodology; Section 4 shows the empirical analysis and Section 5 is the conclusion of the study.

1. Literature review

1.1. Institutional background

1.1.1. Corporate governance in Indonesia

Indonesian body of laws provides substantial flexibility in establishing companies governance structure. The bodies required by Indonesian Company Law (ICL) UU 40/2007 do not relate to number shareholders the company has

or the amount of charter capital. Status of the company that is either public or private company is the only difference that has legal consequences for company's governance structure in Indonesia.

Public companies in Indonesia are required to have a general meeting of shareholders (GMS), a board of commissioners, a board of directors, an internal auditor, an external auditor, an audit committee, and a corporate secretary. Indonesia seems to use a two-tier board for the board model. The two tier model is characterized by the existence of both distinct supervisory latter called as Executive Board and management bodies. Under two tier system, the day-to-day company's managerial activity is handed down to the Executive Board, which is then monitored by the Supervisory Board which is elected by the GMS. These two bodies have different authorities and cannot be merged into one bodies. Based on Indonesian Financial Services Authority regulation number 55/POJK.04/2015, the audit committee established by and responsible to the board of commissioners to assist in carrying out the duties and functions of the board of commissioners. The Audit Committee is focused on oversee the financial reporting, risk management, and internal and external auditing in the company.

1.1.2. Audits in Indonesia

The annual financial statement of a public listed company must be audited by an independent public accountant or also called external auditor that has been registered with Indonesian Financial Service Authority (OJK). Based on ICL on article 68, an external auditor is a separate body of the company that elected by the GMS to conduct the audit, prepare the report and submit to the Board of Directors. Audits are conducted based on the auditing standards promulgated by the Indonesian Institute of Certified Public Accountants (IICPA). The existing standards are largely based on the Statements on Auditing Standards issued by the American Institute of Public Accountants.

The company settle up for the Auditing Company's services and paid audit fee as a return. The Audit Committee reviews the External Auditor's fees and submits its recommendation to the Board of Commissioners. The auditor and auditee may agree to apply one of the following methods of calculating the auditing service charge. The calculation method is calculating the rate based on working hours, for each auditing service with a package charge, based on rates at a percentage of the contract value, or calculated under multi-period audit contracts with a fixed charge rate for each period. Indonesia laws have not stipulated this stringently and clearly.

1.1.3. Hypotheses development

The level of audit fees set by the external auditor depends on several factors. Based on the audit pricing theory by Simunic (1980), an auditor's judgment on client risk determines the level of audit fees that they propose. Conceptually, an auditor's total expected cost is comprised of two elements: first is the cost of the resources allocated in the audit and the second is the estimated cost that may occur in terms of potential losses attributable to future litigations and/or reputational damage. A client's financial reporting risk is one of the risks that affect audit pricing. Poor financial reporting quality will increase the risks associated with financial reporting and the audit risk. The previous literature (Gul, Chen, and Tsui 2003) found there to be a positive association between earning management and audit fees. When the auditor considers this signal to be an audit risk, the auditor will increase the audit effort as well as the level of the proposed audit cost.

Managerial overconfidence is associated with perceptions of control: the perception of a person who has strong control over his actions beyond what actually happens (Stotz and Nitzsch 2005). This results in excessive optimism in a person over future outcomes since an overconfident manager tends to overstate his acumen relative to the average. Beavers and Mobbs (2019) also found that overconfident director exhibit significant influence on the board an over the firm's important decision such as firm's CEO selection. Previous research on managerial overconfidence suggests that an overconfident CEO undertakes higher investments, implying overinvestment and lower investment efficiency (Malmendier and Tate 2005), low dividend payout (Deshmukh, Goel, and Howe 2013) and poor internal control (Lee 2016). Aktas *et al.* (2019) found that CEO overconfidence associated in cash holding activities, He *et al.* (2019) propose a similar result where overconfident manager is tending to inclined the internal financing, it can also fund business opportunities and alleviate capital shortages but also cause an overinvestment.

The first argument is built upon the ability of the overconfident manager to negotiate the audit engagement. Nevertheless, Management has a significant role in the auditor appointment process and audit engagement negotiation (Beck and Mauldin 2014). The client often negotiates with the auditor about the audit plan, which include audit scope to arrive at lower audit fees (Emby and Davidson 1998). Overconfident managers tend to be optimistic about their competence, making them look more competent and capable than they actually are. This perception makes overconfident managers confident in their companies' financial reporting, with a tendency for them not to value the auditors' corrective feedback as much as non-overconfident managers. An overconfident manager will tend to negotiate on the audit's scope to try and achieve lower audit fees.

The other argument believes that the auditor considers the firms' risk when deciding on the audit pricing. Managerial overconfidence not only affects a company's financial and investment policies, but also the company's financial reporting policy (Hsieh *et al*. 2014). We argue that an overconfident manager tends to be optimistic about projects and the investments that they have made as a result. They will delay the loss recognition and show a lack of accounting conservatism. Furthermore, the over-optimistic attitude towards future returns also leads the manager to conduct earning management in order to meet the expectations of the profits that they have previously set. This argument is supported by previous studies that have documented how managerial overconfidence produces inefficient investment (Malmendier and Tate 2005), low accounting conservatism (Ahmed and Duellman 2012), undertaking earning management (Hsieh *et al*. 2014) and the restatement of financial statements (Presley and Abbott 2013). Furthermore, we argue that, when the auditor considers managerial overconfidence as an increasing financial reporting risk factor, the auditor will increase the audit effort and they will charge additional fees to compensate. Based on the above discussion, we propose a formal hypothesis as follows:

Hypothesis 1: Firms with overconfident managers have a positive effect on audit fees

Based on the legal framework in Indonesia, public companies are required to establish audit committees. The purpose of establishing audit committees, according to OJK Regulation 55/2015, is to assist the board of commissioners or supervisory board in ensuring the effectiveness of the internal control system and the effectiveness of both the external and internal auditors' duties. Specifically, the Ministry of State-Owned Enterprise regulation number 1/2011 in article 31 states that the audit committee has a duty to apply for a public accountant and the amount of honorarium proposed for the external auditor.

A widely accepted concept is that a high-caliber board has incentives to protect its reputation and to counter lawsuits (*e.g.* Fama and Jensen 1983). This general idea can be applied specifically to audit committees and their fellow members (*e.g.* Carcello, Hermanson, Neal, and Jr. 2002). Audit committee are also look to enhance the governance quality through building the quality of financial reporting and auditing (Cohen, Krishnamoorthy and Wright 2004; Turley and Zaman 2007). Further Bruynseels and Cardinaels (2014) find that financial expert on audit committee are related to higher demand of audit work as determined by audit fee.

Abbott *et al.* (2003) has shown that an independent and diligence audit committee will affect the audit fee in two ways. First, since audit committee tend to hire the best quality auditor, and if so, it will increase the audit fee. Second, is because they often influence the amount of effort spent by the auditor, through the audit committee's influence on the audit scope and plan. This consequently affects the audit cost. Komalasari and Suryanto (2018) found that audit committee and board characteristics are having significant relation with audit fee. Carcello *et al.* (2002) also found there to be a significant relationship between audit fees and board independence, diligence and expertise. Overall, the prior studies argue that firms with effective audit committees are willing to pay higher audit fees to insist on more work from auditors, supporting the demand-based perspective and to protect their reputation. Similarly, we might expect the presence of accounting experts on the audit committee to be positively associated with audit fees

This imply that an audit committee within the company will want a wider range of audits to ensure that financial statements have been properly and reasonably presented by management. This will cause additional audit work and lead to a higher audit fee. This indicates that in a company with an overconfident manager, a high quality audit committee will demand greater coverage from the external auditor to lessen the negative effect of managerial overconfidence. When this happens, it will lead to a positive relationship between managerial overconfidence and the audit fee.

Hypothesis 2: The high quality of the audit committee will strengthen the relationship between managerial overconfidence and the audit fee.

2. Methodology

2.1. Sample and data resources

The initial sample consisted of all firms listed on the Indonesian Stock Exchange (IDX) that are available in the ORBIS databases for the period 2014-2016. All of the financial data was obtained from ORBIS; the audit fee and audit committee data were hand collected from the company's annual reports. We imposed the following criteria for sample selection. First, due to the different nature of their financial statements, we excluded all firms in financial industries (Standard of Industry Classification (SIC) number 6). Second, we required there to be no missing data for all of the variables used in this study. After applying these criteria, we obtained 527 firm-years from 218 firms as our main sample.

2.1.1. Measurement of managerial overconfidence. Capital expenditure

According to Ben-david *et al* (2013), a company with an overconfident manager has higher capital expenditure than other companies in the same industry. In this study, managerial overconfidence was measured using a dummy variable. *OVERCONFIDENCE* was equal to 1 if the result of the capital expenditure divided by the total assets in the current year was higher than the industry median and 0 if the result was below the median. For our main analysis, we use the same Overconfidence measurement with the second overconfidence measurement called companies' investment decision in Duellman *et al.* (2015). We also provide additional analysis with different overconfidence measurement based on the third overconfidence measurement called Over-Investment on Duellman *et al* (2015) to prove that our measurement are robust. Unfortunately, we can't use the overconfidence measurement that based on the timing of stock option exercise since those data are not publicly available in Indonesia.

2.1.2. Measurement of the Strong Audit Committee

The audit committee characteristics such as audit committee independence and audit committee accounting education background affected the committee audit monitoring role. This study used a dummy variable to measure *AUDITCOM*; *AUDITCOM* was equal to 1 if it met at least three points out of the four criteria below.

Number of audit committee members

Based on OJK regulation number 55/2015, it has been stated that an audit committee should consist of at least three members from an independent committee and parties that are independent of the issuer and company. The previous literature (Albring, Robinson and Robinson 2014; Vafeas and Waegelein 2007) found that the number of audit committee members positively affects the audit fee. This criterion will be equal to 1 if the company's audit committee has more than three members.

Audit committee members' educational background

Based on OJK regulation number 55/2015, it has been stated that an audit committee should have at least one member with an accounting and finance educational background. The existence of a member with a financial accounting background will improve the supervision of management's relationships with the auditor as they know the processes involved and the importance of the audit procedures proposed by the auditor to minimize the audit risks emerging in the company (Abbott *et al.* 2003). This criterion will be equal to 1 if the company's audit committee has more than three members.

Proportion of independent commissioners on the audit committee

Independent commissioners are members of the board of commissioners who are not affiliated with the directors, other members of the board of commissioners and the controlling shareholder, and who are free from any business relationship or other relationship that may affect their ability to act independently or to act solely on behalf of the company. The OJK requires an independent commissioner within the audit committee. Audit committees consisting of independent commissioners and which meet more than four times a year have a significant relationship with the audit fee level. This is due to the demand for better audit quality to maintain their good name and reduce the likelihood of monetary losses (Abbott *et al.* 2003). An independent audit committee will be more objective in overseeing the financial reporting process. This will require a higher audit quality and an audit fee increase. This criterion will be assigned 1 if the company has more than one independent commissioner on its audit committee.

Audit committee meetings

Based on OJK regulation No. 55 year 2015, it has been stated that the audit committee in the company must have at least one meeting each quarter, or at least four meetings a year. Direct coordination and direct communication between the external auditors and audit committees enhances oversight through the knowledge of audit issues so that then the audit committees can act proactively in every audit coverage conducted by external auditors (Abbott, Parker and Peters 2004). In Abbott *et al.* (2003), the audit committees that conducted more than four meetings a year had an effect on the audit fee level. This variable will be assigned a value of 1 if the audit committee meets more than four times a year and 0 otherwise.

2.1.3. Measurement of the audit fee

The audit fee data (*AUDITFEE*) was obtained from the companies' annual reports on the "public accountant" or "external auditor" in the corporate governance section. The obtained data was transformed into a natural logarithm.

Audit Fee = Ln (AUDITFEE) (1)

Empirical model

We used the following OLS regression model to examine the association between audit fees and managerial overconfidence:

$AUDITFEE = \alpha + \beta_1 OVERCONFIDENCE + \beta_2 AUDITCOM + \beta_3 SUBSIDIARIES + \beta_4 SEGMENTS + \beta_5 ROA + \beta_6 OPINION + \beta_7 BIG + \beta_8 LEV + \beta_9 SIZE + \beta_{10} RECINV + \beta_{11} CASH + \beta_{12} GROWTH + \beta_{13} INDUSTRY + \beta_{14} YEAR + \varepsilon$ (2)

AUDITFEE is the natural logarithm of the audit fee. OVERCONFIDENCE is equal to 1 if the results of the capital expenditure divided by the total assets in the current year are higher than the industry median and 0 if the result is below the median. *AUDITCOM* is coded 1 if the sum of the following four dummy variables is equal to or greater than three: having more than three members; holding more than four meetings in a year; with more than one member currently serving as an independent commissioner and with more than one member with an accounting background. *SUBSIDIARIES* is the number of the firm's business subsidiaries. *SEGMENTS* are the firm's business segments. ROA is the return on asset before tax. *OPINION* is 1 if a modified audit opinion is issued, and is 0 otherwise. The BIG indicator variable has the value of 1 if the firm is audited by a Big 4 auditor and 0 otherwise. LEV is the total liabilities divided by the total assets of the client at the end of the fiscal year. *SIZE* is measured according to the company's total assets. RECINV is the proportion of the accounts receivable and inventory in relation to the total assets; *CASH* is cash and equivalents divided by the average total assets. *GROWTH* is the growth rate of the total assets.

We used a set of control variables consistent with the existing literature on the determinants of audit fees (*e.g.* Abbott *et al*. 2003; Duellman, Hurwitz and Sun 2015; Karim, Robin and Suh 2016; Simunic 1980). *BIG* and *Size* were the most dominant determinants of audit fees found in the literature. We used Segment and *Subsidiaries* to control for complexity, since companies with a higher level of complexity tend to pay higher audit fees (Simunic 1980). *ROA* serves as a control as profitability may reduce the audit risk (Hay, Knechel and Wong 2006). We controlled for the inherent risk according to the current assets held by the company, so we used *Recinv* and *Cash* (Duellman *et al*. 2015). We used *Opinion* as a control variable since the auditor's opinion is used to figure out the business complexity and client audit risk (Bell *et al*. 2001, Johl *et al*. 2012,. Lee and Mande 2005, Xie *et al.* 2010). We controlled for client business risk by adding *Growth* and *Leverage* as control variables (Duellman *et al*. 2015, Karim *et al*. 2016). Finally, we included the year and industry indicators to control for time and industry effects. The measurement is summarized in the Appendix.

3. Empirical analysis

3.1 Descriptive statistics

Table 1 shows the distribution of samples based on the industry and Table 2 shows the distribution of samples based on year. Before processing the data to perform descriptive statistics, we first winsorized the data. Winsorizing was done to overcome the data containing outliers by transforming the lowest outlier data to a 1% level and the highest data outliers to a 99% level. The results of the statistical analysis performed using STATA after winsorizing the data have been shown in Table 1.

Table 1. Firm distribution based on industry

SIC Code	Industry	Observation	Percentage
0	Agriculture, Forestry, Fishing	29	6%
1	Mining and Construction	82	16%
2	Manufacturing	165	31%
3	Manufacturing	97	18%
4	Transportation and Public Utilities	81	15%
5	Wholesale Trade	38	7%
7	Retail Trade	26	5%
8	Services	9	2%
Total		527	100%

Table 2. Observation distribution based on year

Year	Observation	Percentage
2014	157	30%
2015	172	33%
2016	198	38%
Total	527	100 %

Note: This table presents observation distribution based on year

Based on Table 3, it is known that the highest *AUDITFEE* value was 40,000,000,000 while the lowest was 46.750.000. *OVERCONFIDENCE* is a dummy variable and shows an average value of 0.51. This means that 51% of the sample represents firms with managerial overconfidence. The *AUDITCOM* variable showing the audit committee characteristics has an average value of 0.047. This means that only 4.7% of the samples have three or more of the following audit committee criteria: more than one independent commissioner, more than one member with an accounting background, more than three members and more than four meetings a year.

Table 3. Descriptive statistics

Variable	Mean	Median	Minimum	Maximum
AUDITFEE	1.944.000.000	787.300.000	46.750.000	40.000.000.000
OVERCONFIDENCE	0.510	1.000	0.000	1.000
AUDITCOM	0.047	0.000	0.000	1.000
SUBSIDIARIES	10.560	5.000	0.000	168.000
SEGMENTS	3.843	4.000	2.000	8.000
ROA	5.363	4.130	-17.910	49.770
OPINION	0.008	0.000	0.000	1.000
BIG	0.452	0.000	0.000	1.000
LEV	0.487	0.479	0.069	1.184
TOTASSET	11.400.000.000.000	3.487.000.000.000	46.760.000.000	261.900.000.000.000
RECINV	0.267	0.230	0.006	0.785
CASH	0.102	0.068	0.001	0.412
GROWTH	0.106	0.062	-0.285	1.346

Note: This table presents statistic descriptive for all variable in this study.

3.2. Main analysis

3.2.1. Pearson correlation

Based on the results of the Pearson correlation test shown in Table 4, it can be seen that there is a positive and significant relationship between managerial overconfidence (*OVERCONFIDENCE*) and audit fee value with a 1% significance level. This gives the indication that firms with management overconfidence will have higher audit fee levels compared to companies without overconfident management.

Table 4. Pearson correlation

	AUDITFEE	OVERCONFIDENCE	AUDITCOM	SUBSIDIARIES	SEGMENTS	ROA	OPINION	BIG	LEV	SIZE	RECINV	CASH	GROWTH
AUDITFEE	1.000												
OVERCONFIDENCE	0.249***	1.000											
	(0.000)												
AUDITCOM	0.302***	0.058	1.000										
	(0.000)	(0.185)											
SUBSIDIARIES	0.409***	0.035	0.347***	1.000									
	(0.000)	(0.420)	(0.000)										
SEGMENTS	0.288***	0.014	0.253***	0.288***	1.000								
	(0.000)	(0.747)	(0.000)	(0.000)									
ROA	0.174***	0.253***	0.050	-0.010	0.052	1.000							
	(0.000)	(0.000)	(0.248)	(0.823)	(0.232)								
OPINION	-0.019	-0.046	-0.020	-0.042	-0.066	-0.099**	1.000						
	(0.659)	(0.296)	(0.655)	(0.333)	(0.130)	(0.023)							
BIG	0.547***	0.179***	0.138***	0.233***	0.117***	0.270***	-0.079*	1.000					
	(0.000)	(0.000)	(0.001)	(0.000)	(0.007)	(0.000)	(0.069)						
LEV	0.119***	-0.094**	0.019	-0.009	0.072	-0.323***	0.058	-0.087**	1.000				
	(0.006)	(0.030)	(0.658)	(0.831)	(0.101)	(0.000)	(0.183)	(0.046)					
SIZE	0.723***	0.250***	0.270***	0.416***	0.364***	0.089**	0.012	0.411***	0.168***	1.000			
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.041)	(0.788)	(0.000)	(0.000)				
RECINV	-0.218***	-0.144***	-0.041	-0.199***	0.111**	0.209***	-0.060	-0.061	-0.028	-0.368***	1.000		
	(0.000)	(0.001)	(0.350)	(0.000)	(0.011)	(0.000)	(0.169)	(0.163)	(0.516)	(0.000)			
CASH	0.105**	0.141***	0.036	0.019	0.099**	0.414***	-0.082*	0.084*	-0.359***	0.081*	-0.047	1.000	
	(0.016)	(0.001)	(0.413)	(0.662)	(0.022)	(0.000)	(0.060)	(0.054)	(0.000)	(0.064)	(0.285)		
GROWTH	-0.010	0.229***	-0.029	-0.035	0.005	0.134***	-0.040	-0.092**	0.016	0.096**	-0.051	0.141***	1.000
	(0.819)	(0.000)	(0.504)	(0.426)	(0.916)	(0.002)	(0.359)	(0.034)	(0.720)	(0.028)	(0.239)	(0.001)	

Notes: This table presents regression results for managerial overconfidence on audit fee, from 527 observations for companies listed on IDX from 2014-2016. AUDITFEE is the natural logarithm of audit fee. OVERCONFIDENCE is equal to 1 if the result of capital expenditure divided by total assets on the current year was higher than the industry median and 0 if the result was below than the median. AUDITCOM is coded 1 if the sum of the following four dummy variables is equal to or greater than three: having more than three members; holding more than four meetings in a year; more than one member currently serving as an independent commissioner; more than one member with accounting background. SUBSIDIARIES the number of firm's business subsidiaries. SEGMENTS the number of firm's business segments. ROA is return on asset before tax. OPINION is 1 if a modified audit opinion is issued, 0 otherwise. BIG indicator variable takes the value of 1 if a firm is audited by a Big 4 auditor and 0 otherwise. LEV is total liabilities divided by total assets for the client at the end of the fiscal year. SIZE is measured from the company's total assets. RECINV is the proportion of accounts receivable and inventory in total assets; CASH is cash and equivalents divided by average total assets. GROWTH is growth rate of total assets. Significant at 10%, 5% and 1%

3.2.2. Independent T-test

Table 5 shows that the average audit fee for firms with overconfident managers is higher than those without overconfident managers. For the variables showing the audit committee characteristics of the *AUDITCOM* variable, firms with higher managerial overconfidence show no significant differences over the mean in the category of firms with and without management overconfidence.

Table 5. Firm characteristics

Variables	Firms with overconfidence manager	Firms with non-overconfidence manager	Coefficient	t-value
AUDITFEE	20.809	20.211	0.598***	5.879
AUDITCOM	0.059	0.035	0.025	1.327
SUBSIDIARIES	11.152	9.942	1.211	0.807
SEGMENTS	3.862	3.822	0.041	0.323
ROA	7.924	2.692	5.232***	5.991
OPINION	0.004	0.012	-0.008	-1.045
BIG	0.539	0.360	0.179***	4.178
LEV	0.467	0.508	-0.042**	-2.175
SIZE	29.303	28.566	0.737***	5.914
RECINV	0.240	0.296	-0.057***	-3.335
CASH	0.115	0.088	0.028***	3.261
GROWTH	0.158	0.052	0.106***	5.395

The table above presents firm characteristics results for research variables used in this study. *AUDITFEE* is the natural logarithm of audit fee. *OVERCONFIDENCE* is equal to 1 if the result of capital expenditure divided by total assets on the current year was higher than the industry median and 0 if the result was below than the median. *AUDITCOM* is coded 1 if the sum of the following four dummy variables is equal to or greater than three: having more than three members; holding more than four meetings in a year; more than one member that currently serves as an independent commissioner; more than one member with an accounting background. *SUBSIDIARIES* the number of firm's business subsidiaries. *SEGMENTS* the number of firm's business segments. ROA is return on asset before tax. *OPINION* is 1 if a modified audit opinion is issued, 0 otherwise. BIG indicator variable takes the value of 1 if a firm is audited by a Big 4 auditor and 0 otherwise. LEV is total liabilities divided by total assets for a client at the end of the fiscal year. *SIZE* is measured from a company's total assets. RECINV is the proportion of accounts receivable and inventory in total assets; *CASH* is cash and equivalents divided by average total assets. *GROWTH* is growth rate of total assets.

3.2.3. Results of regression

Table 6 shows the results of the regression between managerial overconfidence and the control variables on the audit fee level. The first column shows ordinary least square regression test results while the second column shows OLS regression using robust. In the first column, OLS regression for *OVERCONFIDENCE* with audit fee shows a coefficient of 0.172 and a t-value of 2.40, significant at 5%. This result means that every 1-point increase in managerial overconfidence leads to an audit fee increase by 0.172. In the second column, OLS robust regression for *OVERCONFIDENCE* with an audit fee was done; the result shows a coefficient of 0.172 and a t-value of 2.26, significant at 5%.

$$AUDITFEE = \alpha + \beta_1 OVERCONFIDENCE + \beta_2 AUDITCOM + \beta_3 SUBSIDIARIES + \beta_4 SEGMENTS + \beta_5 ROA + \beta_6 OPINION + \beta_7 BIG + \beta_8 LEV + \beta_9 SIZE + \beta_{10} RECINV + \beta_{11} CASH + \beta_{12} GROWTH + \beta_{13} INDUSTRY + \beta_{14} YEAR + \varepsilon \quad (3)$$

Table 6. Regression results of managerial overconfidence on audit fee

Variables	Predicted Sign	Dependent variable: *AUDITFEE*	
		OLS regression	Robust regression
OVERCONFIDENCE	+/-	0.172**	0.172**
		(2.40)	(2.26)
AUDITCOM	+/-	0.480***	0.480**
		(2.83)	(2.42)
SUBSIDIARIES	+	0.008***	0.008***
		(3.35)	(3.89)
SEGMENTS	+	0.003	0.003

Variables	Predicted Sign	Dependent variable: *AUDITFEE*	
		OLS regression	Robust regression
		(0.12)	(0.12)
ROA	+	0.006	0.006
		(1.54)	(1.44)
OPINION	+	0.197	0.197
		(0.52)	(0.46)
BIG	+	0.681***	0.681***
		(8.88)	(9.34)
LEV	+	0.573***	0.573***
		(3.35)	(3.51)
SIZE	+	0.403***	0.403***
		(12.53)	(12.16)
RECINV	+	0.126	0.126
		(0.58)	(0.60)
CASH	+	0.757*	0.757
		(1.93)	(1.62)
GROWTH	+/-	-0.305**	-0.305*
		(-1.99)	(-1.65)
CONSTANT		8.200***	8.200***
		(9.18)	(8.84)
Industry Dummies		*Included*	*Included*
Year Dummies		*Included*	*Included*
R-squared		0.637	0.637
N.		527	527

Table 6 presents regression results for managerial overconfidence on audit fee, from 527 observations for companies listed on IDX from 2014-2016. *AUDITFEE* is the natural logarithm of audit fee. *OVERCONFIDENCE* is equal to 1 if the result of capital expenditure divided by total assets on the current year was higher than the industry median and 0 if the result was below than the median. *AUDITCOM* is coded 1 if the sum of the following four dummy variables is equal to or greater than three: having more than three members; holding more than four meetings in a year; more than one member currently serving as an independent commissioner; more than one member with accounting background. *SUBSIDIARIES* the number of firm's business subsidiaries. *SEGMENTS* the number of firm's business segments. ROA is return on asset before tax. *OPINION* is 1 if a modified audit opinion is issued, 0 otherwise. BIG indicator variable takes the value of 1 if a firm is audited by a Big 4 auditor and 0 otherwise. LEV is total liabilities divided by total assets for the client at the end of the fiscal year. *SIZE* is measured from the company's total assets. RECINV is the proportion of accounts receivable and inventory in total assets; *CASH* is cash and equivalents divided by average total assets. *GROWTH* is growth rate of total assets. Significant at 10%, 5% and 1%.

Table 7 shows the regression results for the interaction between managerial overconfidence and strong audit committee characteristics on audit fee. The OLS result shows a coefficient of 0.854 and a t-value of 2.64 with a significance level of 1%. This result demonstrates that for every 1-point increase in *OVERCONFIDENCE_AUDITCOM* the audit fee will increase equal to 0.854. In the robust test, the coefficient shows as 0.854 with a t-value of 2.95, significant at 1%.

AUDITFEE = α + β_1OVERCONFIDENCE+ β_2OVERCONFIDENCE_AUDITCOM + β_3AUDITCOM + β_4SUBSIDIARIES + β_5SEGMENTS+β_6ROA + β_7OPINION + β_8BIG + β_9LEV + β_{10}SIZE + β_{11}RECINV + β_{12}CASH + β_{13}GROWTH + β_{14}INDUSTRY+ β_{15}YEAR+ ε (4)

Table 7. Regression results of interaction between managerial overconfidence and strong audit committee on audit fee

Variables	Predicted Sign	Dependent variable: AUDITFEE	
		OLS regression	Robust regression
OVERCONFIDENCE_AUDITCOM	+	0.854***	0.854***
		(2.64)	(2.95)
OVERCONFIDENCE	+/-	0.136*	0.136*
		(1.87)	(1.77)
AUDITCOM	+/-	-0.077	-0.077
		(-0.29)	(-0.44)

Variables	Predicted Sign	Dependent variable: AUDITFEE	
		OLS regression	Robust regression
SUBSIDIARIES	+	0.009***	0.009***
		(3.74)	(3.99)
SEGMENTS	+	0.002	0.002
		(0.06)	(0.07)
ROA	+	0.006	0.006
		(1.51)	(1.41)
OPINION	+	0.207	0.207
		(0.55)	(0.47)
BIG	+	0.691***	0.691***
		(9.05)	(9.62)
LEV	+	0.555***	0.555***
		(3.26)	(3.43)
SIZE	+	0.400***	0.400***
		(12.51)	(12.17)
RECINV	+	0.164	0.164
		(0.76)	(0.78)
CASH	+	0.739*	0.739
		(1.89)	(1.58)
GROWTH	+/-	-0.293*	-0.293
		(-1.92)	(-1.60)
CONSTANT		8.286***	8.286***
		(9.32)	(9.00)
Industry Dummies		Included	Included
Year Dummies		Included	Included
R-squared		0.642	0.642
N		527	527

The table above presents regression results for managerial overconfidence on audit fee. From 527 observations for companies listed on IDX from 2014-2016. *AUDITFEE* is the natural logarithm of audit fee. *OVERCONFIDENCE* is equal to 1 if the result of capital expenditure divided by total assets on the current year was higher than the industry median and 0 if the result was below than the median. *AUDITCOM* is coded 1 if the sum of the following four dummy variables is equal to or greater than three: having more than three members; holding more than four meetings in a year; more than one member currently serving as an independent commissioner; more than one member with an accounting background. *OVERCONFIDENCE_AUDITCOM* is the interaction between Overconfidence and Auditcom variables. *SUBSIDIARIES* the number of firm's business subsidiaries. *SEGMENTS* the number of firm's business segments. ROA is return on asset before tax. *OPINION* is 1 if a modified audit opinion is issued, 0 otherwise. BIG indicator variable takes the value of 1 if a firm is audited by a Big 4 auditor and 0 otherwise. LEV is total liabilities divided by total assets for a client at the end of the fiscal year. *SIZE* is measured from company's total assets. RECINV is proportion of accounts receivable and inventory in total assets; *CASH* is cash and equivalents divided by average total assets. *GROWTH* is growth rate of total assets. Significant at 10%, 5% and 1%.

3.3. Additional analysis. Regression of managerial overconfidence with overinvestment as the Proxy

We used overinvestment as the second proxy of overconfidence that originated from Duellman *et al.* (2015). Overinvestment was measured by calculating any residuals from the regression of investment to lagged sales growth for each year and industry with at least 20 observations per year for each industry respectively. Investment is defined as the sum of capital expenditure, research and development costs and the difference between revenue and expenditure on plant and equipment properties divided by the total assets in the previous year. The *OVERCONFIDENCE2* variable will be equal to 1 if the residual result of the investment regression and sales growth is in the top quartile for the industry and the year of observation, and 0 if otherwise. Due to regressing the *OVERCONFIDENCE2* data, the original sample fell to 425 observations. This happened because several industries (SIC 0, 5, 6, 7, 8) did not consist of the minimum 20 observations in a year.

Table 8 shows that both proxies of managerial overconfidence show a positive and significant relationship with the audit fee. *OVERCONFIDENCE2* positively affected the audit fee with a significance level of 5% for both

OLS and robust OLS. OVERCONFIDENCE also positively affected the audit fee with a significance level of 1% for both OLS and robust OLS. This result shows that both measurements of overconfidence indicate that the existence of managerial overconfidence in a company will increase the audit fee paid by the company to the auditor.

$$AUDITFEE = \alpha + \beta_1 OVERCONFIDENCE + \beta_2 AUDITCOM + \beta_3 SUBSIDIARIES + \beta_4 SEGMENTS + \beta_5 ROA + \beta_6 OPINION + \beta_7 BIG + \beta_8 LEV + \beta_9 SIZE + \beta_{10} RECINV + \beta_{11} CASH + \beta_{12} GROWTH + \beta_{13} INDUSTRY + \beta_{14} YEAR + \varepsilon \quad (5)$$

Table 8. Regression for managerial overconfidence on audit fee (2 Proxy)

Variable	Predicted Sign	Dependent variable: *AUDITFEE*		Dependent variable: *AUDITFEE*	
		OLS regression	Robust regression	OLS regression	Robust regression
OVERCONFIDENCE	+/-	0.229***	0.229***		
		(2.89)	(2.73)		
OVERCONFIDENCE2	+/-			0.201**	0.201**
				(2.30)	(2.07)
AUDITCOM	+	0.505***	0.505**	0.478**	0.478**
		(2.70)	(2.24)	(2.55)	(2.06)
SUBSIDIARIES	+	0.008***	0.008***	0.008***	0.008***
		(3.30)	(3.85)	(3.27)	(3.78)
SEGMENTS	+	0.000	0.000	0.005	0.005
		(0.00)	(0.00)	(0.16)	(0.16)
ROA	+	0.007	0.007	0.009*	0.009*
		(1.62)	(1.48)	(1.95)	(1.80)
OPINION	+	0.171	0.171	0.187	0.187
		(0.45)	(0.42)	(0.49)	(0.48)
BIG	+	0.689***	0.689***	0.689***	0.689***
		(8.04)	(8.50)	(8.01)	(8.39)
LEV	+	0.693***	0.693***	0.665***	0.665***
		(3.60)	(3.76)	(3.45)	(3.68)
SIZE	+	0.427***	0.427***	0.443***	0.443***
		(12.12)	(12.07)	(12.74)	(12.68)
RECINV	+	0.138	0.138	0.152	0.152
		(0.56)	(0.55)	(0.61)	(0.61)
CASH	+	0.781*	0.781	0.782*	0.782
		(1.85)	(1.56)	(1.85)	(1.57)
GROWTH	+	-0.542***	-0.542**	-0.545***	-0.545**
		(-2.72)	(-2.27)	(-2.69)	(-2.33)
CONSTANT		7.128***	7.128***	6.717***	6.717***
		(7.33)	(7.36)	(6.98)	(6.98)
Year dummy		*Included*	*Included*	*Included*	*Included*
Industry dummy		*Included*	*Included*	*Included*	*Included*
R-squared		0.674	0.674	0.672	0.672
N		425	425	425	425

This table presents regression results for managerial overconfidence by overinvestment for its proxy on audit fee. From 425 observations for companies listed on IDX from 2014-2016. AUDITFEE is the natural logarithm of audit fee. OVERCONFIDENCE is equal to 1 if the result of capital expenditure divided by total assets on the current year was higher than the industry median and 0 if the result was below than the median. OVERCONFIDENCE2 is equal to 1 if the residual result of the investment regression and sales growth are in the top quartile for the industry and the year of observation, and 0 if otherwise. AUDITCOM is coded 1 if the sum of the following four dummy variables is equal to or greater than three: having more than three members; holding more than four meetings in a year; more than one member currently serving as an independent commissioner; more than one member with an accounting background. SUBSIDIARIES the number of firm's business subsidiaries. SEGMENTS   the number of firm's business segments. ROA is return on asset before tax. OPINION is 1 if a modified audit opinion is issued, 0 otherwise. BIG indicator variable takes the value of 1 if a firm is audited by a Big 4 auditor and 0 otherwise. LEV is total liabilities divided by total assets for the client at the end of the fiscal year. SIZE is measured from company's total assets. RECINV is proportion of accounts receivable and inventory in total

assets; CASH is cash and equivalents divided by average total assets. GROWTH is growth rate of total assets. Significant at 10%, 5% and 1%.

Conclusion

The previous literature indicates that an overconfident manager tends to be optimistic about future projects/investment returns and underestimates any bad possibilities (Heaton 2002, Malmendier and Tate 2005). When their optimism does not meet with the actual results, the manager will tend to manipulate the financial statements and perform earning management for certain purposes, such as realizing the previous expectations (Hsieh *et al.* 2014, Schrand and Zechman 2012). When the auditor perceived managerial overconfidence as a factor that increases the auditor's audit risk, they will increase the audit effort. This leads to an increase in the audit fees, caused by an increased cost to cover the increased audit work.

On the other hand, the determination of the audit fees is not solely between the managers and auditors. Indonesian Financial Services Authority (OJK) regulation number 55 year 2015 has defined the roles and responsibilities of the audit committees within companies. The purpose of establishing the audit committee is to ensure the effectiveness of the internal control system and the effectiveness of the external and internal auditor's duties. The audit committee therefore participate in agreeing the audit fee that will be paid by the company.

This study indicates that auditors perceive managerial overconfidence to be a factor that increases audit risk, leading the auditor to improve their audit efforts which then leads to an increase in the audit fees caused by the increased costs to cover the audit work needed. This result in line with Mitra *et al.* (2019) with the supply side argument where overconfident manager poses higher reporting risk and audit risk, and it give rise auditor to engage higher audit quality to mitigate the audit failure and it poses a higher audit fee. Meanwhile, the existence of an audit committee with three or more of the following audit committee criteria - having more than one independent commissioner, having more than one member with an accounting background, consisting of more than three people and conducting more than four meetings every year at the company and managerial overconfidence - did not mitigate the relationship between the two but strengthened the influence of managerial overconfidence on the audit fee. This arises because experienced audit committee members and auditors both play important monitoring roles in increasing audit quality and in turn financial reporting quality (Sultana *et al.* 2019). The audit committee is likely to choose the best external auditor and will want a wide range of audit work conducted for the benefit of the company (Abbott *et al.* 2003, Carcello *et al.* 2002).

Acknowledgements:

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Appendix

Variable	Variable name	Definition	Data Source
Audit Fee	*AUDITFEE*	The natural logarithm of audit fee.	Annual Report (AR)
Managerial overconfidence	*OVERCONFIDENCE*	Dummy Variable, equal to 1 if the result of the capital expenditure divided by the total assets in the current year was higher than the industry median and 0 if the result was below the median.	Wall street; ORBIS; Financial Report (FR)
	OVERCONFIDENCE2	Dummy Variable, equal to 1 if the residual results of the investment regression and sales growth are in the top quartile for the industry and the year of observation, and 0 if otherwise.	Wall street Journal
Audit Committee	*AUDITCOM*	Coded 1 if the sum of the following four dummy variables is equal to or greater than three: 1. having more than three members; 2. holding more than four meetings in a year; 3. more than one member currently serving as an independent commissioner; 4. more than one member with an accounting background.	AR
Subsidiaries	*SUBSIDIARIES.*	The number of the firm's business subsidiaries.	AR
Segments	*SEGMENTS*	The number of the firm's business segments	AR
ROA	*ROA*	return on asset before tax	ORBIS
Audit Opinion	*OPINION*	Dummy Variable, coded 1 if 1 if a modified audit opinion is issued, 0 otherwise.	ORBIS
Size of External Auditor	*BIG*	Dummy Variable, coded 1 if a firm is audited by a Big 4 auditor (EY, KPMG, PWC, Deloitte) and 0 if otherwise	AR
Leverage	*LEV*	Total liabilities divided by the total assets of the client at the end of the fiscal year	ORBIS
Firm Size	*SIZE*	Natural logarithm of the company's total assets	ORBIS
Cash	*CASH*	Cash and equivalents divided by the average total assets	ORBIS
Inventory and Receivable	*RECINV*	Proportion of the accounts receivable and inventory in the context of total assets	ORBIS
Asset Growth	*GROWTH*	Growth rate of the total assets	ORBIS

The Impact of Thin Capitalization on Effective Tax Rate of Companies Listed on Indonesia Stock Exchange in 2009-2017

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Abstract:

This article elaborates the impact of debt-to-equity ratio policy, which is effective from Fiscal Year 2016, on effective tax rate of companies listed on Indonesia Stock Exchange (IDX) from 2009 to 2017. This study will try to find out whether debt-to-equity ratio policy can change company's debt ratio and company's effective tax rate or not. It will also try to find out the impact of debt-to-equity on effective tax rate in general. In this study, descriptive quantitative design was employed. The study result shows that there is no significant change in debt-to-equity ratio or effective tax rate after the implementation of debt-to-equity ratio policy. Moreover, it is found out that debt-to-equity ratio does not have significant impact on effective tax rate.

Keywords: thin capitalization rule; debt to equity ratio; effective tax rate

JEL Classification: G30; G38

Introduction

The limitation on debt and financial payments is one regulation that was motivated by tax avoidance practice in the form of thin capitalization, where corporation is heavily capitalized by debt claims. Corporations tend to be financed through a relatively high level of debt compared to equity. This condition is usually encouraged by tax issues. With high level of debt, corporations have to pay interest on their debts. According to tax regulation in Indonesia, interest payments are expenses that are deductible in computing taxable income. In other words, the higher the level of debt in a company, and thus amount of interest it pays, the lower will be its taxable profit. Later, minister of finance of Indonesia issued Minister of Finance Regulation No. 169/PMK.010/2015 (PMK-169) on Debt-to-Equity Ratio (DER) which also revoked two previous regulations addressing the same problem. Under the DER regulations, the ratio applicable is 4:1. Any borrowing costs in excess of liability over the 4:1 DER will be permanently disallowed as a deductible expense.

Tax avoidance using thin capitalization scheme will impact on lower tax imposition. In measuring tax avoidance, one aspect that can be considered is corporation's effective tax rate (ETR). Effective tax rate for corporation is basically the average tax rate a corporation pays on its pre-tax profits (Hanlon and Heitzman 2010, 139). Effective tax rate of corporation is a variable that is directly related to DER issues because higher interest expense will directly impact on ETR.

Studies conducted by Taylor and Richardson (2012), Rodriguez and Arias (2013), Isgiyarta (2014), Blouin (2014), and Irianto *et al.* (2017), have analyzed the impact of DER on ETR. All those studies have found out that

DER does have an impact on ETR, positively or negatively. Besides DER, there are other variables or factors that affect ETR of a corporation, such as Cost of Debt (CoD), profitability (which is determined using ROA), firm size (SIZE), capital intensity (CAPINT), and inventory intensity (INVINT). The impact of those variables on ETR has been studied by several researchers. One of those researchers was Isgiyarta (2014), who has studies the impact of cost of debt on ETR. However, in the study of Isgiyarta (2014), it has been found that cost of debt does not have any impact on ETR. Besides cost of debt, based on the study conducted by Rodriguez and Arias (2013), Isgiyarta (2014), Zaina (2017), and Irianto *et al.* (2017), it is found out that DER does have an impact on ETR, both positively and negatively. Meanwhile, SIZE variable, according to studies conducted by Rodriguez and Arias (2013), Zaina (2017), and Irianto *et al.* (2017), has impact on ETR. Capital intensity and inventory intensity are indicated to have impact on ETR as well. Those three studies have also found out that inventory intensity has negative impact on ETR.

Based on studies mentioned above, author was interested in conducting study with the title "The Impact of Thin Capitalization Rule on Effective Tax Rate of Companies Listed on Indonesia Stock Exchange (IDX) from 2009 to 2017". This study will focus on elaborating the chance of PMK No. 169/PMK.010/2015 in changing DER and ETR pattern in corporations. Moreover, this study will also analyze the impact of DER on ETR of companies listed on Indonesia Stock Exchange (IDX) from 2009 to 2017. From the main issues addressed in this study, research questions are formulated as follow:

- Is there any difference in DER (Debt to Equity Ratio) of companies listed on Indonesia Stock Exchange before and after the implementation of PMK No. 169/PMK.010/2015 (from 2014-2015 and 2016-2017)?
- Is there any difference in ETR (Effective Tax Rate) of companies listed on Indonesia Stock Exchange before and after the implementation of PMK No. 169/PMK.010/2015 (from 2014-2015 and from 2016-2017)?
- How is the impact of DER (Debt to Equity Ratio), CoD (Cost of Debt), profitability (which is determined using RoA), SIZE (firm size), Capital Intensity (CAPINT), and Inventory Intensity (INVINT) on ETR (Effective Tax Rate) of companies listed on IDX from 2009-2017 before and after the implementation of PMK No.169/PMK.10/2015?

The purposes of this study are:
- to analyze the difference in DER (Debt to Equity Ratio) of companies listed on IDX from 2009 to 2017 before and after the implementation of PMK No. 169/PMK.010/2015;
- to analyze the difference in ETR (Effective Tax Rate) and DER (Debt to Equity Ratio) of companies listed on IDX from 2009 to 2017 before and after the implementation of PMK No. 169/PMK.010/2015;
- to describe the impact of DER (Debt to Equity Ratio), CoD (Cost of Debt), profitability (which is determined by using RoA), SIZE (firm size), capital intensity (CAPINT), and inventory intensity (INVINT), on ETR of companies listed on IDX from 2009 to 2017 before and after the implementation of PMK No. 169/PMK.010/2015.

1. Literature review

1.1. Tax and financing structure

Several studies have associated financing structure with tax. There are three initial theories that can be employed as basis to understand the relation between financing structure and tax, *i.e.,* Modigliani and Miller's second theorem (1963), trade-off theory, and Pecking order theory.

Modigliani and Miller's second theorem (1963), in Miller and Oats (2014), has assumed that cost of borrowing is deductible and dividends cannot become the subtrahend. In other words, companies with higher level of debt will be more valuable because of tax shield. Therefore, based on Modigliani and Miller's theorem, tax can distort preference for financing structure, where financing through debt is considered more profitable than through equity (Ryan 2007, 198).

The second theory, trade-off theory, discusses the idea that can be chosen by corporation in determining between debt or equity financing and how to balance those two financing choices in order to gain maximum outcome (Eckbo 2008). Thus, according to this theory, the best way is to seek balance between debt financing and optimum point.

The last basic theory is Pecking order theory. This theory suggests that corporation had better assess internal financing in advance. Internal financing is financing through retained earnings. This theory states that in financing, there should be a hierarchy. Thus, according to this theory, debt financing had better be chosen when corporation is in need the most. If debt financing cannot be avoided, corporation should choose low-risk debt first.

1.2. Thin capitalization rule

Thin capitalization rule is often applied to limit the amount of interest that can be deducted in calculating the measure of a company's profit for tax purposes (OECD, 2012). Several countries might apply different approaches to address this issue. Two approaches generally applied are:

- The arms' length approach. Under this approach, the maximum amount of allowable debt is the amount of debt that an independent lender would be willing to lend to the company. If the amount paid by the dependent party is the same as the amount that the independent party has lent, the amount is considered "allowable";
- The "ratio" approach. Under this approach, the maximum amount of debt on which interest may be deducted for tax purposes is established by a pre-determined ratio, such as the ratio of debt to equity. The ratio or ratios used may or may not be intended to reflect "allowable" state of company's debt.

1.3. Effective tax rates

Effective tax rate has been generally discussed in several studies and has been perceived by many companies. Effective tax rate itself is tax rate corporations must pay. The amount of ETR can increase or decrease, depending on the activity of company. There have been several studies that used ETR as research variable, such as studies conducted by Zaina (2017), Saragih (2017), Isgiyarta (2014), Dyreng (2008), *etc*. It can be said that ETR is generated from tax regulations that nteract with each other, for example, tax rate in certain jurisdiction, facilities provided by government, tax reduction, international taxation, and so on (Giannini and Maggiulli 2002). Effective tax rate is calculated by dividing tax liability with pre-tax income.

$$ETR = \frac{measure\ of\ tax\ liability}{measure\ of\ pre-tax\ income} \tag{1}$$

In calculating tax liability, total tax burden, current tax burden, or cash tax expense can be used. One of ETR types is GAAP ETR or ETR which is usually reported by companies in their financial reports (Dyreng S.D. 2008). Characteristic of GAAP ETR is that GAAP ETR uses annual data. Moreover, tax expense in GAAP ETR is the combination between current tax expense and deferred tax expense (Dyreng 2008). If tax rate is negative, GAAP ETR might be distorted, so that in doing research on GAAP ETR, company with negative value should be excluded in advance (Gebhart 2017). Nevertheless, GAAP ETR is a type of measurement that is often applied because it consists of comparison between total tax expense and pre-tax income. GAAP ETR can be formulated as follows:

$$GAAP\ ETRit = \frac{Tax\ Expense_{it}}{Pre-tax\ Income_{it}} \tag{2}$$

There are other types of ETR that can be used in studies, but still GAAP ETR is the most commonly used because it is available on company's financial reports. As mentioned earlier, several researchers have used ETR as variable in their studies. In general, ETR is measurement of comparison between tax liability and pre-tax income.

2. Methodology

2.1. Research approach

The approach used in this research is quantitative approach. Quantitative approach is an approach that is applied to test a theory by observing the relation between variables (Creswell 2014). Quantitative approach, according to Neuman (2006), is a method that is composed to combine deductive logic with empirical observations of individual behavior, aimed to find and confirm a series of possible causes that later can be used to generalize human activities.

2.2. Data collection

Population of this study was companies listed on the Indonesia Stock Exchange from 2009 to 2017. Purposive sampling was applied after some considerations about companies that were chosen as sample. Criteria of sample are:

- Companies are listed on the IDX and are not excluded from implementation of PMK 169/PMK.10 /2015;
- Companies should publish complete annual financial reports from 2009 to 2017;
- Companies do not have negative ETR and negative DER.

In taking samples, author adjusted to each research purpose. The first research purpose is to find out the difference(s) in DER before and after the implementation of PMK No. 169/PMK.010/2015. To address this purpose, the sample used was all companies listed on IDX from 2014 to 2017, so that comparison of outcome two years

before and two years after the implementation of PMK No. 169/PMK.010 / 2015 can be conducted. The following is sample size table for average difference test on DER.

Table 1. Sample size table for average difference test on DER

DER Data	2014	2015	2016	2017
All companies listed on IDX	293	293	293	293
Companies with incomplete DER data	(29)	(24)	(21)	(20)
Total number of observed DER	264	269	272	273

Source: Data processed by author (2018)

The second research purpose is to see the difference(s) in ETR before and after the implementation of PMK No.169/PMK.010/2015. Sample was companies listed on the Indonesia Stock Exchange for the period 2014-2017, so that companies listed in the period 2014-2015 and in the period 2016-2017 could be compared. The following is sample size table for ETR average difference test.

Table 2. Sample size table for average difference test on ETR

ETR Data	2014	2015	2016	2017
All companies listed on IDX	293	293	293	293
Companies with incomplete ETR data	(47)	(55)	(73)	(71)
Total number of observed ETR	246	238	220	222

Source: Data processed by author (2018)

The third research purpose was to find out whether DER, ROA, SIZE, COD, CAPINT, and INVINT variables have an influence on ETR or not. In determining sample for the third research purpose, purposive sampling was carried out from the total population in order to eliminate companies that were excluded from debt expense limitation rule and companies that provide incomplete data. Sample size determination table for regression model to attain the third research purpose can be seen as follows:

Table 3. Sample size determination table for regression model

All companies listed on IDX from 2009 to 2017	557
Companies that are excluded from PMK No 169/PMK.010/2015:	(266)
Finance	151
Basic Materials (Property)	66
Energy	49
Companies that are not excluded:	293
Companies with incomplete data from 2009 to 2017	(236)
Companies with complete data	57
Companies with negative ETR	(21)
Companies with negative DER	-
Sample total	36
Totally Observed (36 companies x 9 years)	324

Source: Data processed by author (2018)

Based on table above, total companies observed are 324, with the characteristics of *strongly balanced data panel*, meaning that each year, the number of companies is the same. Data needed in this study are company's annual financial reports from 2009 to 2017, which were obtained from IDX website, www.idx.co.id, and from websites of each company.

2.3. Research model and operationalizing variable

In the first and second research purpose, in order to find out difference(s) between DER and ETR before and after the implementation of DER limitation policy, average difference test used sample of 2 years before and 2 years after implementation of the policy. Meanwhile, in determining the impact of the thin capitalization rule on tax avoidance, this study used a model that can measure that impact.

This research used two main models. The first model is used to find out whether variables directly related to thin capitalization have an influence on ETR or not. This model is formulated as follows.

$$ETR_{it} = \beta_0 + \beta_1 DER_{it} + \beta_2 COD_{it} + + \beta_3 D_{it} + \beta_4 D^* DER_{it} + \beta_5 CAPINT_{it} + \varepsilon \qquad (3)$$

In the second model, several additional control variables that are not directly related to thin capitalization were added. The addition of these variables was to control the variables that have existed before, so that the results

of the study would not be biased. Control variable was applied to find out the impact of DER variable, with the condition that DER variable is affected by other factors besides thin capitalization. This model is formulated as follows.

$$ETR_{it} = \beta_0 + \beta_1 DER_{it} + \beta_2 COD_{it} + \beta_3 ROA_{it} + \beta_4 SIZE_{it} + \beta_5 D_{it} + \beta_6 D^*DER_{it} + \beta_7 CAPINT_{it} + \beta_8 INVINT_{it} + \varepsilon \tag{4}$$

where: ETR: *Effective Tax Rates;* DER: *Debt to Equity Ratio;* COD: *Cost of Debt;* ROA: *Return on Asset*; SIZE: Firm Size; CAPINT: *Capital Intensity*; INVINT: *Inventory Intensity.*

Dependent variable. Calculation of effective tax rates using ETR is done by dividing total tax expense by pre-tax income. Total tax expense can be in the form of total tax expense, current tax expense, or cash tax expense. This study used basic formula of ETR, using total tax expense, and it means that all tax expenses paid by the company will be used

$$GAAP\ ETR = \frac{total\ tax\ expense}{pre-tax\ income} \tag{5}$$

Independent variable(s) can be listed as below:
- *Debt-to-equity Ratio (DER).* Debt-to-equity ratio is company's financing structure. It is combination of debt and equity. The higher debt-to-equity ratio gets, the higher tax shield the company's interest payment creates. In other words, the higher DER gets, the bigger the tendency to do tax avoidance is.
- *Dummy (D).* Dummy is used to distinguish the years before the implementation of the policy regarding debt-to-equity limitation policy from the years after the implementation of the policy.
- *Dummy DER (DDER).* Dummy DER is value obtained from multiplication of dummy and DER in order to find out whether there is an influence from policy regarding debt-to-equity limitation or not.
- *Cost of Debt (COD).* Cost of debt (COD) is defined as the amount that has to be paid on a debt. COD of a company gives characteristics to that company because it can foresee the risks that will be faced by the company, such as bankruptcy risk, *etc*. (Bhojraj and Sengrupta (2003) in Isgiyarta (2014). The higher COD gets, the higher tax avoidance is (small ETR).
- *Profitability (ROA).* Profitability becomes a variable because income earned by the company will become basis for taxation. Most large companies tend to do tax avoidance in order to become subject to low taxes. The higher the ROA gets, the higher tax avoidance tendency is (ETR is getting smaller).
- *Firm Size (SIZE).* According to Mustami (2016), almost all large companies in Indonesia that have been listed on IDX have created subsidiaries with special purpose. Large companies have lower risk of bankruptcy. Therefore, large companies are expected to have larger debt ratio (Zaina 2017). In accordance to this, the larger a company gets, the higher tax avoidance is (ETR becomes smaller).
- *Capital Intensity (CAPINT).* Capital intensity does not have positive impact on tax avoidance because depreciated costs are not considered to cause tax shield (Zaina 2017). The larger capital intensity gets, the smaller tax avoidance is (large ETR).
- *Inventory Intensity (INVINT).* Companies with high INVINT tend to have small tendency to do tax avoidance (Zaina 2017). Thus, INVINT has a positive influence on ETR.

3. Research results

3.1. Results of average difference test on debt to equity ratio (DER)

In the analysis on average difference test, it was tested the difference(s) in DER before and after the implementation of PMK No.169/PMK.010/2015 on Debt-to-Equity Ratio (DER) limitation. Based on one-sample Kolmogorov-Smirnov test, average difference test was employed Mann-Whitney test. From Mann-Whitney test result, it was found that the p value was bigger than significant value (0.05). This result means that there is not enough evidence to reject H_0. This result also means that debt-to-equity ratio limitation policy does not make companies change their policies regarding financing structure.

Table 4. Mann-Whitney test DER

Ranks				
DER	Years Recode	N	Mean Rank	Sum of Ranks
	2014-2015	533	542.85	289338.00
	2016-2017	545	536.23	292243.00
	Total	1078		
Test Statistics*				
			DER	
Mann-Whitney U				143458.000
Wilcoxon W				292243.000
Z				-0.349
Asymp. Siq. (2-tailed)				0.727

Source: Data processed by author (2018)

3.2. Results of average difference test on effective tax rate (ETR)

Debt-to-equity ratio limitation policy through PMK No. 160PMK.010/2015 was implemented so that there will not be too many companies that take advantage of debt-related expenses to minimize effective tax rate (ETR) of their respective companies. With the limitation of expenses related to debt, it is expected that taxable income of the company will increase, so that the ETR of the company will increase as well. To find out differences in ETR owned by company before and after the implementation of the policy, Mann-Whitney test was conducted as follows.

From Mann-Whitney test result, it was found that p value (asymp. Sig) was equal to 0.205, which was higher than the significant value (0.05). The asymp.Sig value which was higher than significance value means that there was not enough evidence to reject H_0. Thus, it can be interpreted that there is no difference in ETR before and after the implementation of PMK No. 169 / PMK.010/2015.

Table 5. Mann-Whitney test on ETR

Ranks				
DER	Years_Recode	N	Mean Rank	Sum of Ranks
	1.00	484	452.87	219187.00
	2.00	442	475.14	210014.00
	Total	926		
Test Statistics*				
			DER	
Mann-Whitney U				101817.000
Wilcoxon W				219187.000
Z				-1.266
Asymp. Siq. (2-tailed)				0.205

Note: Grouping Variable: Years_Recode
Source: Data processed by author (2018)

3.3. Regression Model I result

Test result on classical assumption as a whole shows multicollinearity or autocorrelation did not occur in this model, but heteroscedasticity did. In order to make this model free from all violations of classical assumptions, robust standard error was applied. The output(s) that have been estimated using robust standard error are as follows:

$$ETR_{it} = 0.4005646 + 0.0010804\ DER_{it} - 0,1435891\ D_{it} + 0.1556523\ D * DER_{it} - 1.80325\ COD_{it} - 6.412183\ CAPINT_{it}$$

R-Squared = 0.0268   (6)

It can be seen from table above that the model can be used to find the impact of variables on ETR. The finding from this model was that all variables above affect effective tax rates (ETR). This can be seen from the results of Prob (F-statistic) which showed value of 0.0087. Regression model can be accepted if the value of Prob (F-statistic) is less than significance value (0.05). Because the value of the Prob (F-statistic) in this test was less than significance value, it can be said that DER, D, dummy DER, COD, and CAPINT variables have an impact on ETR.

Table 6. First regression model result

Dependent variable	: ETR			
Method	: Pooled Least Square			
Sample	: 2009Q1 2017Q4			
Number of observations : 324				
Variable	Coefficient	Std. Error	t-Statistic	Prob
C	0.4005646	0.912118	4.39	0.000**
DER	0.0010804	0.0164795	0.07	0.948
D	-0.1435891	0.082831	-1.73	0.084*
DDER	0.1556523	0.145682	1.07	0.286
COD	-1.80325	1.896677	-0.95	0.342
CAPINT	-6.412183	2.57404	-2.49	0.013**
R-Squared				0.0268
Prob(F-statistic)				0.0087

Note: *significant at 10% level (α<0.10), **significant at 5% level (α<0.05)
Source: Data processed by author (2018)

3.4. Regression Model II result

Overall, classic assumptions that were violated was only heteroscedasticity. Heteroscedasticity was successfully overcome using robust standard error. The following is output of the model that has been estimated using robust standard error.

$$ETR_{it} = 0.4917532 - 0.0039744\,DER_{it} - 0.1667142\,D_{it} + 0.1586204\,D*DER_{it}$$
$$- 0.7883592\,ROA_{it} + 0.0000249\,SIZE_{it} - 2.337922\,COD_{it}$$
$$- 10.18118\,CAPINT_{it} + 6.353085\,INVINT_{it}$$

R-Squared = 0.0483   (7)

Regression models mentioned earlier will be explained in more detail in the following table.

Table 7. Second regression model result

Dependent Variable	: ETR			
Method	: Pooled Least Square			
Sample	: 2009Q1 2017Q4			
Number of Observations : 324				
Variable	Coefficient	Std. Error	t-Statistic	Prob
C	0.4917532	0.104005	4.73	0.000**
DER	-0.0039744	0.017606	-0.23	0.822
D	-0.1667142	0.0854832	-1.95	0.052*
DDER	0.1586204	0.14603606	1.09	0.278
ROA	-0.7883592	0.1977515	-3.99	0.000**
SIZE	0.0000249	0.0012246	0.02	0.984
COD	-2.337922	1.913497	-1.22	0.223
CAPINT	-10.18118	8.979683	-1.13	0.258
INVINT	6.353085	28.41793	0.22	0.823
R-Squared				0.0483
Prob(F-statistic)				0.0008

Note: *significant at 10% level (α<0.10), **significant at 5% level (α<0.05)
Source: Data processed by author (2018)

Based on the output above, it can be seen that the research model could describe the impact of each variable on ETR. All variables were proven to have an influence on effective tax rate (ETR). It was indicated by the value of Prob (F-statistic), which was 0.0008. The value was smaller than significance value (0.05). All variables, DER, D, DDER, ROA, SIZE, COD, CAPINT, and INVINT, have an impact of 4.83% on ETR. This value was reflected on the result of R-Squared model, which was 0.0483. In other words, there are still 95.17% that come from other factors that can affect ETR. These factors vary diversely. They can be in the form of income, costs, good corporate governance, and other components that can affect effective tax rate of a company.

4. Discussion

4.1. Average difference test on debt-to-equity ratio (DER)

Before the implementation of PMK No.169/PMK.010.2015, there were a total of 17 companies that possessed DER above 4: 1 ratio; 8 companies in 2014 and 9 companies in 2015. This finding illustrated that even though maximum DER of 4: 1 had not been implemented, most companies in Indonesia did not have debt that exceeds ratio set by government later on. This condition might be caused by several factors.

Many companies in Indonesia did not have DER that exceeds the ratio and it made companies more inclined to trade-off theory or Pecking order theory, which states that debt is not the most optimum funding source. In addition, through Mann-Whitney test, DER owned by companies listed on the IDX did not change significantly. It means that companies are not dependent on debt as their financing structure.

4.2. Average difference test on effective tax rate (ETR)

Debt-to-equity ratio limitation policy through PMK No. 160PMK.010/2015 has been implemented in order to increase ETR of companies. Compared to the number of companies in previous DER comparison, there were only 33 companies, from total companies listed from 2014 to 2017, which have DER above 4.

Theoretically, the higher debt-to-equity ratio gets, the more effective tax rate will be. Meanwhile, based on Mann-Whitney test result, after the implementation of DER limitation policy to 4:1 ratio, ETR of companies did not seem to change significantly. It can be said that other than DER, indeed there are other factors that make company's effective tax rate grow smaller.

4.3. Regression model

In order to obtain maximum results, researcher employed several models to be compared. Some of those models would comprehensively explain the influence of DER on ETR. The first model, as previously explained, used variables that are directly related to debt and equity. In the second model, several variables were used to control DER variable so that the results of regression would be unbiased. Two additional models were also added for analysis. Meanwhile, in the third model, dummy variable (D) and dummy DER (DDER) were reduced in order to ensure the DER itself has impact. From comparison between regression results of each model above, the following is analysis and explanation regarding the relationship of each variable with ETR:

- *DER variable.* The DER variable does not have significant impact on ETR. This is in line with the results obtained by Zaina (2017), which found that DER variable does not affect companies that have low DER or DER that is below 4: 1 ratio. According to assessment of implementation of debt limitation policy, only few companies have DER more than 4: 1. In general, almost all companies in Indonesia have DER lower than the ratio, so it can be said that DER does not have a significant impact on ETR.
- *Dummy (D) variable and Dummy DER (DDER) variable.* Dummy (D) variable and Dummy DER (DDER) variable do not have significant impact on ETR. It indicates that the implementation of PMK No. 169 / PMK.010 / 2015 does not significantly affect ETR. The cause might be the fact that it takes a long time to determine company's financing structure, while at the same time, the implementation of the policy has only been for 2 years. This is in line with the research conducted by Zaina (2017). In addition, research sample is public companies. Their DER is usually already good to begin with.
- *Return on Assets (ROA) Variable.* Based on regression results, ROA variable is a variable that has significant impact on ETR. Model II, model III, and model IV show the same result, in which ROA has significant impact on ETR. In addition, all models also showed that ROA has negative impact on ETR. ROA that is negatively related to ETR is in line with the result of research of Irianto *et al.* (2017) and Rodriguez and Arias (2013). When company's profitability increases, company becomes more capable to do tax planning.
- *Firm Size (SIZE) Variable.* Firm size (SIZE) might become one of factors affecting ETR because large SIZE companies have low risk of bankruptcy. Based on Trade-off Theory, companies will tend to maximize debt to the point where the risk of bankruptcy is low. Although the three models show different relations, SIZE variable does not have significant impact on ETR. In other words, the size of the company does not really affect the amount of tax paid by the company.
- *Cost of Debt (COD) Variable.* Theoretically, cost of debt (COD) variable has an impact on ETR because COD tends to be used by companies to reduce taxes. From regression results of all models, it was found out that COD was negatively related to ETR. The higher COD value gets, the smaller ETR value will be. This result is in accordance with the characteristic of COD itself, which is deduction expense for taxable

income. However, from the results of regression above, it was known that COD did not significantly affect ETR. This opinion is in accordance to the opinion of Isgiyarta (2014) which states that insignificant impact is evidence that company's COD is based on other motives other than taxation motives.

- *Variable Capital Intensity (CAPINT).* Capital Intensity is a measurement that states the amount of fixed assets owned by company. If the assets of the company increase, the depreciated cost for these assets will also increase. Increasing depreciated cost can become deductible cost of taxable income so the tax paid by the company will decrease. Regression results were in accordance with the theory. Even so, CAPINT is not a variable that significantly affect ETR.
- *Inventory Intensity (INVINT) Variable.* Companies with high INVINT usually also have high ETR. Because unlike CAPINT variable which has depreciated component, inventory does not create cost that can reduce taxes. The regression of model II and model IV show results that are in line with this prediction. INVINT was positively related to ETR. These results were in line with the results obtained by Zaina (2018). However, positive relationship of INVINT was considered insignificant.

Conclusion

From all empirical tests that have been conducted, conclusions can be drawn as follows:

- using Mann-Whitney test, it was found out that from 2014 to 2017, there was no significant change in DER. Therefore, thin capitalization rule cannot effectively change DER of companies listed on the IDX. However, it is still possible for the policy to significantly change the DER, but not in an instant;
- based on the results of Mann-Whitney test, it was found that ETR of companies did not significantly change. It means that the implementation of thin capitalization rule has not succeeded in changing the ETR of companies listed on IDX. In other words, ETR of companies listed on the IDX depends more on other factors other than DER;
- according to regression results, DER variable did not have significant impact on ETR. So did D variable and DDER variable. It indicates that the implementation of thin capitalization rule in Indonesia does not (yet) affect tax paid by companies. The only variable that has significant impact on ETR is ROA, which has negative relation with ETR.

Recommendations

Based on conclusions and limitations in this research, the following are suggestions proposed:

- Increase sample size so that research will be bigger and more reliable;
- Consider the measurement of current ETR or other ETR that are more suitable. In addition, it is necessary to add variables that are not related to financial data, such as Good Corporate Governance variable;
- Conduct research in longer period so that the results obtained will be able to describe the real situation;
- Use all types of company in general, not only public companies.

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Managerial Overconfidence and Compensation: Evidence from Hose-Listed Companies

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Abstract:

This research investigates the impact of managerial overconfidence on CEO compensation. The data include 143 non-financial companies listed on Ho Chi Minh City Stock Exchange (HoSE), Vietnam with 858 observations in a six-year period from 2012 through 2017. By employing GMM (Generalized Method of Moments) technique to take account of endogeneity, the results show a significant and positive relationship between managerial overconfidence and cash-based compensation. However, we find no evidence of the linkage between overconfidence and equity-based compensation.

Keywords: CEO compensation; overconfidence.

JEL Classification: G34; J33; M52.

Introduction

Jensen and Meckling (1976) theorized that owners or principals can possibly ease the agency problem by offering agents adequate incentives, and one of the most significant practices is to reward managers financially, or alternatively, compensation schemes are to be devised according closely with their interest for reduced conflicts of interest. Formulating optimal compensation contracts are instrumental in balancing shareholders' interest against that of executives on the board. Importantly, a compensation scheme must be drawn up in harmony with every single executive characteristic as compensation is such that could alter executive behavior and thus could afflict firm value. To set optimal compensation levels, companies must well apprehend CEO (Chief Executive Officer) characteristics, and one of these which presently comes to attention of numerous economists is overconfidence. Indeed, overconfident CEOs have a great tendency to overestimate return on investment while underestimating risk (Dittrich *et al.* 2005). Overconfident CEOs are both advantageous and disadvantageous to firm value.

On the positive side, they are more creative and willing to accept risk (Galasso and Simcoe 2011, Hirshleifer *et al.* 2012). An incentive-based compensation contract may give managers better decision-making ability and allow them to contribute more to maximizing firm value. It is noteworthy that rational CEOs (not too overconfident) displaying no risk-taking tendency request higher compensation levels for more uncertainties with respect to incentive pay. On the other hand, however, for their overconfident counterparts who are supremely confident of future firm value, devising optimal compensation contracts will definitely be another story. Thus, owners should grasp and capitalize on overconfident CEOs' advantages to draw up opportune compensation contracts.

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This is, in fact, an interesting topic of discussion, but due to data constraints, research in Vietnam on this very issue is still scarce, which leaves a gap for the conduct of this study. The primary aim of the study is to estimate the impact of CEOs' overconfidence on their compensation. Specifically, it seeks to address these following issues:

- Does overconfidence have any effect on cash-based executive compensation?
- Does overconfidence have any effect on equity-based executive compensation?

The study is conducted on a sample of 143 firms listed on HoSE with a total of 858 observations for a six-year period between 2012 and 2017 (excluding financial firms due to difference in capital structure or insufficient data collection). The reason why the informed study period is chosen is that only in this period are the data for executive compensation available for each year.

1. Literature review

Chief Executive Officer compensation

Total compensation is an employee's aggregate benefits derived from his performance. This concept is commonly referred to as salary and non-cash benefits that an employee can possibly enjoy. Compensation (also known as salary, rewards, employment income, *etc.*) comprises basic pay, bonuses, additional allowances, and other benefits.

Principal–agent theory and Chief Executive Officer compensation

Principal–agent theory takes a crucial part in various studies on executive compensation. Due to existence of differential interests between principals and agents (Jensen and Meckling 1976), and moral hazard caused by imperfect information in the principal–agent relation (Holmstrom 1979), agents may not invariably act in the best interests of their principals (Jensen and Meckling 1976). Accordingly, in adhering to the principal–agent theory, it is necessary that compensation schemes be formulated in line with CEOs' interests to reduce conflicts arising between both sides.

2. Managerial overconfidence

A number of studies have indicated that those who tend to be overconfident have so much faith in themselves and thus overestimate their own ability. Overconfidence refers to people's tendency to vastly overrate their knowledge, ability, and information precision, or to be overly optimistic about themselves in coping with their own situations (Glaser and Weber 2003). According to Ackert and Deaves (2010), overconfidence manifests itself in these facets: miscalibration - a tendency to overestimate the accuracy of one's knowledge; better-than-average effect—people's unrealistic tendency to believe that their own capabilities are better than average; illusion of control—the tendency for people to assume that they might have certain control over events while in reality they have no; excessive optimism - an inclination to overestimate the probability of positive outcomes and underestimate the probability of negative ones.

One of the earliest investigations into the issue of overconfidence was Svenson (1981), which demonstrated that 90 percent of the participants credit themselves as more skilful drivers than average ones. People have a common tendency to attribute success or positive outcomes to their capabilities rather than a stroke of good fortune while ascribing failure to external reasons. Consequently, they put so much trust in themselves, which can thus be regarded as the root of overconfidence (Skala 2008). Further, they search for evidence to reinforce their already held beliefs with little consideration of other kinds (Skala 2008).

Earlier literature has established that overestimation is derived from an underlying psychological cause (Alba and Hutchinson 2000, Barber and Odean 2001). Interestingly, Fischhoff *et al.* (1997) found evidence to show that people are overconfident in complex, hard-to-solve, or uncertain situations, whereas during simple, pleasant events, there is an absence of this overconfidence tendency. As a firm's executive, one's job should always involve quite many arduous, perplexing tasks.

As demonstrated by Patty Bick (2015), to achieve their top positions, CEOs ought to have overcome a great number of obstacles and taken many actions that others who are less confident might not have done. This very success might reinforce a CEO's conception of his own ability. For this reason, CEOs are often overconfident. Patty Bick (2015) argued that as often, overconfident CEOs underestimate the actual risks of their projects, yet overestimate the expected results, and so they overinvest in the hope that more profits will be gained. In the same vein, Kidd and Morgan (1969) noted that CEOs tend to predict their work outcomes to be better than they actually are. In light of David and Graham's (2007) reasoning, overconfident CEOs invest more, apply more leverage, pay less dividends, prefer long-term debt to short-term debt, and pursue more mergers and acquisitions.

Quantifying the characteristic of overconfidence poses tough challenges to researchers. Still, previously employed have been a few measures depending on, for example, the duration of stock holdings or stock holdings until a stock price rises by 67% or more stock purchases despite the signal of risk sent out by these (Malmendier and Tate 2005), CEOs' press portrayal (Malmendier and Tate 2008), and a survey index (Oliver 2005).

This study utilizes estimation techniques as proposed by Malmendier (2005) and Glaser *et al.* (2003), and to fit the real current context of Vietnam, we employ 'net buyer' as another estimator. As such, CEOs are classified as overconfident based on their stock acquisitions within the first five years in the sample as they are specifically optimistic about their firms' performance. Overconfidence is a dummy equaling 1 if one of the CEOs on the board bought more stocks than they sold in a year, and 0 otherwise. The second measure of overconfidence suggested by Lucas and Silveira (2008) also treats it as a dummy, equaling 1 if one of the CEOs on the board of directors own more than 50% of the company's shares, and 0 otherwise. In addition to persistent optimism for their firms' future prospects, a great number of overconfident CEOs desire to acquire far more stocks than they genuinely need to gain control or take a hold for increased benefits that can be enjoyed from this authority (Lucas and Silveira 2008).

3. Overconfidence and Chief Executive Officer compensation

Overconfident CEOs have a great tendency to overestimate return on investment while underestimating risk (Dittrich *et al.* 2005; Malmendier and Tate 2005; 2008; Kolasinski and Li 2013). Hirshleifer *et al.* (2012) noted that CEO overconfidence can be beneficial to shareholders by means of enhanced investment in risky projects. Applying measures of overconfidence based on options and press media information, economists have demonstrated that firms managed by overconfident CEOs undergo more volatile events, invest more in innovation, and obtain more patents in research and development.

As observed in an empirical study by Patty Bick (2015), with respect to rational CEOs, investment risk acceptance levels are low, so they exercise safer options. Specifically, they find it more enjoyable to undertake ongoing projects that offer already set profits than to implement new ones of higher degrees of risk. An overconfident CEO, on the other hand, credits himself as being more skillful and having greater influence on the outcomes of his projects, and this very optimism causes him take charge of a larger number of projects than his rational counterparts. Actions taken by overconfident CEOs might better respond to shareholders' interests, thereby leading to increased firm value. Nonetheless, a rise in the level of CEOs' confidence implies the likelihood of riskier projects they may possibly be implementing, Net present value (NVP), as a consequence, will be negative, entailing a drop in firm value.

Likewise, Campbell *et al.* (2011) suggested that overconfident CEOs create an optimal level of investment for firms. Palomino and Sadrieh (2011) held that owners benefit from CEO overconfidence once they detect any who are remarkably confident. Adjusting incentives relating to CEO benefits can motivate operators to act in the best interests of shareholders. Therefore, if the owner discovers a certain level of overconfidence shown by one of the CEOs, a compensation contract can later be formed taking into account this very level (Patty Bick 2015).

Gervais *et al.* (2011) indicated that overconfident CEOs are fully compensated for the maximization of shareholder value. CEO overconfidence levels are closely associated with firm value. Patty Bick (2015) reasoned that CEOs are influential in opting for investment projects, and their decisions have direct effects on firm value. Defining the level of CEO confidence, therefore, is the first step taken in maximizing firm value. While shareholders can perceive CEOs' overconfidence, boards of directors and firm owners should also do so, exclusively when these boards interact more closely with their CEOs and assess them more accurately than shareholders.

Two research strands exist as regards the linkage between overconfidence and CEO compensation with results indicating both positive and negative association. Otto (2014), employing data of American enterprises on CEO compensation, provided evidence of overconfident CEOs who receive less compensation and enjoy less stock options, rewards, and total remuneration than their rational counterparts. Nevertheless, the study of Gervais (2011) drew even more general conclusion, conjecturing that two hypotheses are to be formulated. On one hand, the hypothesis of incentives contingent on the concept of the CEO belittling the risk entailing a project or overestimating the level of completion of a project predicts that he requests slightly lower remuneration. On the other hand, if a CEO is extremely overconfident, the author hypothesizes that to optimize their value, firms offer higher compensation to take advantage of his overconfidence, and this is viewed as the hypothesis of exploitation. Thus, depending on current situations and firm policies, owners can put into effect either incentive or exploitation hypothesis to devise compensation contracts accordingly. In addition, quite a few studies indicated that overconfident CEOs have a tendency to better perform in firms demanding higher degrees of creativity as well as risk (Galasso and Simcoe 2011, Hirshleifer *et al.* 2012). Gervais (2011) argued that highly respected CEOs are captivated by businesses whose projects involve underlying risk and call for more initiatives or by firms that

capitalize on the exploitation hypothesis. Hence, CEO overconfidence makes them less conservative in undertaking risky projects and saves certain cost for firm owners apropos well-devised compensation contracts (Gervais 2011). Similarly, Humphery (2016) found evidence to indicate that overconfident CEOs obtain better compensation when enrolling in more creative, riskier, and higher growth firms.

Vietnam businesses' operation has been reported to progress at high growth rates. As disclosed by McKinsey Global Institute on September 12, 2018 in its article titled "Outperformers: High-growth emerging economies and the companies that propel them," Vietnam is one of 18 economies to be rated as outperformer as evidenced by rapid growth rate of 5% per year in a short term (20 years) from 1996 through 2016. The growth rate of Vietnam businesses is kept stable and remains unaffected by past financial crises. Over the period of 1995–2016, revenues, as contributed to total GDP of the economy have almost tripled, from 22% to 64% of GDP. Further, the size of Vietnam stock market has doubled during 2010–2015. Thus, Vietnam enterprises have undergone a period of high growth, so compensation schemes tailored especially for overconfident CEOs are prone more to the exploitation hypothesis. Based on the actual situation in Vietnam and earlier research by Gervais (2011) and Humphery (2016), the following is proposed.

H1: Overconfident CEOs have a positive impact on cash-based compensation.

Humphery (2016) maintained that overconfident CEOs would gain more stock options than their rational counterparts. Gervais (2011) further suggested that firms showing high growth potential will benefit from participation of CEOs of high confidence levels. As established by these authors, one of the best ways to compensate for those assessed as overconfident to take advantage of CEOs' behavioral tendencies is utilization of equity-based compensation contracts, governed by the powerful exploitation hypothesis. Such a compensation contract available for overconfident CEOs upon the shortage of stock options would have a negative impact on the relationship between overconfident CEOs and firm value. In Vietnam, as with its exponential and explosive growth, firms are supposed to consider fine-tuning their compensation contracts that underscores powerful incentives in accordance with CEOs' personality traits including confidence, thereby genuinely motivating them to act dynamically on the company's overall direction. Accordingly:

H2: Overconfident CEOs have a positive impact on equity-based compensation.

4. Methods

This study utilizes quantitative approach typified by regression models. The data were collated from financial statements, prospectuses, annual and management reports, *etc*. available for companies listed on HoSE. The models are computed using Stata 12.0.

Regression models

To capture the impact of overconfidence on cash-based CEO compensation, we run the following regression:

$$\text{LOGCASH} = \beta_0 + \beta_1 \text{ OVER} + \beta_2 \text{ LOGTOBINQ}_{it} + \beta_3 \text{ CEO CHAR}_{it} + \beta_4 \text{ ADMIN}_{it} + \beta_5 \text{ FIRM CHAR}_{it} + \varepsilon_{it} \qquad (1)$$

where: β - estimation coefficient; i_{th} observation; t - year; ε – residuals.

We regress Equation (1) using the techniques of pooled OLS, fixed effects model (FEM), random effects model (REM), and generalized least squares (GLS). Then, we regress Equation (1) with the selected approach, and tackle endogeneity by employing GMM. Given the effects of overconfidence on equity-based CEO compensation, we compute the following:

$$\text{EQUITY} = \beta_0 + \beta_1 \text{ OVER} + \beta_2 \text{ CEO CHAR}_{it} + \beta_3 \text{ ADMIN}_{it} + \beta_4 \text{ FIRM CHAR}_{it} + \varepsilon_{it} \qquad (2)$$

We regress Equation (2) by means of pooled OLS and GLS and identify the most appropriate.

Variable description

Dependent variables:
- Cash-based CEO compensation (LOGCASH): log of total amount of salary and rewards received by the CEO in a fiscal year;
- Equity-based CEO compensation (EQUITY): Dummy = 1 if the CEO's rewards are based on equity in a fiscal year, and = 0 otherwise.

Independent variable - Overconfidence (OVER):

- Overconfidence 1 (OVER1): = 1 if the number of stocks purchased by one of the CEOs on the board of directors is larger than that of ones sold in a year, and = 0 otherwise;
- Overconfidence 2 (OVER2): = 1 if the proportion of shares possessed by one of the CEOs on the board of directors is larger than 50%, and = 0 otherwise.

Control variables:
- Firm performance (Return on Asset) is measured by Tobin's q (LOGTOBINQ) (log of the firm's market value as a ratio to total assets) +CEO characteristics (CEO CHAR);
- Age (AGE): Age of the CEO;
- Education level (EDUCATION): Dummy = 1 if CEO earns an MBA degree or higher, and = 0 otherwise;
- Tenure (TENURE): The number of years for which the CEO holds a particular position in a given fiscal year;
- Executive Ownership (OWNERSHIP): Number of CEO's shares/Total number of shares of the company +Firm characteristics (FIRM CHAR);
- Firm size (FSIZE): log of firm's total annual assets;
- Leverage (LEVERAGE): liabilities/total assets;
- Duration of firm operation (FAGE): total years of operation since its foundation + Business administration characteristics (ADMIN);
- Level of independent board members(INDEPENDENT): Number of independent board members;
- Size of board of directors (BSIZE): Total members of board of directors;
- State ownership (STATE): Dummy = 1 if the state is the firm's largest shareholder, and = 0 otherwise;
- Foreign ownership (FOWNER): Foreign shares/total shares;
- Ownership of the largest shareholder (CONCENTRATION): Level of firm's largest shareholder ownership/total shares;
- Dummies for different sectors: 1 (real estate and construction), 2 (technology), 3 (industry), 4 (service), 5 (consumer goods), 6 (energy), 7 (materials), 8 (agriculture), 9 (healthcare).

5. Results

5.1 Regression results of equation (1)

Statistical description

Descriptive statistics results show that the lowest cash-based CEO compensation of the firms in our sample is 0, thus implying that there are firms that offer no CEO compensation. CEO age ranges between 24 and 72 along with the longest tenure of 23 years. The highest number of directors on the board is 11, in addition to the maximum level of independence of 5. Correlation coefficients among the variables are all lower than 0.5, which is not considered significant.

Testing multicollinearity

The results of multicollinearity check using variance inflation factor (VIF) suggest its value smaller than 10 and thus no existing multicollinearity. For panel data, pooled OLS estimation may produce biased results or those which are not robust since it disregards unobserved factors; therefore, we consider using FEM and REM as alternatives. To decide between OLS and REM, we run Breusch-Pagan test. With the results showing Prob>chibar2 = 0.000<1%, the null hypothesis (H_0) is rejected; thus, REM outweighs OLS given this respect. Next, to test REM against FEM, we perform Hausman test, whose results favor FEM over REM due to Prob>chi2 = 0.0024<5% as well as rejection of the null hypothesis (H_0). Accordingly, FEM is the optimum among the three estimators.

Testing heteroskedasticity

We apply modified Wald test with the null hypothesis (H0) that no heteroskedasticity exists. The results suggest Prob>chi2 = 0.000 (<1%); therefore, H_0 is rejected at 1% level, and the model reflects the problem of heteroskedasticity.

Testing autocorrelation:

Wooldridge test for autocorrelation reveals Prob>F = 0.2219 (>5%), so no autocorrelation problem is found. Still, due to the existence of heteroskedasticity, we employ generalized least squares (GLS) technique to address the issue.

Handling endogeneity:

CEO compensation (LOGCASH) observably has effects on firm performance (LOGTOBINQ) and vice versa; thus, the perceivable existence of endogeneity could result in biased, *unrobust* results, which requires that this very problem be appropriately solved. To tackle the endogeneity problem, we adopt generalized method of moments (GMM), which is practically suitable for panel data with small T (short period) and large N (plenty of firms under inspection). Further, as our sample does exhibit the existing heteroskedasticity, it would be even more appropriate to do xtabond2 using two-step robust. The instrument of the endogenous variable LOGCASH is the lag of the endogenous variable and dependent variable with Lag=4.

Table 1. Regression results of Equation (1)

Variables	POOL	FEM	GLS	GMM
	LOGCASH	LOGCASH	LOGCASH	LOGCASH
OVER1	0.0676	0.00448	0.0179	-0.00658
	(1.23)	(0.12)	(1.18)	(-0.15)
OVER2	0.733***	0.00692	0.292*	0.473*
	(2.99)	(0.03)	(1.80)	(1.83)
LOGTONBINQ	0.0937***	-0.00870	0.109***	0.0482
	(3.11)	(-0.29)	(9.89)	(0.53)
AGE	0.00391	-0.00210	0.00368***	-0.000123
	(1.41)	(-0.57)	(3.83)	(-0.02)
TENURE	0.00130	0.00685	0.000125	0.00497
	(0.28)	(1.01)	(0.07)	(0.71)
EDUCATION	0.105**	0.110*	0.102***	0.0850
	(2.39)	(1.69)	(7.39)	(1.00)
OWNERSHIP	0.00682***	-0.000916	0.00620***	0.00560
	(3.02)	(-0.34)	(7.60)	(1.09)
STATE	-0.0396	0.0561	-0.00282	-0.138
	(-0.92)	(0.90)	(-0.20)	(-1.59)
FOWNER	0.00436***	0.00312	0.00379***	0.00366*
	(3.57)	(1.53)	(9.91)	(1.90)
CONCENTRATION	0.00190*	0.00129	0.00129***	0.00207
	(1.92)	(0.85)	(3.96)	(1.22)
BSIZE	0.0460***	0.0334	0.0378***	0.0274
	(2.69)	(1.57)	(5.97)	(1.15)
INDEPENDENT	0.00178	0.000866	-0.00104	0.00268
	(0.12)	(0.05)	(-0.21)	(0.13)
FSIZE	0.0582*	0.269***	0.0813***	0.0795
	(1.89)	(2.79)	(6.54)	(0.75)
LEVERAGE	-1.26	6.14	-7.91	2.09
	(-0.36)	(0.24)	(-0.21)	(0.06)
FAGE	-0.00492***	0.00648	-0.00391***	-0.00514*
	(-3.64)	(0.88)	(-10.96)	(-1.86)
_cons	1.625***	0.760	1.501***	2.032**
	(6.53)	(1.39)	(14.13)	(2.36)
Obs	847	847	847	847
Adj -squared	0.1130			
Modifed Waled - Prob>chi2		0.0000		
Wooldridge - Prob>F		0.2219		
Hausman - Prob>chi2		0.0024	0.0024	
Durbin Wu Hausman - P value				1
Hansen test of overid. Restrictions AR (1) AR (2)				0.018 0.128

Notes: *t* statistics in parentheses * p<0.1, ** p<0.05, *** p<0.01
Source: Authors' compilation.

Regression analysis of Eq. (1) reflects adjusted R2 = 11.30%, implying that the variance in the dependent variable that the independent variable can explain is 11.3%. Despite its low value, most variables in the model are

significant. The regression result of overconfidence 1 (OVER1) is not statistically significant, whereas that of overconfident 2 (OVER2) suggests the positive impact in all the three models of Pool, GLS, and GMM at confidence interval of up to 99% for Pool and 90% for the others. Accordingly, the more overconfident the CEO, the larger the compensation packages he receives. This result is in line with that of Gervais (2011) apropos the exploitation hypothesis, which theorizes that given that a CEO is extremely overconfident, higher compensation levels ought to be considered by firms to capitalize on the explicit advantages of this very characteristic, which is intended for subsequent increased investment and optimum profits that firms are going to genuinely enjoy. It also agrees with the current landscape of Vietnam enterprises' advancement processes where such an immature market demanding exponential growth is absolutely opportune for CEO overconfidence.

The regression results of most control variables are consistent with previous findings. Both Pool and GLS produce similar results which indicate that firm performance (LOGTOBINQ) has a positive and powerful impact on CEO compensation at 99% confidence interval. Thus, firms whose performance is better offer higher compensation. These results are highly consistent with earlier findings by, for example, Meeks and Wittington (1975) and Murphy (1985, 1999). The effects of such CEO characteristics as age and education level on CEO compensation in the GLS model are positive in sign. More advanced age, more experience, and higher education level are associated with more adequate compensation, which roughly reflects reality and is in agreement with previous findings by Gibbons and Murphy (1992) and Lambert *el al.* (1993).

Others comprising tenure and level of independence are not statistically significant, which is similar to the findings of one study conducted in Vietnam by Vo Hong Duc (2013). For business administration characteristics, our results are consistent with both realities and earlier findings by Murphy (1985), Core *et al.* (1999), and Conyon and He (2012). Specifically, firm size, size of board of directors, ownership of the largest shareholder, and foreign ownership have positive effects on CEO compensation. First, why larger firms in size offers higher compensation levels is that these firms, normally with their enviable reputation, can easily attract and recruit quite a few technically adept managers. Next, over large boards of directors, a competitive compensation scheme is supposed to be devised predominantly to motivate them to work for the best of their firms. Last, foreign-owned corporations in Vietnam execute very big remuneration contracts compared to domestic businesses to attract talents. Concerning the other variables, no evidence is accumulated to justify their associations with CEO compensation.

5.2 Regression results of Equation (2)

Table 2. Regression results of Equation (2)

Variables	POOL	GLS
	EQUITY	EQUITY
OVER1	0.138***	0.00536
	(4.65)	(0.43)
OVER2	-0.155	0.0143
	(-1.15)	(0.19)
Obs.	847	847
Adj -squared	0.0785	
White Prob>chi2		0.0000
Wooldridge Prob>F		0.2216

Source: Authors' compilation
Notes: *t* statistics in parentheses * $p<0.1$, ** $p<0.05$, *** $p<0.01$

Analogously, we employ the GLS technique to tackle heteroskedasticity (there exist no problems of multicollinearity and autocorrelation). The regression result of OVER2 in Equation (2) shows that it is not significant in both Pool and GLS. OVER1 is significant in the Pool model, and impacts positively on equity-based CEO compensation at 99% confidence interval. This implies that the more overconfident the CEOs, the more equity-based compensation they obtain. OVER1, nevertheless, is not significant given the GLS estimator. This issue may boil down to the fact that compensation incentives in the form of equity have yet to be prevalent in Vietnam, and that Vietnam business owners have not taken advantage of this to align their compensation schemes with CEO overconfidence.

Conclusion

This study contributes a novel approach to formulating efficient executive compensation schemes in Vietnam. First, CEO overconfidence is found to positively affect cash-based compensation; thus, besides a combination of CEO characteristics as well as firm and business administration characteristics, compensation schemes should also

underline overconfidence as a major component to exploit CEO advantages for optimal firm value. Second, there is no convincing evidence to justify the linkage between CEO overconfidence and equity-based compensation. Still, this study sheds some light on incentive stocks on which firms are recommended to rely and which are intended especially for overconfident CEOs to not only achieve general consensus but also exploit their advantages for tremendous firm benefits. As a whole, the study results demonstrate that clever owners capitalize on overconfidence CEOs' strengths by optimally adjusting their compensation contracts and highlighting potential benefits that may be enjoyed from hiring these. Our results advocate previous studies by Heaton (2002) and Malmendier *et al.* (2011), who argued that shareholders' interests can be best satisfied by establishing compensation mechanisms for exploiting management's personal traits rather than equating all executives.

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Macroeconomics Determinants and Its Impact on the Effective Tax Rate

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Abstract:

An effective corporate tax rate is an important indicator for fiscal policy in the country. Corporate taxation has a significant impact on the decision-making of companies to locate business activities. The aim of the article is to empirically verify the impact of macroeconomic determinants (nominal tax rate, gross domestic product, inflation, corporation tax revenues, foreign direct investment and unemployment) in the European Union Member States. Input data are from Eurostat and Taxes in Europe for tax revenues. The period under review was the period 2008-2017. Relationships were analyzed by linear regression in the econometric program R. The basic hypothesis, the effective corporate tax rate is mainly influenced by the nominal tax rate from a macroeconomic perspective, was confirmed. But the dependence is less than expected. One consequence of the result achieved may be the way in which companies manage their economic results and thus reduce the amount of tax paid by their activities. Statistical significant determinants have become GDP and unemployment, which point to strong positive dependence. Other determinants did not show a significant relationship to effective corporate taxation.

Keywords: effective tax rate; GDP; inflation; tax revenues; FDI; unemployment.

JEL Classification: H21; H29.

Introduction

An effective tax rate can be influenced by macroeconomic indicators that have a decisive impact on the company's investment decisions. In analyzing the impact of these indicators, it is also necessary to monitor the nominal tax rate, which is the first legislative information in terms of corporate taxation. For international companies, lowering the nominal tax rate in another country may lead to a reduction in its effective tax rate by lowering foreign income. In addition, the declining nominal rate may increase firms' motivation to move their activities to a country where taxation is lower and more attractive to individual companies. It is also one of the reasons why companies are becoming more and more global, with the result of capital mobility. Major changes in the tax systems of EU countries result in globalization and digitalization of the economy, which has substantially increased geographic taxation.

1. Research background

The first and important dimension of taxation in the country is the statutory tax rate, which is given by the tax legislation. It is the easiest and most affordable way of obtaining information from a country tax perspective, but it is certainly not the only criterion. As reported by Gupta (2007), Bird *et al.* (2008), Devereux, Griffith and Klemm (2002), it is important to monitor the overall tax burden, which is the size of the taxation of the companies, in other words, the proportion of taxes paid on the total income or profits of the company in the country.

The decisive determinant of corporate taxation from a macroeconomic perspective is gross domestic product (GDP), which is used to determine the performance of national economies. Change of the GDP over a period of time reflects the country's economic growth rate. One of the main objectives of economic science is to analyze and find the root causes of economic growth. The first and main issue on this topic is whether fiscal policy has an impact on economic growth. The impact of corporate taxation on the country's growth rate is analyzed by several economists Lee and Gordon (2005), Rosen (1992), Schwellnuss *et al.* (2008) and Arnold (2011), who support the view the corporate tax rates have a significant negative impact on average economic growth in both short and long term observations. Increasing corporate tax rates leads to a reduction in the country's future economic growth. Confirmation of that claim came in a study that monitors the profit ratio of companies converted to GDP and average tax rates (Livermore 2004). The conclusion, the profits have fallen and the average tax rate has increased.

The significant positive impact of corporate taxes on economic growth has also been demonstrated by a panel regression analysis of data that examined all types of taxes. This result is because of higher dependence of corporate tax revenues on the tax burden and the relative ease of tax evasion (Kotlán *et al.* 2012). Gravelle (1994) pointed out the actual tax burden on companies is rising due to inflation. The argument of these studies is based on the fact the inflation reduces the true value of tax deductions. Tax depreciation and cost of goods are based on historical cost accounts rather than inflation or current asset values. This reduces the company's actual tax burden in the presence of inflation and compensates for tax distortions resulting from the use of historical tax methods (Modigliani and Cohn 1979).

Different tax rates and tax policy can be a determinant of attractiveness for foreign direct investment. This is also evidenced by the trend of increasing tax competition and lowering corporate tax rates, which is particularly important for small countries (Loretz 2008, Durkalić 2016, Mazák 2018). Because of number of tax incentives that is difficult to measure. The literature mainly focuses on corporate income tax rates (Benassy-Quéré *et al.* 2005). The traditional theory of tax competition points out the open economies with full mobile capital where the capital taxation should be zero (Wilson 1999). Understanding the determinants of tax rates is important, but there are many other factors that affect the governments revenue. It depends not only on nominal tax rates set by legislators, but also on the scope of the tax base, the possibility of tax evasion, the aggressiveness of corporate tax plans and the corporate sector's share of the economy (Clausing 2007).

Griffith and Klemm (2004) analyzed the relationship between foreign investment, tax rates and corporate tax revenues. The results pointed the foreign investment is sensitive to differences in tax rates. In countries that exempt foreign tax revenues, the effect has higher statistical significance. Clausing (2007) concluded in his study the maximum corporate tax rate was 33%. It is about of sample of OECD countries and does not necessarily mean maximum taxation for any other country. It will depend on the circumstances of the country such as its size and openness.

2. Methodology

The aim of the article is to empirically verify the impact of selected microeconomic determinants of corporate taxation, which affect the effective tax rate and indirectly also the decision-making of companies to place business activities within the European Union. The effect of corporate tax determinants on the effective tax rate was realized using the linear regression analysis in econometric program R - commander. The analysis of macroeconomic determinants addressed the dependence of the effective rate on the level of nominal tax rate, gross domestic product, inflation, corporation tax revenues, foreign direct investment and unemployment in the EU Member States. The period under review was 2008-2017.

The basis for the selection of the indicators was the theoretical knowledge of the authors: Teera and Hudson (2004), Tanzi (1996), Kemmerling (2003), Wigger and Wartha (2004), Tosun and Abizadeh (2005), Fedeli and Forte (2012) for the macro domain. The authors observed a considerable number of determinants affecting the effective tax rate.

The model for linear regression analysis:

$$EF_{i,t} = \beta_0 + \beta_1 NOM_{i,t} + \beta_2 HDP_{i,t} + \beta_3 INF_{i,t} + \beta_4 TAX_{i,t} + \beta_5 PZI_{i,t} + \beta_6 UN_{i,t} + \varepsilon_{i,t}, \qquad (1)$$

where: the explanatory (dependent) variable: $EF_{i,t}$ = effective tax rate of the state *i* in year *t* (in %); the explained (independent) variables: $NOM_{i,t}$ = nominal rate of the state *i* in year *t* (in %), $HDP_{i,t}$ = gross domestic product of the state *i* in year *t* (in mil. EUR),, $INF_{i,t}$ = inflation of the state *i* in year *t* (in %), $TAX_{i,t}$ = tax revenues of the state *i* in year *t* (in % of GDP), $FDI_{i,t}$ = foreign direct investment of the state *i* in year *t* (in % of GDP), $UN_{i,t}$ = unemployment of the state *i* in year *t* (in %).

The hypothesis for analysis:

H1: The effective corporate tax rate is mainly affected by the nominal tax rate in macroeconomic terms.

3. Results

Descriptive statistics: The highest average GDP per capita is in Luxembourg, around 80 000 EUR in the period. This country is twice as high as Denmark, which has the second highest per capita GDP in the EU of 45000 EUR. Luxembourg has the highest public sector investment. Denmark (41000 EUR per capita) and Sweden (40000 EUR per capita) are behind Denmark. Other countries are significantly lower. The lowest average economic growth was recorded in Bulgaria, where the average GDP per capita in the reporting period was only around 5400 EUR.

Between 2008 and 2017, average inflation in all EU Member States reached 1.84%. Countries that exceeded the 2% target were Romania (3.54%), Estonia (3.04%) and Hungary (2.94%). Values close to deflation are observed in Ireland, where average inflation was only 0.39%.

Figure 1. Average inflation in% in EU countries between 2008-2017
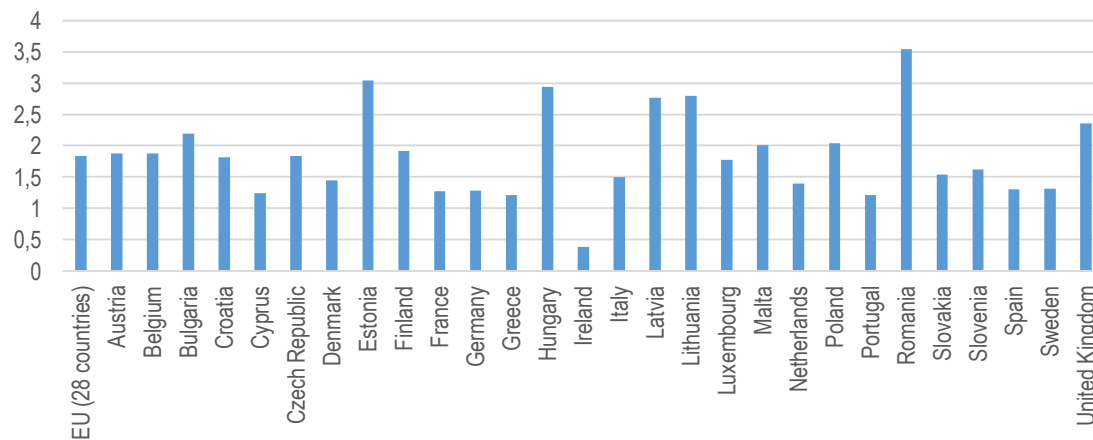
Source: own processing according to Eurostat database (2018)

There are considerable differences among the member countries in the share of foreign direct investment in the country's GDP. The highest share of investment is in Luxembourg (56.51%) and Malta (51.77%), which account for more than half of the country's GDP. These countries are also known for a high level of exports, which exceeds the GDP produced several times. The European average is 26.76%. The EU average is Ireland (28.82%) and the Netherlands (22.77%). Northern social countries show a low level of foreign direct investment, *e.g.* in Denmark, the ratio is 0.38%.

Many countries have fought with unemployment during the crisis, but also in the post-crisis period. Their average unemployment is relatively high. Spain has the highest unemployment rate in all EU Member States at 13.72%. Behind him is Greece with 11.54%. Greece has been so hit by the crisis that so far their economy cannot return to a stable level. The lowest unemployment rates were recorded in export countries, which are Luxembourg and Malta, where unemployment is 3.4%. Austria, Germany, the Czech Republic and the Netherlands have also registered similar unemployment.

Linear regression: The results of linear regression are shown in Table 1. An effective tax rate as a dependent (explained) variable and other determinants (GDP, inflation, tax revenues, direct foreign investment and unemployment) as independent variables. The level constant β_0 is statistically significant at 99.9%. Its significance is also confirmed by t-statistics. Its value is β_0 = 0.1433. That means if all other variables were zero, the effective rate would be 14.33%.

Table 1. Results of regression analysis of macroeconomic model

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	$1.433e^{-01}$	$1.974e^{-02}$	7.263	$5.03e^{-12}$	***
NOM	$4.759e^{-02}$	$5.387e^{-02}$	2.083	$3.7e^{-03}$	.
HDP	$4.869e^{-07}$	$6.459e^{-08}$	7.539	$9.20e^{-13}$	***
INF	$1.434e^{-01}$	$1.625e^{-01}$	0.883	0.378	
TAX	$-1.375e^{-01}$	$2.645e^{-01}$	-0.520	0.603	
PZI	$1.139e^{-03}$	$2.967e^{-03}$	0.384	0.701	
UN	$6.421e^{-02}$	$1.313e^{-02}$	4.892	$1.81e^{-06}$	***

Note: Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Source: own processing according to Eurostat database (2018)

The nominal rate proved to be statistically significant, at 90%. The assumption was the dependence of the effective rate on this indicator would be high. However, the linear model does not confirm assumption. The dependence of the effective rate on the nominal tax rate is confirmed by the value of t-statistics and the p-value. If the nominal tax rate increased by 1%, the effective rate will only increase by 0.4759% with a probability of 90%. This dependence may be due to the fact the companies have the ability to manage their financial results for the accounting period and their activities reduce the amount of tax paid.

The most significant variable of the econometric model is gross domestic product (GDP). The dependence between GDP and the effective corporate tax rate is positive. The value of t-statistics at 7.54 and also p-value point to a significant dependence between these two variables. The increase in gross domestic product has an impact on the GDP growth of countries.

In addition to the nominal rate, two other determinants, namely gross domestic product and unemployment, proved to be significant in macroeconomic indicators. GDP in the regression analysis shows a strong positive dependence on the effective tax rate. Such a positive dependence between economic growth and tax rates has been proven by several authors, *e.g.* Kotlán *et al.* (2012), who explain that by the relative ease of tax evasion. Huňady and Orvinská (2015) in their study also found a positive impact of taxes related to public expenditures and especially its increase in the case of infrastructure and expenditure on research and development. That has already been mentioned in the theoretical findings.

Another macroeconomic indicator is inflation, which is statistically insignificant. Its change does not affect the change in the effective tax rate. We can conclude that inflation is not a suitable indicator for the company's decisions to locate their investment activities. This result is also found in the literature. Specifically, Modigliani and Cohne (1979) criticize the impact of inflation on corporate taxation, which is due to the deductibility of nominal interest costs. Its reduces the actual tax burden on companies in the presence of inflation. This compensates for tax distortions caused by inflation.

Insignificant macroeconomic determinants are corporate tax revenues. Several authors have pointed out in their studies that raising tax rates may reduce corporate tax revenues. Increasing tax rates brings a decline in business activity or, in some cases, a shift of business to another more tax-efficient state.

Another non-statistically significant macroeconomic indicator is foreign direct investment. FDI has almost no effect on changing the effective tax rate. As in the case of inflation, the impact of foreign direct investment on the effective tax rate was not confirmed either. Bénassy-Quéré *et al.* (2005) in the study of the impact of foreign direct investment on corporate taxation, puts forward a number of reasons supported by literature why the relationship between FDI and tax rate is unobservable or misleading. These main reasons were theoretically defined in the theoretical part.

The last macroeconomic indicator entering the model is unemployment, whose statistical significance was confirmed at a significance level of 0.001. The value of the t-test statistics is at 4.89. The rise in unemployment affects the effective tax rate. The value of the correlation coefficient β_6 is 0.64. The relationship between unemployment and the effective tax rate is positive. An increase of 1% in unemployment will cause an increase in the effective corporate tax rate of 6.421%.

The regression function explains about 89% of the variability of the selected model. There was also no problem with multicolinearity. The H1 hypothesis was confirmed. The effective tax rate is affected by the nominal tax rate. However, the impact is not as strong as we expected. We can justify that by increasing the nominal rate to businesses start. The companies make greater efforts to reduce the tax base and there is also a significant risk of tax evasion.

Conclusion

The positive dependence between the effective corporate tax rate and the nominal rate was confirmed by the analysis. A similar view came from Dias and Reis (2018). They argue the effective rate on average increases by lower than the nominal rate. Graham *et al.* (2016), Rego and Wilson (2012), Rego *et al.* (2008) point to companies that reduce the total tax by their management. There is also a positive dependency between unemployment, GDP and the effective corporate tax rate. In case of unemployment, its 1% increase will bring an increase in the effective tax rate of 6.421%, which is confirmed by the fact the unemployment may also be caused by excessive taxation. Kotlán *et al.* (2012) explain it by the relative ease of tax evasion.

The impact of inflation, foreign direct investment and corporation tax revenues on effective corporate tax rates has not been confirmed. Modigliani and Cohne (1979) mention tax distortions in their studies. The relationship between FDI and the tax rate is not clear. The result regarding corporate tax revenues is linked to the attempts of businesses to reduce tax liability illegally.

Acknowledgement

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Which Dilemmas of Policy Making under Thatcher and Reagan can be Identified in the Transition Economies of 1990s?

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Abstract:

The macroeconomic aspects of the transition experience in the early 90s were a great challenge. Different policy mixes were introduced, both on a country level and among the transition countries. Some of the programs shared similarities to Thatcher and Reagan packages for economic recovery. There was no clear-cut answer to the question of how to achieve macro stabilization in a transition environment: to implement supply-side or demand-side policies, micro reforms or macro reforms first. Blindly relying on theory or other countries' policies could be damaging. That is why historical experience has to be taken with caution and tailored to the specific environment in the particular country.

Keywords: policy dilemmas; Thatcher; Reagan; transition economies.

JEL Classification: P21.

Introduction

The transformation of the transition economies in the 1990s was a major process. The reform agenda was impressive in terms of the challenges and problems of political, social and economic nature that were involved, and especially the magnitude and significance of those challenges. Scholars, however, do not unanimously agree that the transition process had no predecessors in ideological and conceptual terms. Officials at Washington institutions – IMF and World Bank - claim that Thatcher and Reagan, when coming to power in UK and US, respectively, faced a similar set of problems. Thus programs, based on the UK and US experience, were among the ones proposed to the transition countries.

This paper focuses at the dilemmas that Thatcher and Reagan governments faced. The difficult choices they faced are analyses and compared to the ones that policymakers in early 90s in transition countries made. The structure of the paper is the following: Section 1 provides a short overview of the transition economies in end of 80s and the beginning of 90s. Section 2 identifies Thatcher's economic policies and their impact on the UK economy. Section 3 delves into Reagan's plan and the effect it had in on the US performance. Section 4 discusses the applicability of the two approaches in the context of transition countries with their shortcomings and limitations. Last section concludes.

1. Short overview of transition countries in the 1980s and early 1990s

In the early 90s, Soviet Union collapsed. That breakdown made obvious the need for reforms in the other centrally planned economies as a whole. All the countries in Eastern Europe and the ones that once belonged to the Soviet Federation operated under administrative planning. Although differing from country to country, those regimes shared many similar characteristics of the economy.

Unsustainable and chronic fiscal deficits prevailed in government books. That financial situation was mostly due to the subsidies given to the loss-making state-owned enterprises, the phenomenon which Janos Kornai (1992) calls soft budget constraints. Moreover, those swelling deficits were monetized through the issuance of credit from the central bank. The ballooning deficits were financed by excessive money creation (so-called "monetization"), which fuelled inflation. Prices of goods were state-controlled and most of the commodities were in shortage and were rationed.

On the supply side, there was over-industrialization. One gigantic, monopolistic enterprise dominated in each sector. On first glance, there was no unemployment, since everyone had a place to work either in a plant or in the rural sector. However, unemployment was hidden because there were many employees who received wages without exercising any effort in the production process. In the last years of central planning only cosmetic attempts of reform were made. In some countries, introductions of semi-market measures in rural areas were implemented. Farmers were allowed to trade the excess production on the market, once they have fulfilled the required quota.

On the labor market, the situation was dismal as well. The skills people have done not match the ones required in a typical market economy. There were too many engineers and too few entrepreneurs with vision and new ideas to start their own businesses. Although possessing a very well-qualified labor force, transition countries did not have an adequate human capital at the beginning of the reforms.

The above-mentioned problems were the most severe ones that had to be addressed. Macroeconomic stabilization and some serious restructuring on a micro level was needed to facilitate the transition from centrally planned system to a market-based one.

2. Thatcher's economic policies 1979-87

When she took office in 1979, Margaret Thatcher announced her program of economic stabilization, based on the supply-side view. It featured liberalization and deregulation of monopolies, privatizing of inefficient state enterprises, as well as cuts in public spending to close the gap in the government deficit. Inflation was to be curbed by setting a target on money growth and decreasing the power of trade unions by establishing a better coordination on wage bargaining. Thatcher started with demand-side policies in order to eliminate the high demand. Monetary and fiscal policies should be put under control before supply-side reforms are implemented. The priority in Margaret.

Thatcher's plan was to put a halt on inflation. In economic theory inflation is the most distortionary tax, because it twists relative prices. Moreover, inflation also interferes with the normal economic activities. People shy away from the currency and money cannot exercise its role of the lubricant of the economy. Transaction costs increase, people expect higher levels of inflation yet to follow. The very expectations act as self-fulfilling prophecies and regenerate the inflation spiral.

Thatcher's government implemented a policy of setting explicit targets for monetary growth, which are to be announced to the public. It was expected that people should correct downwards their anticipated level of inflation. Those expectations enter the equation in the form of the wage bargaining. Usually contracts are signed for a couple of years ahead, and somehow indexed to inflation, so that the real purchasing power of money is preserved.

The problem with such a policy, however, is how to define money. Economic theory says that money is everything that is generally accepted as payment among people. There are different monetary aggregates that range from currency in circulation (M0) to all assets that are liquid and can be turned relatively easy into cash (M3). In that aspect the government in the face of the Treasury can change the interest rate and control the rate at which new currency was issued but they cannot control the way people use their credit cards. Bank lending turned out to be less responsive to the interest rate, one of the reasons behind that being the financial deregulation.

To fight this, a medium-term financial strategy was launched in June 1979. That was an ambitious four-year program, which aim was to bring the rate of growth of sterling M3 within a target range, announced beforehand for each year. As we note from Table 1 below, a reduction was achieved, but the targets were never met.

Table 1. Medium-term strategy of 1979s

1980 – 1981		1981-82	1982-83	1983-84
Target growth rate M3 (%)	7-11	6-10	5-9	4-8
Actual growth rate (%)	17.9	13.6	11.7	8.2

Source: HMSO as in Smith (1997)

The historical effect of this policy was about to bring a severe recession, maybe the most severe one since 1930s. The reason behind that was not that the monetary targets were set too high, though. The contributing factors turned out to be the wage settlement process that did not come down as quickly as expected and the appreciation of the pound on the international markets. Thatcher increased the wages of the workers in the public sector and the others followed. Together with the raise in the salaries, the interest rate was increased. That pushed the mortgage rates up, as the interest rates are flexible and moving together with the main interest rate. Mortgages are an important component in the retail price index, which is a proxy for the overall price level, and thus measure inflation. Thus, the increase in mortgages rates added to the wage demands on the workers' side. So the trade union officials did not perceive this government policy as credible and continued negotiating

wages in the same way as before. Their expectations were for loose monetary policy in the future. As a result, inflation did not come down as fast as it was initially intended. The targets were not met, but the trend in inflation was going down. Building societies accounts were included in the targeted monetary aggregate, and eventually price level was stabilized. The other reasons for the decrease in inflation were the international trade and exchange rate effects. Since pound was a petrocurrency (because of North Sea oil), an increase in oil prices pushed the value of the sterling higher relative to UK trade partners' currencies. Imported goods became cheaper at home and UK exports more expensive in the world markets, which additionally depressed demand.

After the elimination of the high demand, Thatcher turned to supply-side measures and the micro-foundations that were not working, such as the excessively strong trade unions. The Iron Lady aimed at reducing their negotiating power, since unions aim at facilitating higher payment for members and lower overall level of employment, and make the economy more flexible.

Thatcher pushed legislation in the form of a series of employment acts that made it possible for small enterprises to fire people without going through lengthy procedures. Workers were held accountable for closed shops (enterprises hiring only trade union members) and any industrial action not aimed at the employer and that disrupts economic activity. Thus, the last act of 1990 granted the individuals the right not to be refused employment on the ground of their union (non-) membership. In case that right was infringed on, they could appeal to a higher instance for assistance in taking court actions against trade unions if necessary. The result of the employment acts on the reduction in union power was that it made people unwilling to stay a member of a union.

Thatcher also advocated the idea about a smaller welfare state, so she privatized state-run utilities. Even theoretically, the story of privatizing state monopolies is controversial issue. In the UK case, however, the additional hindrance was the very powerful public sector trade unions. Those state-owned enterprises were captured by the trade unions. So it is not just the state ownership issue, but also an additional twist. In this way privatization is a way to get the enterprise out of the control of the trade unions. The vicious symbiosis had to be broken because the trade unions will not allow the company to go bust. State ownership becomes a mechanism for soft budget constraint. Thatcher propagated the idea that it is not the role of the state to do business. Private sector and public sector were presented as competitors for resources. The presence of a big public sector threatens the prospects for growth of the economy because it draws goods and services that would get a higher price if employed in the private sector. Government may borrow from private savings that could have been directed to higher return private investment. The result is a *crowding out* and may lead to higher interest rate if government borrowing is financed domestically. This is what theory dictated through the supply-demand framework (see Figure 1).

Figure 1. Government borrowing and interest rates
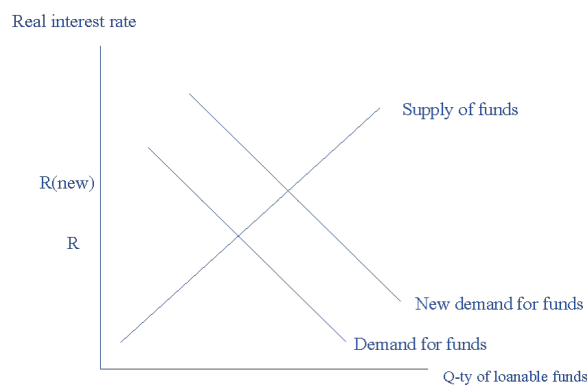
What happens in the market for private loanable funds is not obvious? Advocates of the crowding out argument claim that the result is just a distributive one - with a higher interest rate and a greater share of public investment if higher government borrowing induces a decrease in the same amount of private borrowing. That reasoning is summarized in Figure 2 on the next page. Investment, however, is not a function of the current interest rate alone, but also of the expectations of the future economic environment. Consumers could buy durable goods or real estates as a store of value or for speculative purposes. In such occasion, the measure of raising interest rate may not be an effective restraint on such behavior, if it lacks credibility. Thus Thatcher's government decided to reduce the influence of the government on the UK economy and let the markets work, most probably having the government failure idea in mind. The market is the controlling device and exercises pressure on firms to act competitively by operating efficiently. Without competition, there is no spur for development and growth.

Figure 2. Private sector's demand for loanable funds
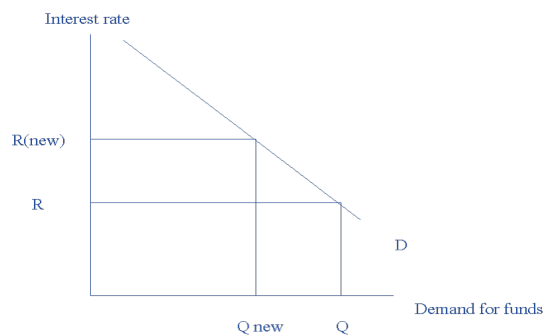
In the private sector, managers and workers know whether they do the things right. Profit is the indicator for the managers' performance because it shows whether the right goods were produced at the right prices. On the employees' side, wage in real terms is the reward for the effort exercised in the production process – the higher the productivity, the more workers will get. Thus, prices reveal the relative scarcity of goods and services and eliminate waste and bureaucratic slack.

Public sector, however, is not driven by the profit motive but by other objectives. The government may pursue maximizing employment or offering public goods – those that cannot be provided by market (defense, legal system) or ones that have hidden welfare effects (pollution, healthcare). The consumer consumes those goods no matter whether she likes it or not. In the government-owned firm, there is job and firm security. Even if the company performs very poorly, it will not be driven out of business; managers and workers are not rewarded for greater effort exercised because of the fixed by law wages for the state employees.

The above descriptions are not necessarily true in reality. In the world economy, there are some very efficient public companies and some private firms where the profit motive is not the leading one. However, those descriptions were the ones that people were most likely to believe, and Thatcher's government used them.

The state, however, needed to provide the right incentives for the prosperity of the private sector. In theory, private property is one such device because it excludes the possibility of getting subsidies if the factory runs continuous losses. If the enterprise is not able to cover its costs, it leaves the market. Bankruptcy is the market mechanism that facilitates the exit. All the assets are sold to the highest bidder in the presence of a properly working price mechanism and stock market that is reflecting the true value of the company. There are certain critiques, however, to this approach. The policy is based on the fact that it is implemented in an economy with predominant private sector, which sends the right signals to all economic agents - firms, households (workers), *etc*. Smith (1997) points that in mid-1970s the official figures provided by the Treasury showed that public sector formed less than 50 percent of the gross domestic product. That estimate, however, is a great overestimation because the productive capacity of the public sector was less than 10% of the whole economy. Moreover, the companies that are to be transferred into private hands are not supposed by the textbook model to have marker power. Otherwise, there would be a need for bailing out. A monopoly, as most of the companies in charge of utilities, is big enough to produce serious crash in the economy if it goes bankrupt. In economic jargon, such a company is too big to fail. The government and especially the UK Treasury in the British case is in charge of keeping the economy stable in such occasions may decide to inject funds into otherwise bankrupt firm, thus bailing the company out.

Another aspect of firm size is that privatization is not supposed to be a result, but a means to achieve a certain end. Making a firm private is supposed to increase the efficiency in management and production process. The price of the product is to reflect the unit cost in perfect competition and subsequently maximize consumers' welfare. That textbook idea holds in an artificial economy with numerous small producers and homogeneous products, but is a big departure from real life. Not only people have different tastes, but also there are some specific products that are provided in the most efficient way by a monopoly. Certain scale of production is needed in order for the firm to cover the huge setup costs (so-called natural monopoly), and/or there may be a common platform for producing certain products jointly. The result of privatizing the monopolies turned out to be just a transfer into private hands of monopoly power. Smith (1997) notes the most criticized case in the UK - the privatized British Telecom that started abusing its position of a price-maker after it was transferred into private hands. There are also counter examples because some economists prefer properly regulated private monopolies than public monopolies. Indeed, some of the privatized monopolies started restructuring. Shareholders and the regulatory agencies, namely Oftel for British Telecom and Ofgas for British Gas had to enforce efficiency.

Fiscal policy as a whole had to be put in order as well. The evidence from expansionary Keynesian policies was that although beneficial in the short-run, they had no real effect on the economy in the long run when all agents have adjusted their behavior and expectations accordingly. Mrs. Thatcher attempted to cut government expenditure. Since her government came to power in the middle of the year (May 1979), the slashes in spending had to wait until the beginning of the next year. The 1980 White Paper stated the government determination not to stop the growth in public spending but to reduce it progressively over the course of the following years. The economic plan was to increase money allocated to defense and legal system, and start reducing funds for health care and social security. To achieve a negative overall effect, the policy featured ambitious cuts in industry subsidies in line with the free market philosophy. The result after the four-year mandate was an increase, rather than a decrease, though. The areas of law and defense required more resources than initially planned. In addition, increase unemployment put a greater than expected pressure on demand for health care services and social benefits.

Finally, yet importantly, there was the political unfeasibility of the ambitious plans for cuts in the other sectors: funds were provided to the nationalized industries to alleviate the risk of the downturn of the economy. Ironically, the only real cuts in the economy were the ones under the line capital spending. Public investment on infrastructure went into oblivion - roads, schools, among other structures, were gradually falling into despair. That was a mistake, since when policy aims at fiscal adjustment, cut on current consumption are to made instead of reducing expenditure on investment projects, which could increase growth in the future.

In order to put government books in balance the government wanted to increase tax revenues by cutting the marginal tax rates. Following the Laffer curve logic, Thatcher's economic advisors believed the rates are to the right of the optimum and if decreased, the revenues can increase. That is why the government announced cuts in marginal income rates at the expense of the indirect taxation in the form of VAT, which served as a broadening of the tax base. That was a very clever move since you cannot escape paying it. In addition, it is a flat tax, which is less progressive than the income taxes. The policy was to be revenue neutral so the only effect was not a real one but a redistributional one. The tax burden was shifted from the rich to the poor. Besides political considerations, the cut in income taxes was intended to give incentives to work harder and to move their preferences towards entering the work force, working more hours, and exiting the shadow economy. The decreases in corporate tax were intended to make businesses flourish as well and generate more revenue for the budget, but did not exercise the boost that was initially anticipated.

Despite all the unexpected negative consequences of Thatcher policies, however, her reforms represented the first major return to market economy. That is why Thatcher's government two mandates in the office would stay as an important episode in the economic history of stabilization.

3. Reagan package

President Reagan's comprehensive program issued on February 18, 1981 had the aim to take the economy out of the slack by reducing the high inflation, cutting taxes and deregulate the economy. A new commitment to a stable monetary policy was made. The personal and corporate tax rates were to be reduced. This expansionary fiscal policy had to trigger subsequent spending cuts to close the gap of the budget deficit. Thus, the role of the government in the economy would diminish, when coupled with acts for government non-intervention and de-regulation in the economy. Reagan announced his intention to reduce interest rates for credit purchases and borrowing of money by reducing government borrowing. Real incomes were to increase by spurring capital investment and enhancing productivity.

This arrangement was possible because of the specific institutional framework in the US. It is the Congress that passes the expenditures, and the president can veto its decision. President Reagan passed tax cut bills having the Laffer curve theory in mind. Even in case tax revenues did not increase, Reagan hoped that the Democratic government would take into account that there were fewer available funds for the state, and cut on spending. That is the first measure that distinguishes Reagan's regime from Thatcher's austerity plan. Moreover, such a political bet would be impossible in the UK because it is equivalent to betting with yourself.

The problem with Laffer curve is that there is no time dimension in it. The exact shape depends on the time period governments have at their disposal. If it is a short one, it might be the case that very high tax rates are needed to decrease the deficit. But if the Laffer curve is a long-term one, lower tax rates will lead to higher revenue because of the higher elasticity of GDP. Economic theory claims that the effect of such a tax cut has long-lasting effects on the real economy. Government can only change the form and distribution of the burden, but not the intertemporal budget constraint. First, tax financing is distortionary. But if the government outlays decrease, that means future taxation would be lower. However, if this tax cut does not induce dwindling government size and

deficits balloon, higher taxes have to be raised in order to balance the books. At the time this policy was implemented, it was not obvious how long would it take for the government to achieve the required spending cuts.

Although not directly connected to the Reagan policies, debt financing is worth mentioning as an alternative to tax financing. Debt financing is less distortionary because technically speaking; it is not in the households' optimization problem. The country borrows, the economy is growing and future tax revenue is higher. This means that financing the debt is possible without raising taxes in the future. That instrument, however, was not in the agenda because of the already high deficit that the US was running.

Once elected, Reagan administration continued the dis-inflation activity that was in place under Carter's regime. Blanchard (1987) notes that Reagan's role was to establish more credibility. People were to adjust downwards their inflationary expectations. Tight money would squeeze the economy on the one hand. On the other, expansionary fiscal policy was to decrease private savings and make private sector cut back on investment. Those two factors would reinforce the recession, but once the government makes government savings less negative, the crowding out effect would be alleviated and investment will spur. A sustained expansion was to follow.

In the IS-LM framework, the initial effects of Reagan policies are described by a shift to the right of the IS curve and shift to the left of the LM curve, so that the overall result is a higher interest rate and lower output, see Figure 3.

Figure 3. The effect of tight fiscal and monetary policies on the US economy under Reagan
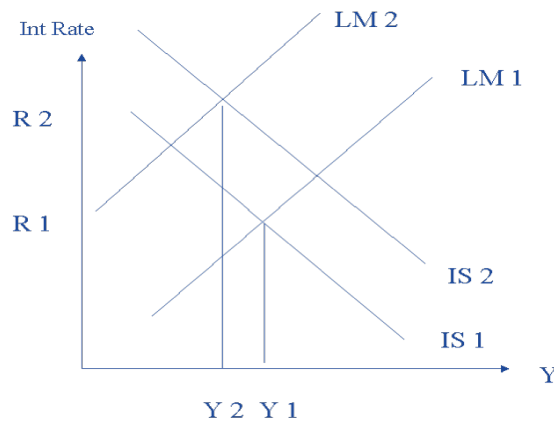
The interesting thing about this disinflation episode was that Fed Chairman Volker achieved credibility without strict control on the growth rates of the money aggregates. The targeted variable was the interest rate, which remained high during the period of swelling deficits at the cost of more fluctuations in growth rates of M1, M2 and M3 money aggregates. The increase in the interest rate was not met fully by foreign central banks and that lead to appreciation of the US dollar, which was an external factor that helped bring inflation down. The credibility of the anti-inflationary commitment was not undermined by either the failure of the Federal Reserve to achieve the monetary targets, or the decline in interest rates, as the economy slowed down in 1986.

The second part of the government action was, as mentioned before, fiscal policy. The deficits increased first because of expenditure effect - more funds were directed for defense and transfers to poor, veterans, unemployed and pensioners. Moreover, as the interest rate was set high to cool down the economy, that increased the interest payments on the public debt and the current account deficit. The tax cuts also reinforced the rise in the deficit. Personal tax rates were cut, and there were tax breaks on savings and deductions for contributions to individual retirement accounts (IRA). That increases both disposable income and private savings. Moreover, when inflation was decreased, people went into lower tax brackets and their effective tax rates decreased as well. The coupling of the two effects was expected to lead to more funds available for households, lower inequality and better incentives on labor supply.

On the investment side, there was a cut in incomes in the top tax bracket, that is the taxes businesses pay. Depreciation for tax purposes was accelerated. That meant that a company writes-off the price of newly purchased machinery faster than the machinery depreciates. The effect of the depreciation allowances and deductions was offset by the tight credit conditions imposed by high interest rates in the economy. Simple calculations by Blanchard (1987) point even to a negative overall effect for investment. Moreover, the deficit as a percentage of GDP increased and Reagan administration had to step in with a more detailed tax reform and faster reduction in spending. Later in his mandate, however, Reagan government eliminated investment tax credit. Write-off periods were lengthened, thus counterfeiting the beneficial effect on investment exercised by the cut in the corporate taxes.

On the spending side there was a bill legislating automatic cuts in both defense and non-defense sector. Some programs were exempt (Social Security) and some protected by imposing limitation for cuts (health care and retirement programs). Nevertheless, due to the credibility effect as well as the appreciation of the dollar on the international markets, dis-inflation was less costly in terms of forgone output. The recovery, not especially strong, was partly credited to the expansionary fiscal policy. William Branson from Princeton University (qt. in Blanchard 1987) makes the point that Reagan plan was based on the Laffer curve theory: that cutting tax rates increases tax revenue. As evidence, he brings forth the budget outlook as of 1981, which turned out to be a rather rosy scenario:

Table 2. 1981 Budget outlook

	1981	1982	1983	1984	1985	1986
Proposed Outlay Ceilings	654.7	695.5	733.1	771.6	844.0	912.1
Receipts with tax plan	600.2	650.5	710.2	772.1	850.9	942.1
Target Deficit(-) or Surplus	-54.5	-45	-22.9	+0.5	+6.9	+29.9

Source: A Program for economic recovery (in Hailstones (1982)

Branson continues that the story with the political bet was used only after the recovery in 1983, which did not translate into decreasing of the deficit. Reagan administration could not attribute the deficit to the recession or blame the Fed, but had to recognize that a structural deficit had emerged. Branson continues that the recovery was actually self-bred from the recession the government put the economy into. Increasing in the interest rates and announcing the anticipated budget change made financial markets react to the news and depress demand beforehand. Once the expansionary fiscal policy was implemented, it had rather a Keynesian stimulating effect on the economy. In general, he believes that the performance of the US economy under Reagan led to deterioration of all macroeconomic factors (except inflation).

Even though Reagan regime is marked with ambivalent feelings, it bears an important piece of important advice for policy makers. In addition to the smaller welfare state idea, it argues that fiscal adjustment through increased tax revenues by cutting marginal tax rates may be a cause worth fighting for.

4. Transition countries case

While Thatcher came to power with first thing in mind to drastically reduce inflation, the problem of transition countries were their fiscal balances. In the majority of the cases, institutional framework is underdeveloped and monetary policy out of control. That made fiscal domination in transition countries rule and necessitated the conducting of pro-cyclical fiscal policy because of low credibility. Low inflation requires tight budget. The latter can be achieved through working tax system. Budget cannot be balanced in the midst of inflation, however. Moreover, market prices of capital and labor cannot emerge in high inflation environment. Because institutions in transition economies are underdeveloped, fiscal and monetary decisions will not be translated to the micro-foundations.

By decreasing the deficit, the government would make a commitment of low future inflation. The government is implicitly saying that it will borrow less and less both domestically and internationally, and the inflationary pressures will be weaker. That is what Poland did under Balcerowicz and was remembered as one of the successes in the transition world. It is a consensus among economists that a well-functioning market economy needs stable price levels. Prices are important signals to what goods and services are in demand, and their relative valuation. Under central planning, there were price controls imposed and that is how inflation was held on check. So some economists (Sachs, Lipton and others) proposed that price liberalization be executed immediately, so that the economic agents perceive the relative prices in the right and not in a distorted way. Eliminating all price caps was easier and was quickly implemented. The effect of this policy was that prices skyrocketed.

According to some group of economists, the explanation for that phenomenon was the excessive demand for certain commodities: people were ready to pay a higher price once rationing was abolished. The forced, involuntary money savings they were holding in state banks had almost no purchasing power. Those were savings that caused a monetary overhang. The problem with that argument is that even if people had some forced savings, they could buy goods on the second-hand market. Another option was to buy foreign currency on the black market. The value of domestic currency is different from zero, and the value of foreign currency is not infinite in terms of units of domestic currency.

It is true, indeed, that the goods in state shops were under-priced. When prices are liberalized, however, commodity prices jump up. If there is enough competition among state shop providers and you allow private shops to enter the market you have a very quick supply response. The example is Poland, where the number of shops tripled in a very short time.

However, if people have rational expectations, it is wise to instigate once-for- all increase in prices because gradual increase will feed into consumers' expectations for another increase and they would try to outguess the government by increasing their demand for goods one period ahead. In transition economies, inflationary expectations were highly volatile because of the great uncertainty surrounding everyday economic choices.

Similarly, if people have adaptive expectations, it is better to increase prices little by little, until agents adjust their behavior accordingly. A rapid increase in the price level will provide too slow a response and would deepen the problem through the wage bargaining channel. Higher wages meant higher costs for SOEs: those went through the so-called "cost inflation" channel (Herr *et al.* 1994). Indeed, increases in the administered prices and budgetary cuts followed. Ironically, it was exactly those cuts that fuelled inflation.

The case with the interest rate was very much the same. High nominal interest rate was put in place to limit credit expansion and suppress the high demand. High interest rates are important in curbing inflationary expectation as well, but they might be a reason for time-inconsistency problems as discussed in Blanchard *et al.* (1991). High interest rates may hint about disbelief on the central bank's side of a decreasing inflation in the future. They will not be cut unless inflation starts falling. But staying high, inflation expectations are revised upwards and a vicious circle comes into motion.

The question policymakers were trying to answer was how to set the right interest rate. In theory, that constitutes a very big problem because there is no real interest rate that is objectively high, only nominal ones. Ex-ante real interest rate is a good candidate, as that is the interest rate on the assets you are holding, given the prices you expect to get. That interest rate is a function of expectation of future inflation. This issue comes to illustrate the vital role credibility is playing. It all boils down to the basics: what is inflation going to be and what are people's expectations about it. In Poland after the price liberalization and tight monetary policy was implemented, the monthly inflation rate was 45%. It seems big in nominal terms, but in comparison, the actual price increase in the first month was 80%. The interest rate proved to be sufficiently high. From the next moment on, inflation started coming down.

Fixing the ER temporarily is another option: if everyone believed the peg is going to hold, there would be capital inflows, attracted by the higher than abroad interest rates. Foreigners turn their currency into zloty and make money in foreign currency terms when they exchange once again. So we note how delicate, even knife- edge the choices a government has to make are. Expectations are very important and sometimes success is due to luck.

The Philips curve is intertwined with the issue of stabilization, and this relation is worth delving into. Before privatization, the economies are situated at the origin – no inflation, no unemployment. Thus freeing prices will not lead to a stable situation. There will be pressure to go towards the curve. If there has to be zero unemployment with free prices, that would correspond to infinitely high inflation. Thus, the story of fighting inflation is the story of allowing too much unemployment. Labor reform is usually a trade-off between current vs. potential (future) employees. Since all those are sensitive issues, there is little discussion on them in the literature.

Moreover, unemployment is not only inefficiency. Labor allocation can be improved, but there is no need for new allocation because the initial one was not completely irrational. Once there is capital (because the country does not build the enterprises anew from scratch) and the exchange rate is sufficiently devalued, employment can be maintained. (Actually, a lot of pressures for printing more money were aiming to use credits to employ more people and to keep them on work, since more workers in a factory meant higher prestige for the managers). We take Poland as an example with its booming exports of low-quality steel. Even if it was rotten, that was the only commodity that was produced competitively. The result was that Western countries steel industries forego high-quality production in favor of the lousy steel. Therefore, this example comes to show that all sorts of scenarios are possible at competitive prices.

On the question of financing stabilization in transition countries in the 1990s, it should be said that the best to finance by issuing debt because the expectation was that those countries would become much richer once capitalist. However, markets were unwilling to lend. It was true that most of the transition countries had high debt/GDP ratios, but even Ukraine, which seceded from the Soviet Union with no debt obligations, could not borrow (see table 3 on the next page). Thus, transition countries had to turn to tax financing, which made the problem even worse because there was no working tax administration. Tax evasion flourished. Workers find it in their own interest not to pay taxes. The government faces serious hardships in raising the necessary revenue through income taxes. It decides to focus on indirect taxation such as the value-added tax (VAT). Even nowadays, the revenue from this tax comprises more than a third of the tax receipts in transition countries.

The dilemma between micro-reform and macro-reform first was present in transition countries as well. It was very hard to sort the micro-fundamentals unless we fix macro-fundamentals before that. Micro changes to increase competitiveness on the supply side are practically impossible in a situation of high demand. Take for example trade

unions in Poland, which were very strong. In case of a strike, they could block the whole supply. This is a classic hold-up problem, a bottleneck, which everyone suffers from. In an economy of high demand, if the company where a worker is employed goes bust, the worker could get another job relatively easy. So trade unions organize strikes in order for the members to maintain their privileges. In transition countries, the role of the trade unions was taken by management. At first, that comparison may seem awkward, but there are many important similarities. Managers oppose restructuring because they perceive it as a loss. Some of them might think of employees as political influence. The higher the employment, the more powerful they are. As a result, inter-enterprise arrears accumulated to postpone restructuring.

Table 3. External debt, 1991-1999, percentage of GDP

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Central Europe									
Poland	61.5	56.4	54.9	47.1	38	35.2	36	36.2	38.3
Czech Rep.	26.4	23.8	24.3	26	31.8	36	40.6	43.1	42.3
Slovakia	n.a.	24.1	26.6	32	30.9	38.8	48.5	55.9	53.1
Hungary	67.8	58.1	63.7	68.7	70.4	61.1	51.9	56.9	59.9
South-East Europe									
Romania	7.4	16.5	16.1	18.3	24.1	29.5	30.1	24	27.1
Bulgaria	157.4	160.4	127.7	116.8	77.4	97.7	95.8	83.7	80.5
Baltic countries									
Estonia	n.a.	n.a.	18.2	23.4	22.1	31.8	55.3	55.6	56
Latvia	n.a.	n.a.	n.a.	n.a.	31.8	39.4	48.4	50.3	60.7
Lithuania	n.a.	3.1	12.2	12.4	22.8	26.4	32.8	33.3	40.8
CIS									
Russia	161.2	128.2	66.9	43.7	36.6	32.3	29.8	58.6	87.1
Belarus	n.a.	10.7	27.7	45.2	25.8	15.5	17.2	18.3	31.1
Ukraine	n.a.	2	11.2	19.1	22	20.6	23.5	28	37.3
Moldova	n.a.	1.3	20.4	53.1	46.3	48.1	54.3	59.7	105.7
Armenia	n.a.	n.a.	n.a.	30.9	29.2	38.4	48	42.9	46.3
Azerbaijan	n.a.	n.a.	4	18.3	17.6	14.7	10.2	12.1	24.1
Georgia	n.a.	12.8	67.8	80	63.7	44.9	44.6	47.2	63
Kazakhstan	n.a.	24.5	33.4	28	21	21.3	28.6	37.3	50.1
Kyrgyzstan	n.a.	n.a.	33	37.3	51.2	63.2	76.8	89.5	138.7
Tajikistan	n.a.	n.a.	73.3	93.8	158	83.8	98.5	90	94.9
Turkmenistan	n.a.	n.a.	3.6	207.8	36.6	34.3	65.3	75.6	112.2
Uzbekistan	n.a.	n.a.	n.a.	20	20.2	30.6	56.5	72.7	109.5

Source: EBRD (Aslund 2002)

Another question with no clear-cut answer in transition countries was what to pursue first: stabilization or privatization? A reason pro privatization first is that SOEs would not react properly to the effects of stabilization policies: cannot anticipate old managers to initiate restructuring. On the other hand, stabilization would lead to weaker labor unions and more responsive labor market, which would ease the difficulty of privatization and restructuring. Thus, it is more appropriate to stabilize before.

Macroeconomic stabilization is not just to reduce the inflation rate, because inflation is just one of the symptoms of high demand. However, that excess demand makes micro reforms difficult. Countries that have some small level of micro flexibility, like Russia, attempted to introduce macro stabilization first. In countries, where there was no flexibility, steps were taken to introduce some. What is the minimum of supply- side flexibility is hard to say? In that aspect, Poland had an advantage, as it had high flexibility. There were small private enterprises that were competing among themselves. Corporate governance was good since worker representatives elected managers. As a result, those enterprises responded quite strongly to stabilization. The product mix was also very important Of course, in other countries the situation was not the same. Every country took a different road. The dilemmas, however, were the same: Do you make micro reforms first or macro ones? Do you implement supply- side reforms or demand-side ones? Still, there is no one-size-fits-all answer.

Conclusion

The transition experience of former socialist economies in the 1990s in Eastern Europe posed a great challenge for economists trained in modern market economics. Western advisors, who came to help the formerly centrally-planned systems, proposed different sets of policies for different countries. Those advisors only had knowledge of reform measures implemented in developed economies, thus most of the stabilization programs shared similarities

to Thatcher and Reagan packages for reform in the UK and the US, respectively. In the early 1990s, there was no clear-cut answer to the challenge of achieving a successful aggregate stabilization in a transition country; there was no consensus whether supply-side of demand-side policies were a priority, whether macro reforms should be introduced first, and then focus on microeconomic issues, or vice versa – whether distortions at microeconomic level were detrimental for macroeconomic stability. Advisors who implemented a "one size fits all" package, in ignored specifics, were detrimental and created huge damages. Historical experience had to be taken into consideration as a primary factor, and then reform measured needed to be tailored to the specific environment in each transition country.

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The Financial and Macroeconomic Effects of Security Market Programme, Long Term Refinancing Operation and Outright Monetary Transaction Announcements

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Abstract:

The term Non-Conventional Monetary Policies, referred to the Central Banks, indicates the possibility that these may adopt intervention of an extraordinary nature. The motivation consists in the fact that conventional   on which they had always based their interventions, pushing them towards these exceptional measures. This study evaluates the macroeconomic effects of three different Non-Conventional Monetary Policies on financial and bond market. Securities Market Programme (SMP), Long Term Refinancing Operation (LTRO) and Outright Monetary Transaction (OMT) represents the announcements of the European Central Bank (ECB) analyzed. It is shown that the markets examined (France, Germany, Spain and Italy) have a significant impact in terms of real activity, credit and prices, for the SMP and OMT announcement, whereas LTRO displays relatively muted results.

Keywords: securities market programmed; long term refinancing operation; outright monetary transaction; event study.

JEL Classification: E52; G01; G21; G28.

Introduction

The term Non-Conventional Policies, referred to the Central Banks, indicates the possibility that these banks may adopt some forms of interventions, that are considered of extraordinary nature. The reason is that conventional policies have temporarily lost their effectiveness. The financial crisis of 2007-2009 represents a good example to explain the use of an unconventional approach by the Central Banks. To understand what they consist of, just remember that the actions of Monetary Policy are transmitted to the economy through two channels: the interest rates and the bank stocks that, in turn, influence the supply of credit.

1. Research background

There are several situations in which the rate and credit channels lose importance, bringing the conventional policy of the Central Bank to lose its effectiveness. For instance, when the reference rates tend to zero, or at very low levels in order to be further reduced. Therefore, the possibility of influencing the expectations of the operators through the change in rates is missing. It should be noted that during the crisis, especially since October 2008, the central bank reference rates were rapidly brought to their minimum levels.

Another case is when the economic crisis and uncertainty make investors more likely to hold cash than to buy medium to long-term securities. If this happens, the manoeuvre of the rates, through the lowering of the reference rates, and therefore more generally the short-term rates, does not produce any effect; in particular, the lowering of the long portion of the rate structure ("liquidity trap") does not occur.

On the other hand, the credit channel is ineffective if banks are in crisis: they have suffered capital losses and therefore they can not grant new credits; the interbank market is blocked and therefore the liquidity situation remains critical. These conditions developed violently during the crisis. It is in this situation that Central Banks can move towards the use of unconventional policies, which can be summarized in three main points:

- the massive creation of liquidity (quantitative easing); Thanks to the purchase of cash in the market, with the hope that traders are committed to buy their excess cash stocks;

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- the slope of the structure for the expiry of rates; influencing economic prices represents the main goal, giving a framework of rates low and stable;
- the outlet of the credit market; the purpose concerns the credit reactivation in the economy and this can be done through the refinancing operations of the Central Bank, which accepts as guarantee, the securities issued by private individuals.

The first effect of the unconventional monetary policies concerns the dimension, in which the balance sheet enlarged in a special way. In the case of the ECB the increment was of 60%; in other cases, as for the FED, it has exceeded 100%.

The second effect concerns the composition of the items, especially the assets. The need to reactivate the credit market leads Central Banks to implement financing transactions, which do not have government bonds as goal, like in the conventional scheme, but securities of private issuers (commercial paper, corporate bonds, etc.).

The Central Banks of the major developed countries, in response to the extreme criticality of the economic and financial crisis, have adopted non-conventional monetary policies. Previously, the monetary policies of many countries seemed to follow the Taylor rule, according to which the Central Bank varied the nominal interest rate in response to changes in inflation and GDP, with an inflation target as a reference. The financial crisis of 2007 has led the Monetary Authorities of the major countries to no longer consider the conventional criteria on which they had always based their interventions, pushing them to adopt exceptional measures called non-conventional policies. The US Central Bank was urged to resort to unconventional measures, not only because of the severity of the crisis, but also because the traditional instruments could no longer be used, as the Fed Funds Rate was already at minimum levels (close to 0). Therefore, the Federal Reserve has developed innovative tools, that were not used previously, to alleviate the tensions on the money market and reduce the repercussions on the real one. These instruments were introduced at an early stage of the crisis and subsequently upgraded following the bankruptcy of Lehman Bank. The FED adopted quantitative easing measures to facilitate the access to the credit and stimulate the economic growth. An operation the bank acts as an investor of its economy. Hence, FED ordered the purchase of securities for a total of $ 40 billion per month by introducing the Term Auction Facility (TAF), which provides liquidity after one month through an auction mechanism and against a broader category of guarantees. Moreover, since 2009, FED, in accordance with the Treasury, began buying medium and long-term treasuries, debt securities of federal agencies and mortgage-backed securities issued by federal agencies. Since 2011 the TWIST program has begun to lengthen the maturity of government securities by purchasing around 400 billion of government bonds at 6/30 years and selling 400 billion of short-term government securities. The ECB also adopted policies, in line with the extraordinary FED ones to front the crisis. In particular, since 2008 the total assets in the ECB's balance sheet have doubled to around 3,000 billion of euros towards the end of 2011.

However, the two banks faced the crisis with different instruments considering the different structure of the financial markets and the different role of banks in financing the economy. While the FED has begun actions aimed to ensure the direct disbursement of credit to households and businesses, the ECB has favored the bank's liquidity offer to counter the credit contraction, implementing the so-called credit easing.

Thus, since 2008 the ECB has conducted refinancing operations through fixed rate auctions with full adjudication of amounts and has increased long-term refinancing operations, increasing the size of assets. Moreover, since 2009 it has intervened directly in some securities markets. The absence of a traditional QE, like that of the Federal Reserve, is explained by two reasons:
- the difficulty of the ECB, that is the expression of 18 countries, of buying government bonds without creating political tensions;
- in the euro area, most of the funding is linked to the bank credit, so credit easing (in principle) is the most appropriate instrument.

In the Eurozone, the injection of liquidity to reduce the cost of money passed through the banks, with low rates and huge loans to banks (refinancing operations).

1.1. The new monetary policy of European Central Bank

The FED and the ECB have faced the crisis by using different instruments. While the FED has undertaken direct actions aimed to ensure the direct disbursement of credit and has launched plans to purchase public and private securities, the ECB has favored the supply of liquidity to banks in order to contain the contraction of the supply of credit and has always sterilized the unconventional measures of Monetary Policy, giving rise to the so-called Credit Easing.

1.2. Securities Markets Programme (SMP)

Since October 2008, the ECB has conducted all the refinancing operations through fixed rate auctions with the full awarding of the amounts, ensuring in this way an unlimited liquidity offer. Unlike the usual practice, the financial institutions were awarded the full amount of liquidity required, this measure was designed to meet the short-term needs of banks in order to facilitate the provision of credit. The central bank has extended the types of assets eligible for collateral in open market operations, and it has also increased the number and the frequency of long-term refinancing operations, thereby increasing the size of assets. The refinancing operations that, before 2008, were mostly constituted by "short-term" refinancing operations, at the beginning of 2012 were almost exclusively composed of "long-term" refinancing operations. Since 2009 the ECB has intervened directly in some securities markets:

- the first intervention has concerned the Covered Bonds, in fact between 2009 and 2012 the ECB bought € 68 millions of it through two purchase programs: The Covered Bond Purchasing Program (CBPP and CBPP2), in order to look after the financing conditions of the banks and the firms. The aim of the program was to support a specific segment of the financial market that is important for bank financing operation, which had been particularly affected by the financial crisis;
- the second intervention has concerned the Securities Markets Program (SMP) relating to the sector of government bonds. It provided the purchase, on the secondary markets, of government bonds accepted by the ECB as collateral in the refinancing operations. The program initially concerned Greece, Ireland and Portugal; subsequently, in August 2011, it was extended for Spain and Italy too.

The program concerned the purchase of securities on the secondary markets for a value of € 219 millions until the 2012, with the aim of correcting the serious malfunctions of the market of debt securities in several countries of the euro zone and of safeguarding the effectiveness of the transmission of Monetary Policy. The impact of the program on the spreads of government bonds was immediate, the spread between Greek and German government bonds recorded a fall of 400 points, in the Italian and Spanish case, the fall touched the 100 points. The long-term effect on returns was significant too, it has been estimated a reduction between 0.1 and 7 basis points for 10-year bonds for every € 100 millions of securities purchased. Similar results were found for 5-year Italian bonds. According to some analysis, the effects of the SMP could even be around 200 basis points on Italian 2 and 10-year bonds. Furthermore, ECB purchases appear to have significantly reduced the volatility of government bonds.

1.3. Long Term Refinancing Operation (LTRO)

In December 2011 and February 2012, two Bank refinancing operations were activated: the 3-year Long Term Refinancing Operation (LTRO) that allowed liquidity to the Euro-zone for more of 1,000 MLD of € avoiding the risk of a looming crisis. Through the LTROs the Euro-zone Banks obtained liquidity at a rate of 1%, of which one quarter of the funds was given to Italian banks. The two 3-year auctions have added additional liquidity of about € 523 million to the system. The possibility of early reparation of the liquidity obtained in the auctions was largely used by Italian banks. In the first few months of 2014, funds amounting to € 60 million were returned. At the end of 2013, Italian banks held 232 MLD of LTRO funds with a 15% restitution rate compared to 39% of the Euro area. LTRO liquidity injections have been estimated to have reduced interest rates on the interbank market by 70-100 basis points. Most of the funds that the Italian banks obtained in the LTROs were used to buy domestic debt securities, between 2011-2013 purchases were 150 MLD of €, bringing the total public bonds held to 386 MLD. The share of assets held by credit institutions in government bonds went from 6% to 10% of these purchases, more than 80% of bonds with a fixed term of up to 5 years.

1.4. Outright Monetary Transaction (OMT)

In September 2012 the Board of Directors announced that the bank might engage in outright monetary (OMT), through which the ECB undertakes to buy government bonds on the secondary market without restrictions. It was a plan with the aim of reducing the pressures arising from the spread and allaying fears on the international markets. The OMT is summarized in the following points:

- the ECB does not set ex ante quantitative limits on the securities it buys;
- the government securities in question are those short (1-3 years);
- transactions take place on the secondary market; the market for outstanding securities;
- the liquidity created by the OMT plan will be sterilized, to avoid that the plan becomes a way to introduce liquidity with consequent inflationary tensions;

▪ in order to receive aid from the OMT program, the cross-compliance program must be signed.

Therefore, the subscription by the State to a Program of the European Stability Mechanism Fund (EMS) represents a necessary condition for receiving the OMT plan. The cross-compliance program concerns the supervision of budgets and the application of structural reforms.

The OMT program is a security measure to protect investors, which sees the ECB as the guarantor of the Euro system. On 4 September 2014, the Governing Council of the ECB decided to launch a new program to purchase covered bonds (CBPP 3) which, together with the program to purchase securities issued for securitization transactions and longer-term refinancing operations term (LTRO), had the purpose to facilitate the orientation of the ECB's monetary policy, also facilitating the provision of credit in the euro area. The covered bonds are considered suitable if they meet some conditions (such as a credit rating of at least grade 3, equal to a BBB rating, and the 70% limit of the issue for regards the total share held by the Central Bank) in addition to what is required in the previous programs.

2. Methodology

2.1. Event study

To assess the effects of the SMP policy announcement on financial markets, the behavior of share prices has been analyzed on the day of the announcement of the referred policy. In particular, the work focuses on four main European indices: Dax for the Frankfurt Stock Exchange, CAC 40 for the Paris Stock Exchange, IBEX - 35 for the Madrid Stock Exchange and FTSE MIB for the Milan Stock Exchange. The following model has been used for each index, where the sampling period starts on the 1st of January 2007 and ends on the 31st of December 2014 with a total of 2,029 observations:

$$\Delta y_t = c + \sum_{j=1}^{J} \alpha_j D_{jt} + \varepsilon_t \tag{1}$$

The model refers to the daily variation of the closing prices of each index, Δ represents the first difference operator, y_t is the financial variable of interest, D_{jt} are the dummy variables that assumes the value of 1 on the day of the announcement and in the j – 1 days following the date, and value 0 in the remaining sampling days; ε_t is a random error with zero mean and constant variance, while c and α_j are parameters to be estimated. The algebraic sum of the α_j parameters represents the total variation of y_t due to the policy, which takes into account the reaction of the markets that occurred on the day of the announcement and in the $K - 1$ following days.

Firstly, a two-day window was taken into consideration; the reason for this is that, in a period of low liquidity, index prices can react slowly in response to an announcement. The dummies reflect the only announcement associated with the Securities Market Program on May 9, 2010. The estimate was obtained through standard regression techniques. However, the change in yt is also caused by events other than the announcement of the policy, therefore implicitly it is assumed that the monetary policy considered is the most important event that occurred in those days. However, Altavilla *et al.* (2014) estimated the impact of the OMT policy on the yields of 2 and 10-year bonds in Germany, France, Italy and Spain, (extending the model with the inclusion of an additional β$Newst$ variable that contains all the possible news available on a data set in Bloomberg that had in any way influenced the model) showing that the results remain substantially unchanged when the model also takes into account the effect exerted by other information flowed to the markets in the days of the announcement of the policy itself. Therefore, the analysis will focus on the starting model.

The Standard Tests can be used to evaluate if the sum of the dummies coefficients is statistically different from zero. The joint significance of the dummies can be verified through a Test F. More precisely, given the hypothesis system:

$$\begin{cases} H_0: \alpha_i = 0, \quad i = 1, \dots, K \\ H_1: \text{at least one } \alpha_i \neq 0 \end{cases}$$

The F-statistic is expressed as:

$$F = \frac{(RSS_0 - RSS)/J}{RSS/(N-K)} \sim F_{J,N-K} \tag{2}$$

In which, RSS_0 is the sum of the squared residuals of the restricted model, RSS is the sum of the squared residuals of the unrestricted model, J is the number of restrictions, N is the number of observations, K is the number of parameters and $F_{J,N-p-1}$ represents the distribution of Fisher F with J and $N - K$ degrees of freedom. In this case the restricted model contains only the intercept, so that RSS coincides with the deviance of the

dependent variable. The number of restrictions, J is equal to the number of dummies included in the model and $K = \ + 1$. The test statistic, under the null hypothesis, is distributed as a Fisher F with J and $N - K$ degrees of freedom.

For $J = 1$ the model contains only one dummy and therefore the reaction of the markets is supposed to be finished on the day of the announcement; for $J = 2$ the model contains two dummies, that means it is assumed that the reaction occurred on the day of the announcement and in the next, and so on for higher values of J.

3. Case studies

The model was estimated with Ordinary Least Squares for values of J from 1 to 5 and therefore considering the impact of the SMP policy announcement for up to 5 days. The following graphs show the time series of the four indices in the period considered with the highlighting of the date of announcement of the SMP policy, that was on May 9, 2010:

Figure 1. SMP
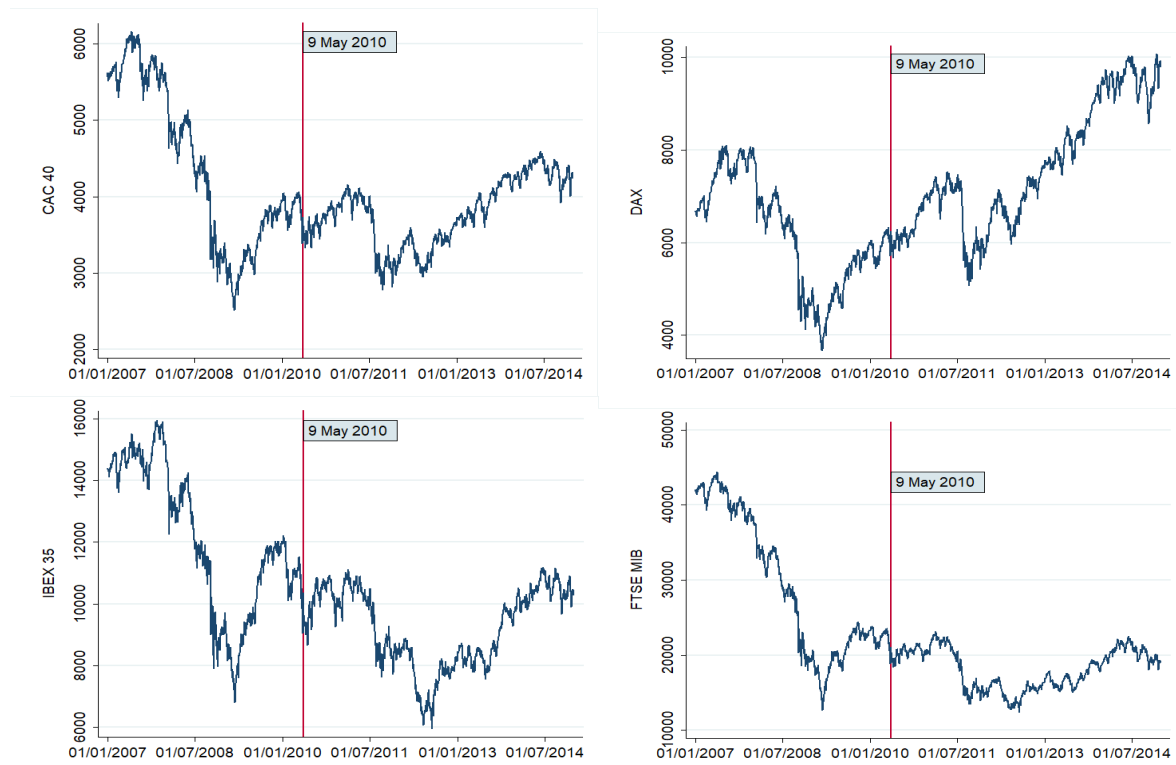
Note: The figure reports the distribution of the four indexes over time, highlighting the day of the announcement

The Standard test results are displayed in the following table:

Table 1. Effect of SMP announcement on stock indexes (basis points) 2 days window

Index	Announcement		Total
	10/05/2010	11/05/2010	
CAC 40	328.53	-26.26	302.26***
DAX	301.44	18.42	319.85***
IBEX 35	1,308.29	-340.81	967.48***
FTSE MIB	2,137.36	-84.14	2,053.21***

Note: The table shows the results (relating to the closing price) of the day of the announcement (it was taken into consideration on the 10th, since the day 9/05/2010 was the closing day of the exchange) and the following day, the last column shows the algebraic sum of the variations always based on a two-day window and the result of the Test F. *, **, *** represent the significance of the Test F at intervals of 10%, 5%, 1%.

According to the results it can be said that the policy has had a significant impact of 1% on all four markets, in fact, in Piazza Affari, FTSE MIB closes at 11.3% gaining 2,053 points, 302 in Paris where CAC 40 earns the 9.6%, IBEX 35, Madrid's most important index, showed a 14% growth with 967 points and finally DAX scored a

5.3% growth gaining 320 points. The different dimension of the absolute variation depends on the average level of the four indices.

In any case, the greatest impact is displayed on the day of the announcement. Except for the DAX, in which the signs are negative in the second day. This can be explained by the tendency of the operators to realize the profits achieved in the first day, with a consequent fall in the prices of the shares (and therefore of the index) in the following days. A significant result especially for Piazza Affari; the second biggest boom ever. The raise has been determined by a mix of factors, first of all the maxi-plan launched during the week-end to protect the Euro: a package of measures to guarantee a financial stability in Europe which provided bilateral loans from Eurozone countries for 440 billion, 60 of funds from the EU budget and up to 250 billion of "substantial" IMF contributions (equal to one third of the total).

This package, in fact, has been interpreted by the markets as a defense of the ring most exposed to the possible sovereign debt crisis: the credit institutions. Therefore, as the banks had slashed the price lists on the previous weekend, after seven days they took them into orbit. It is not a coincidence that in Milan market the bundle of blue chips rises to a higher level than the general index of the list (FTSE all share, + 9.16%), or it can not be surprising that the French Stock Exchange, which financial sector had been hardly hit in the previous Friday, rebounded more than in London (+ 4.57%) and Frankfurt (+ 5.3%); by the way, the euphoria did not last long. The following day, in fact, the European stock exchanges after a decisively declined opening, widened in the middle of the session, recovered at the end, behind the wake of Wall Street that, after having fluctuated above and below the parity, archives the day with the following result: Dow Jones lose the 0.43% and the S & P 500 the 0.34%. Nevertheless, with the exception of the Frankfurt index, the rest of the exchanges closes in negative (all the Δy_t are negative, apart from the German one, which however remains at very low levels compared to the previous day one) since the operators fear that the EU aid plan will not be able to stabilize the euro area. For this reason, the single currency has come to fall down, even if it did not reach the minimum levels of the previous week, when it stopped just above $ 1.25.

The total impact was strongly positive for the markets, without letting us be fooled by the Italian table, which is considerably greater, due to the simple fact that the FTSE MIB has a much higher average quotation than the others (also visible on the vertical axis of graphs shown).

The studies obtained, could lead to think that the effects of the policies are persistent, but this hypothesis could not stand, especially if considered in periods of severe financial turbulence. Therefore, to verify if the studies have had only a temporary impact on the prices of the indexes, the window has been increased to five consecutive days, so the model will be estimated for values of J from 1 to 5.

Table 2. Prices reaction (basis points) 1-5 days window

Index	Day 1	Day 2	Day 3	Day 4	Day 5
CAC 40	328.54	302.26	343.82	342.33	171.58
DAX	301.43	319.85	464.47	531.77	334.74
IBEX 35	1,308.46	967.48	1,051.30	941.31	279.36
FTSE MIB	2,137.40	2,053.21	2,220.62	2,082.08	994.17

Note: The table shows the results of the day of the announcement and the 4 following days

In this case a dummy of value 1 is added to every single day after 10/05/2010 (for instance in case of 3 days, the dummies of the days 10/05/2010, 11/05/2010, 12/05/2010 assume a value of 1, while in the remaining days 0 and so on).

It can be noticed that the overall impact shows a certain persistence for 4 days from the announcement. Over a period of 5 days, the rend shows a considerably reduction, signaling a profit taking (a negative impact) on the fifth day. Anyway, independently from the index considered, the most important result occurs on the first day. The only exception is the DAX for which the effect increases with the increase in the width of the window, except for what has been said about the fifth day.

Therefore, it can be seen that after 3 days the impact is still positive, in fact, on 12/05 the main European prices closed sharply: they welcomed the austerity plan announced by the head of the Spanish government, Jose Luis Rodriguez Zapatero. In Milan FTSE BIB earns 0.74%, Paris closes at + 1.10%, Madrid at + 0.81% and finally the Frankfurt exploits: + 2.41%. From the 4th day something changes, the pressures come from the ECB asking for greater commitment to the Eurozone governments to restore public finances. In fact, it is stated in the Monthly Bulletin, that in order to correct the large imbalances, it will generally be necessary to intensify the efforts. The consolidation will have to "substantially exceed the structural adjustment of 0.5% of GDP on an annual basis

established as a minimum requirement in the Stability and Growth Pact". Contrasting the session of European indexes: Piazza Affari is with Madrid the only one to close at a loss weighed down by bankers; the German index remains very lively (+ 1%).

The 5th day is really tense in the Eurozone: the depreciation of the euro against the dollar continues. In one session, the single currency firstly fell to 1.25 and then below 1.24 against the US currency. The euro also weakened against the yen and the pound, while it remained stable compared to the Swiss franc. Sales started at the opening of the European markets and finding field in the news that the French president, then in office, Nicholas Sarkozy threatened the exit of France from the monetary union if Germany had not accepted the Greek aid plan, forcing the German chancellor, Angela Merkel to support the Greek bailout.

To determine the loss in value of the euro were mainly some US macroeconomic data (Michigan confidence index, industrial production and sales which recorded the greatest increase since November thanks to the auto sector), from which the better health state of the US economy (compared to the euro area one) emerged. This led operators to imagine an increase in interest rates on the part of the Fed and therefore to move capital on the dollar.

In the case of Monetary Policy Long Term Refinancing Operation (LTRO), the analysis has planned to focus on two different dates related to the two refinancing operations of the banks, so as to understand how the four equity indices reacted in the two different occasions. The model structure is the same, with the only difference that now two groups of dummy variables are considered, one for each announcement:

$$\Delta y_t = c + \sum_{j=1}^{J} \alpha_j D_{jt} + \sum_{j=1}^{J} \beta_j E_{jt} + \varepsilon_t \tag{2}$$

Therefore, for $J = 2$, the model takes the form as:

$$\Delta y_t = c + \alpha_1 D_{1t} + \alpha_1 D_{1t} + \beta_1 E_{1t} + \beta_2 E_{2t} + \varepsilon_t \tag{3}$$

where: $D_{1t}, D_{2t}, E_{1t}, E_{2t}$ represent the dummies related to the following days: 22/12/2011, 23/12/201, 29/2/2012 and 1/3/2012.

Figure 2. LTRO
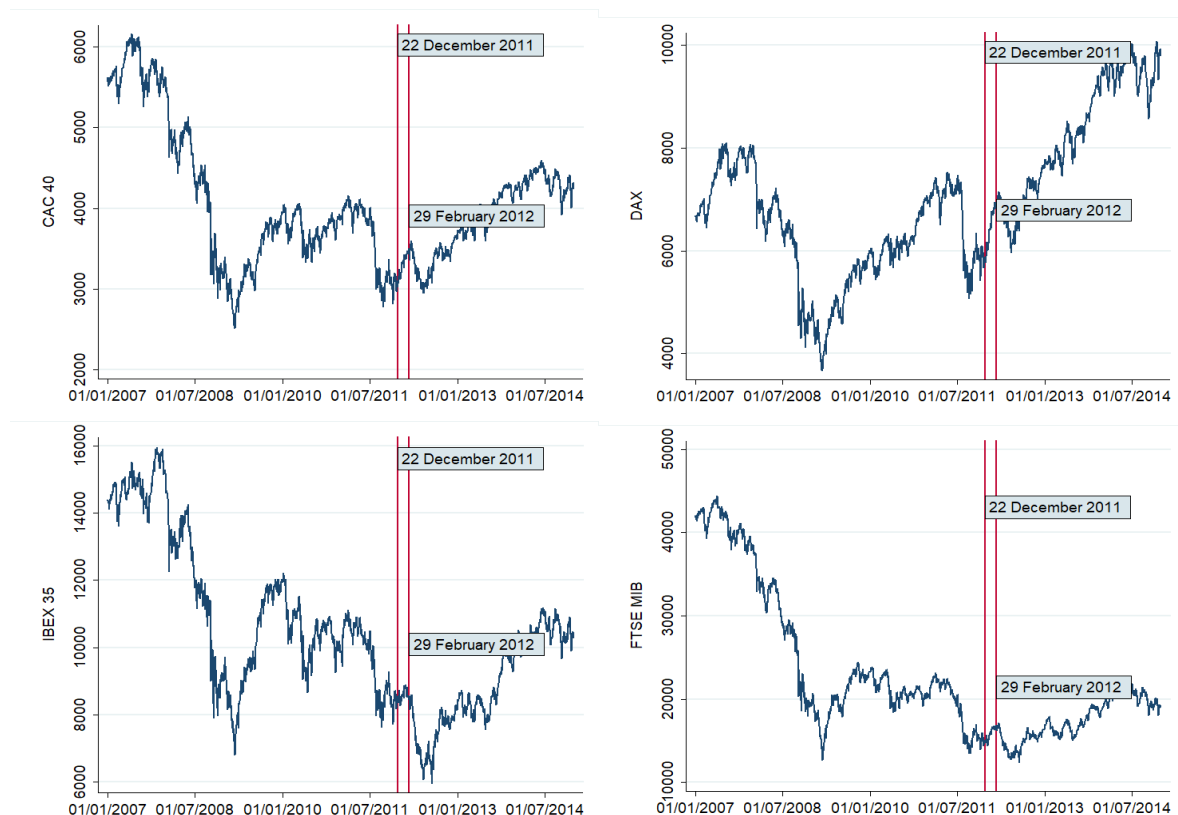
Note: The figure reports the distribution of the four indexes over time, highlighting the two days of the announcements

The Standard test results are displayed in the following tables:

Table 3. Effect of LTRO announcement on stock indexes (basis points) 2 days window

Index	Announcement I		Announcement II		Total
	22/12/2011	23/12/2011	29/02/2012	01/03/2012	
CAC 40	42.07	31.03	-0.80	48.02	120.30
DAX	59.18	25.28	-33.02	84.22	135.64
IBEX 35	86.61	81.91	-58.69	83.91	193.74
FTSE MIB	219.23	58.33	17.83	490.93	786.33

Note: The table shows the results of the two days of the announcement and the following day

In this case, the table will no longer have one column, but two, where the dummies take the value of 1 in correspondence with the two dates specified above. After making the algebraic sum of the two dates associated with the following days, on the basis of Statistics F, it can be seen that for this policy the results were not significant.

In fact, despite the long-awaited day, the markets remained lukewarm from one side because of the semi-freezing of the interbank market - with institutions that refuse to grant loans to each other, preferring the safest deposits with the ECB – and from the other side because of the recessionary effect that budget containment policies were producing on the national economic systems. The latter has been an effect that was fueled by the credit crunch too. Citizens, in brief, paid more taxes, remained more easily unemployed and consumed less. Whereas companies, already subject to the consequences of the declined demand, were struggling to be financed by banks. Finally, the distrust and bearish speculation increased the yields of sovereign bonds by increasing the pressure on public debts in a clear vicious circle.

The pressure exerted by the Basel Committee, which imposes more stringent capital requirements on institutions, favored in practice the increase in the amount on deposit; playing in favor of the credit crunch. Therefore, only a small part of the available funds went into the coffers of the states, making the pressure of public deficits light. The uncertainty remained therefore evident, the rain of loans of the ECB has not convinced too much the main European stock exchanges, that closed in negative. The negative closing is also due to the worrying statements of Fitch, which exactly on the 21st puts under observation the debt of six European nations including France and Germany, which boasted a triple A. According to a spokesman of the rating agency in fact, the probability of a cut in the French rating over the next two years exceeded the 50%.

The effects of the second announcement were also very poor, in fact the goal was to normalize the credit parameters in the Eurozone and avoid a credit crunch: the banks were essentially encouraged to buy back part of the European sovereign debt, in which months, especially in peripheral Europe, displayed too high rates. A significant portion of these loans was, however, used by banks to buy back their bonds and to restructure their capital in view of the application of the strictest requirements of the European Banking Authority, which required the consolidation of the European credit system.

As before, it has been performed the same regressive test over a broader time horizon (5 days). It is shown that politics has had insignificant effects even on a broader horizon:

Table 4. Prices reaction (basis points) 1-5 days window

Index	Day 1	Day 2	Day 3	Day 4	Day 5
CAC 40	41.18	120.30	124.25	79.89	12.49
DAX	26.04	135.64	123.09	-53.97	-213.73
IBEX 35	27.76	193.74	200.58	-77.39	-231.60
FTSE MIB	236.52	786.33	731.53	511.27	75.21

Note: The table shows the results of the day of the announcement and the 4 following days

In this case, it is displayed a certain optimism, but after some days the prices fall down. In the last analysis (concerning the financial markets), The Outright Monetary Transactions (OMT) policy has been evaluated. There are three announcement dates that have been taken into consideration, so the model has been structured as follows:

$$\Delta y_t \; = \; c \; + \sum_{j=1}^{J} \alpha_j D_{jt} + \sum_{j=1}^{J} \beta_j E_{jt} + \; \sum_{j=1}^{J} \gamma_j F_{jt} + \varepsilon_t \tag{4}$$

This time, there are three different announcements in the market on the following dates: 26/07/2012 - 2/08/2012 - 6/09/2012. Therefore, three columns have been analyzed to study the trend of share prices (each of which will have a dummy with a value of 1 corresponding to the date of analysis).

The graphs have now three red vertical axes that will identify the behavior of the title:

Figure 3. OMT
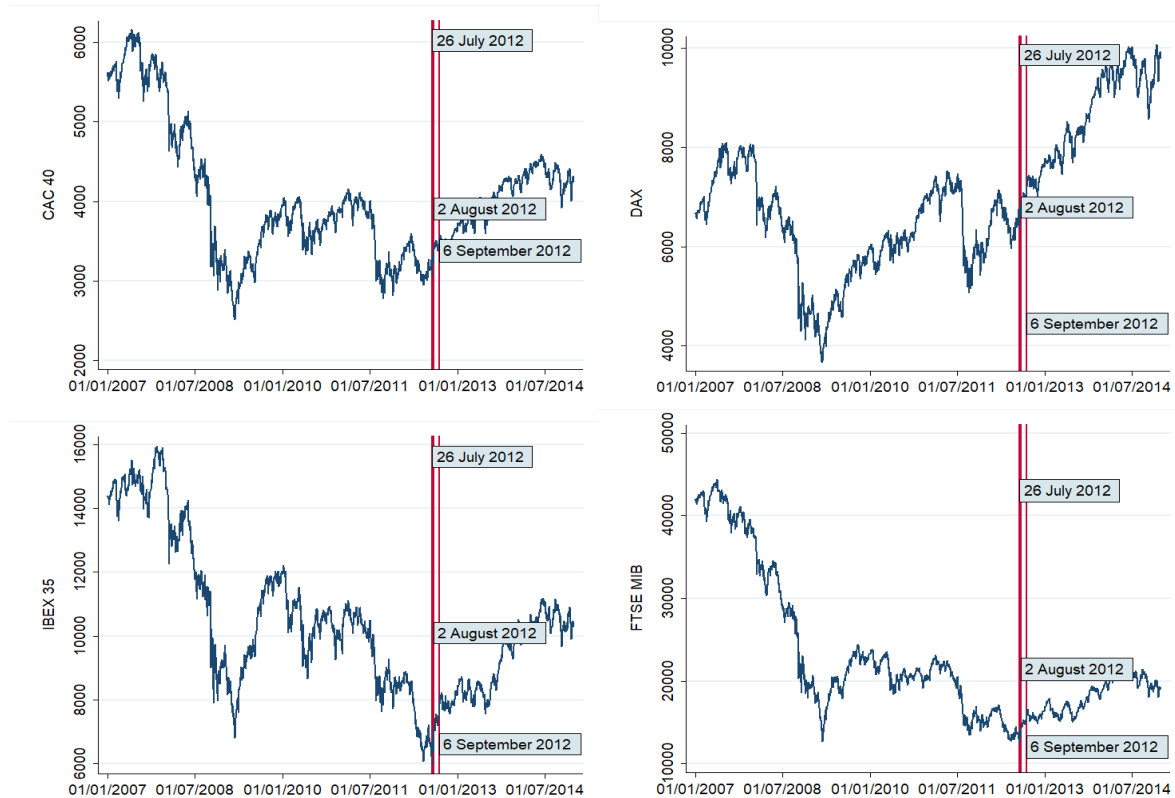
Note: the figure reports the distribution of the four indexes over time, highlighting the three days of the announcements

Table 5. Effect of OMT announcement on stock indexes (basis points) 2 days window

Index	Announcement I		Announcement II		Announcement II		Total
	26/07/2012	27/07/2012	02/08/2012	03/08/2012	06/09/2012	07/09/2012	
CAC 40	126.239	73.929	-88.241	142.589	104.949	10.029	369.49***
DAX	175.213	105.213	-149.597	258.343	201.413	45.943	636.53***
IBEX 35	366.433	251.333	-344.067	384.833	370.533	23.333	1,052.40***
FTSE MIB	715.799	399.399	-633.601	854.899	664.699	342.499	2343.70***

Note: The table shows the results of the two days of the announcement and the following day

In this case, like with the SMP announcement, the F test tells us that the values are highly significant for a range of values equal to 1%. The results are very clear, 26/07 was the day when Mario Draghi announced: "The ECB will do as much as possible and believe me it will be enough". The president affirms this at the Global Investment Conference in London on the eve of the opening ceremony of the Olympics. It was enough to overturn the indices of half the world. On the 2nd of August the markets disappointed, there are no purchases from the ECB and therefore they lose ground, but immediately the next day the head of the Euro tower opens to the possibility about the acquisition of securities. The announcements of the ECB in the day 06/09 burst at the Democratic convention and on Wall Street, where the Down Jones closed at +230 points and automatically the European indices closed in positive too. The impact of the five-day policy is shown in table 7, where, unlike the previous cases, optimism is growing until day 5. In fact, on 31/07 the ECB President confirms that those of the previous week were not just words and the BC is ready to buy private bonds as well.

Table 6. Prices reaction (basis points) 1-5 days window

Index	Day 1	Day 2	Day 3	Day 4	Day 5
CAC 40	142.61	369.49	427.22	484.13	508.43
DAX	226.42	636.53	770.36	911.56	922.18
IBEX 35	391.92	1,052.40	1,519.07	1,694.90	1,686.09
FTSE MIB	744.53	2,343.70	2,963.95	3,365.94	3,647.43

Note: The table shows the results of the day of the announcement and the 4 following days

Event study: Bond markets.

Tables 6 and Table 7 report the effect of the SMP announcement on two-days and five-days window respectively.

Table 6. Effect of SMP announcement on bond market (basis points) 2 days window

Variable	Announcement		Total
	10/05/2010	11/05/2010	
IT	-0.34	-0.01	-0.35***
FR	0.08	-0.01	0.08
DE	0.17	-0.01	0.16***
ES	-0.50	0.01	-0.49***

Table 7. Bond market reaction (basis points) 1-5 days window

Variable	Day 1	Day 2	Day 3	Day 4	Day 5
IT	-0.34	-0.35	-0.38	-0.41	-0.39
FR	0.08	0.08	0.07	0.05	-0.02
DE	0.17	0.16	0.17	0.18	0.10
ES	-0.50	-0.49	-0.51	-0.50	-0.48

Figures 4 reports interest rates on 10-year government bonds in Italy, France, Germany and Spain during the sample period of the event study analysis, that is (like in the stock market) from January 2007 to December 2014. Vertical red lines denote the SMP announcement day.

Figure 4. SMP
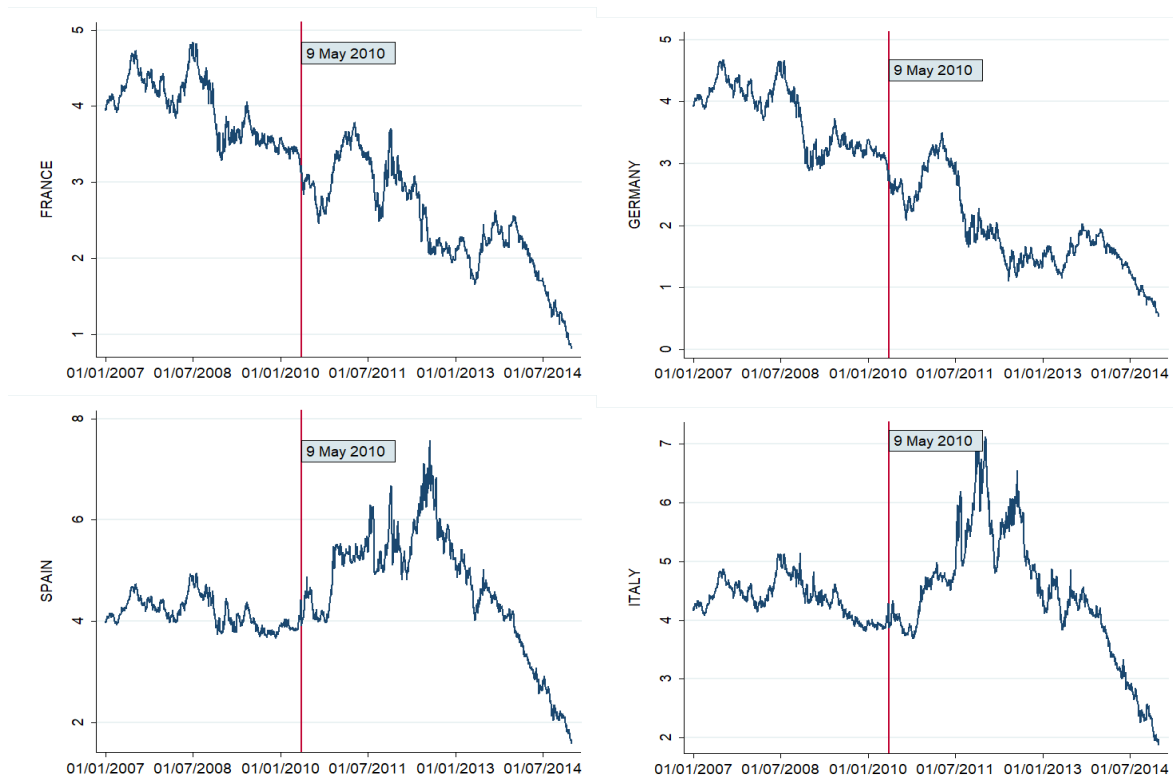
Table 7. Bond market reaction (basis points) 1-5 days window

Variable	Day 1	Day 2	Day 3	Day 4	Day 5
IT	-0.34	-0.35	-0.38	-0.41	-0.39
FR	0.08	0.08	0.07	0.05	-0.02
DE	0.17	0.16	0.17	0.18	0.10
ES	-0.50	-0.49	-0.51	-0.50	-0.48

According to the Table 6, it can be inferred that it is necessary to reject the null hypothesis of joint significance of the dummies for a range of values equal to 1%, so the values (outside from France) are highly significant.

The overall impact shows a certain persistence up to 4 days from the announcement, France apart where returns decrease over time; however, the most important part of the ad effect occurs on the first day. From the LTRO side, the following results have been obtained:

Figure 5. LTRO
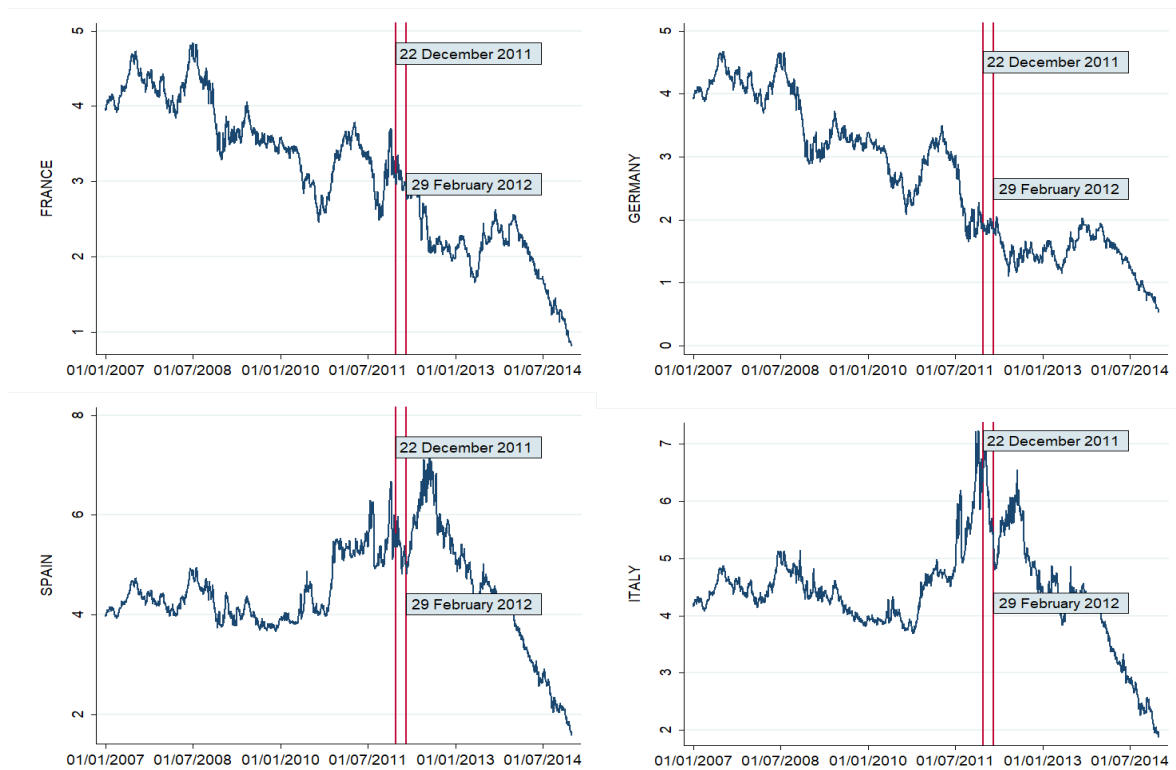
Vertical red lines denote the LTRO announcement days. Tables 8 and 9 report the effect of the LTRO announcements on two-days window and on five-days window respectively.

Table 8. Effect of LTRO announcement on bond market (basis points) 2 days window

Variable	Announcement I		Announcement II		Total
	22/12/2011	23/12/2011	29/02/2012	01/03/2012	
IT	0.13	0.12	-0.16	-0.24	-0.15***
FR	-0.04	-0.08	-0.04	-0.11	-0.27**
DE	0.01	0.02	0.02	0.05	0.11
ES	0.08	0.00	-0.05	-0.14	-0.10

In this case, the results are highly significant for the Italian bonds in both the announcements, and less for France.

Table 9. Bond market reaction (basis points) 1-5 days window

Variable	Day 1	Day 2	Day 3	Day 4	Day 5
IT	-0.03	-0.15	-0.21	-0.12	-0.07
FR	-0.08	-0.27	-0.26	-0.23	-0.19
DE	0.03	0.11	0.04	0.03	-0.03
ES	0.03	-0.10	-0.05	-0.02	-0.05

According to the Table 9, the impact is much more significant in the two-days window, with a decrease in the following days (it displays the same results that has been obtained on the stock market).

From the OMT side, the following results have been obtained. The red line in Figure 6 denotes the OMT announcement days, whereas Tables 10 and 11 display the effect of OMT announcements on two-days and five-days respectively.

Figure 6. OMT
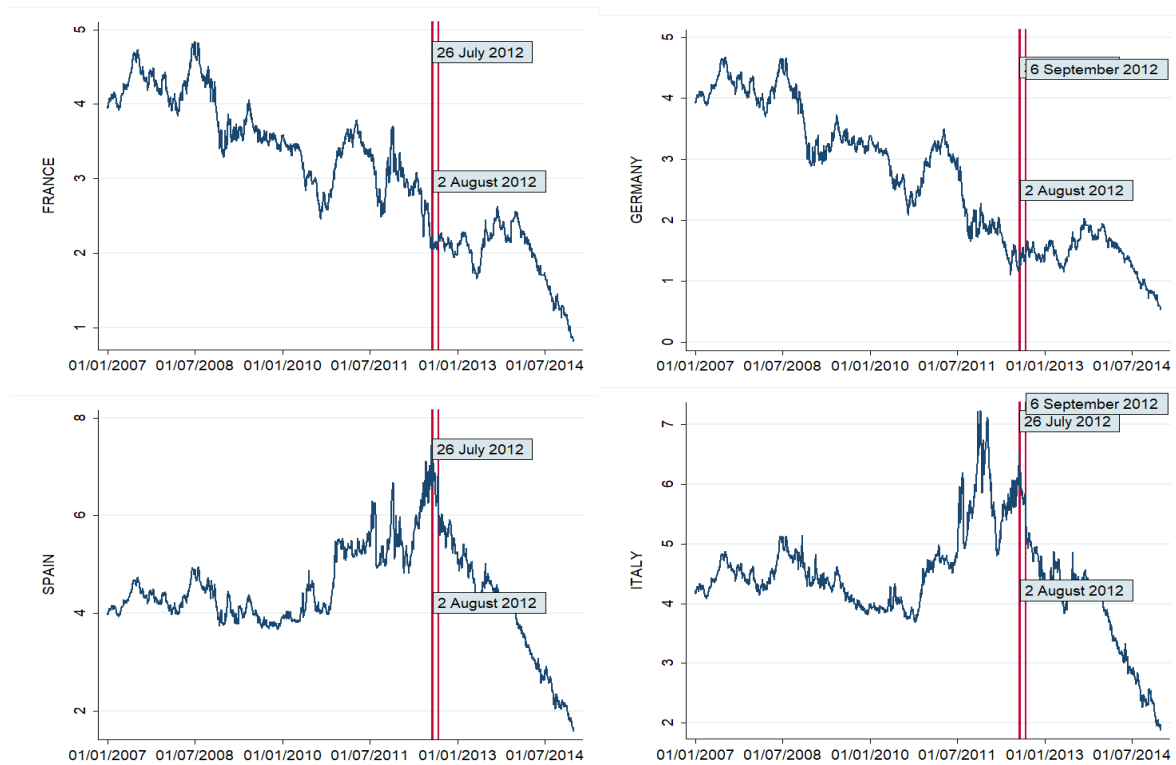
Table 10. Effect of OMT announcement on bond market (basis points) 2 days window

Variable	Announcement I		Announcement II		Announcement II		Total
	26/07/2012	27/07/2012	02/08/2012	03/08/2012	06/09/2012	07/09/2012	
IT	-0.402	-0.115	0.287	-0.166	-0.209	-0.233	-0.840***
FR	-0.066	0.014	-0.043	0.044	0.022	-0.042	-0.068
DE	0.065	0.074	-0.119	0.161	0.113	-0.042	0.251***
ES	-0.467	-0.183	0.397	-0.269	-0.384	-0.387	-1.296***

Table 11. Bond market reaction (basis points) 1-5 days window

Variable	Day 1	Day 2	Day 3	Day 4	Day 5
IT	-0.32	-0.84	-0.77	-0.79	-1.08
FR	-0.09	-0.07	-0.07	-0.22	-0.17
DE	0.06	0.25	0.25	0.24	0.37
ES	-0.45	-1.30	-1.49	-1.23	-1.30

In general, OMT announcements have had much more significant in Italy, Spain and Germany than in France. Clearly, even in this case the hypothesis of a two-day window may not hold up and expanding the window up to five-days, the results suggest, France aside, that the impact of the announcements has been very persistent with signs of possible rebound in the following days. The OMTs contributed to a statistically significant reduction in the spreads of Italian and Spanish government bond yields (short and long term) against the German one, allowing a more equitable ECB accommodating monetary policy on euro area countries.

Conclusion

The announcements of the three non-standard monetary policies have had a sizable impact on financial and obligation markets. It has been shown that the SMP and OMT announcements have led to a significant increase to the closed prices in the four most important European markets, bringing a large wave of optimism. Whereas, the LTRO announcement has displayed lighted effects due to the distrust on the same markets, which has led to an increasing pressure on public debts in a clear vicious circle.

The study highlighted the trend of the markets in the day of each announcements and in the following five days, taking into consideration each policy as the only variable able to explain the effects. Even though this

hypothesis could lack in terms of robustness, Altavilla *et al*. (2014) showed that also in case of other information, the absolute value of the effect is very close.

Thus, because a measured return to a normal phase has been displayed in the refinancing of the Euro area, the findings of this work attribute a part of these improvements to the unconventional monetary policies program.

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The Impacts of Working Capital Management on Profitability: A Study on Portuguese Small and Medium-sized Enterprises in High Technology and Medium-high Technology Manufacturing Sectors

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Abstract:

With using panel data methods (fixed effects model and pooled regression model), this paper mainly analyzes the impacts of the period of receivables, the period of inventory, the period of payables, and cash conversion cycle (as the factors of working capital management) on the profitability of Portuguese small and medium-sized enterprises (SMEs) in high technology and medium-high technology manufacturing sectors. Besides, the influence of some important firm-related factors, industry-related factor (industry dummy), and macro-economic factor (GDP growth) is also taken into consideration. In particular, the total sample is classified into micro and non-micro SME groups as well as young and mature groups, in order to compare the differences. The research results show that: (1) the negative effects of the period of receivables, the period of inventory, the period of payables, and cash conversion cycle are stressed, but not for the non-micro and the mature firms (where positive relationships too exist for the period of inventory, the period of payables, and cash conversion cycle); so here aggressive working capital management strategy and shorter cash conversion cycle are partially supported; (2) the positive effects of total assets and GDP growth as well as the negative effects of indebtedness and age are highlighted.

Keywords: small and medium-sized enterprises; working capital; profitability; technology; manufacturing sectors.

JEL Classification: G30; M10.

Introduction

Working capital management is a basic part of asset management and financial management of business (Motlíček and Polák 2015). Working capital (including current assets) usually comprises a major share of total assets (Bieniasz and Gołaś 2011, Yazdanfar and Öhman 2014), because working capital is necessary for daily operations of business (Mazzarol 2014). Jose *et al.* (1996) too point out the importance of day-to-day management of firm's short-term assets and liabilities in the success of firms. In fact, the average percentage of investment in tangible fixed assets is much lower than it is in current assets (Baños-Caballero *et al.* 2010), so investing in working capital represents a relevant percentage of firm's total investment.

Working capital is defined as current assets minus current liabilities (Kroflin and Kratz 2015), so financial

managers need to manage working capital by balancing the available current assets and current liabilities (Muscettola 2014). Schwartzman (2013) points out that short-term assets and liabilities are necessary for firms to facilitate production and sales, and working capital should be in advance of production (which means that the components of working capital should be related to the future values of cash flows). Motlíček and Polák (2015) also state that business costs and revenues could be influenced by the changes in the size of working capital constituents (for example the influence of the changes in the size of receivables and inventories on the size of sales); thus, impacting on profitability. In fact, the influence of working capital management on firm's profitability is an important topic of financial management (Cristian and Raisa 2017).

Working capital management, as an important part of financial management, is a challenge to small and medium-sized enterprises (Mazzarol 2014). As pointed out by Tauringana and Afrifa (2013), compared to large firms, SMEs have difficulties in managing all the components of working capital due to limited resources. The importance of working capital management is also highlighted by Rădaşănu (2015) in the situation of limitation in accessing to long-term debt and equity. In Portugal, SMEs contribute much to employment and productivity: according to the data of Portuguese National Institute of Statistics, in 2011 over 99% of the business units were SMEs which generated 77% of the jobs and more than 50% of the total turnover (Pais and Gama 2015).

This paper focuses on studying the impacts of working capital management (in particular, the management of cash conversion cycle and its components) on SME profitability in high and medium-high technology manufacturing sectors in Portugal. As pointed out by Hogan and Hutson (2005), technology-based SMEs play an important role in employment generation and economic growth; and high technology firms can be representative of technology-based firms (Brown *et al.* 2012). Further, if we see technology-based industry sectors as R&D intensive sectors (which show relatively higher intensity of R&D expenditure on value added), both high-tech and medium-high-tech manufacturing sectors could be identified as technology-based sectors (Sterlacchini and Venturini 2014). Therefore, here the SMEs in both high and medium-high technology manufacturing sectors are researched together; in fact, it is possible to study high and medium-high technology sectors together (for instance, in the research of Bertarelli and Lodi (2018) and Kanellos and Papadimitriou (2013)), because of the blurring boundaries between medium-high and high technology sectors and the similarity in the challenges faced by the firms in these two types of sector (Müller and Vorbach 2015).

Compared to small firms in general, high technology small firms may face more financing problems because of being riskier (including the uncertainty of the market for the product or service and whether the research will even lead to a product or service) and then showing higher default rate (Westhead and Storey 1997). In fact, R&D activity may not realize any benefit and return on investment in the near future, which would increase the uncertainty in cash flows and working capital (Baum *et al.* 2013); with sampling firms in the high-tech industries for representing the majority of R&D, the research of Borisova and Brown (2013) shows that firms use net working capital (liquid assets) to smooth R&D investment in intangible capital. On the other hand, the positive effect of R&D on the productivity of the manufacturing firms in high-tech sectors is supported by some researchers (Ortega-Argilés *et al.* (2015). Hence, it is necessary to research on working capital management (that is related to R&D investment and then productivity and profitability) in technology-based SMEs, where rich intangible assets are shown as the results of R&D investment (Baum *et al.* 2013, Revest and Sapio 2012).

With using panel data methods (fixed effects model and pooled regression model), this paper mainly analyzes the impacts of the period of receivables, the period of inventory, the period of payables, and cash conversion cycle (as the factors of working capital management) on the profitability of Portuguese SMEs in high technology and medium-high technology manufacturing sectors. Besides, the influence of some important firm-related factors (including firm size, growth, age, leverage, and intangible assets), industry-related factor (industry dummy), and macro-economic factor (Gross Domestic Product growth—GDP growth) is also taken into

account. In particular, the total sample is classified into micro and non-micro SME groups as well as young and mature groups, in order to compare the differences of firms in different size and age stages. Thus, this paper contributes to the traditional issue of working capital management with new evidence in technology-based SMEs by finding some strongly influential factors on profitability. The followings are organized in this order: literature review, data, variables, and methodology, results and discussion, and conclusion.

1. Literature review

Working capital is defined as current assets (mainly accounts receivable, inventories, and cash) less current liabilities (mainly accounts payable and short-term debt), which represents net liquid assets (Fazzari and Petersen 1993). Kroflin and Kratz (2015) further state that: in the cash-related research of working capital, asset side (especially trade receivables and inventories) is highlighted especially for the growing companies which need constant investment in inventory and accounts receivable with long-term financing; on the other hand, if using the definition of working capital from the liability side as long-term capital minus fixed assets, working capital is the long-term funds used in financing current assets, and reducing working capital could be helpful to generate cash and decrease capital requirements, then reducing firm's future dependence on external debt financing.

As pointed out by Bieniasz and Gołaś (2011), optimization of current assets is concerned with both the assets level and the sources of financing. Rădăşanu (2015) states that the firms with low level of working capital (not holding idle cash) mainly rely on short-term debt, and these firms could be profitable by virtue of not being overcapitalized; however, in the situation of requiring funds in illiquid market, those firms would have troubles in financing growth and would lose competitive position. On the other hand, the firms with excess long-term financing (long-term debt or equity) need to pay high costs of capital but gain the flexibility in extra financing (if needed), which could gain extra profits when the competitors are in financial distress and cash shortages, so high level of working capital with large amount of long-term debt or equity can help firms to attack competitor's market position, especially in the instable financial environments (Rădăşanu 2015).

With regard to SMEs, based on previous studies, Afrifa (2013) points out some financial features of SMEs compared to large firms: more current assets, less liquidity, more volatility in cash flow, and more reliance on short-term debt; thus, it is necessary for SMEs to pay particular attention to the control and monitoring of working capital, which has been studied by many researchers, such as: Muscettola (2014), García-Teruel and Martínez-Solano (2007), and Yazdanfar and Öhman (2014). In fact, due to information asymmetries, SMEs tend to suffer financing constraints, and financial constraints usually exert negative effects on working capital to the firms lacking of internal funds (Martinez-Carrascal and Ferrando 2008, García-Posada 2018); this is especially true for European technology-based small firms (or high-tech small businesses) which finance new investments mainly by internal funds due to the gap between the costs of internal and outside finance (Revest and Sapio 2012).

In the case of financing constraints, the relationship between working capital investment and fixed investment is competitive for limited financing sources (Fazzari and Petersen 1993). As pointed out by Kroflin and Kratz (2015), because the return of working capital is relatively lower, reducing working capital can release capital employment and then increase liquidity, which could be used for strategic investments with higher returns or for decreasing debt to reduce capital costs. This viewpoint is to some extent supported by Fazzari and Petersen (1993), who believe that the change of fixed investment is relatively costly especially in the situation of financial constraints, so even financially constrained firms can adjust working capital to offset the impact of cash flow shocks on fixed investment (especially when the stock of working capital is high).

Working capital is usually measured by cash conversion cycle (the time from the expenditure for purchasing raw materials to the collection of sales), and longer cash conversion cycle means larger investment in

working capital (Deloof 2003). As pointed by Jose *et al.* (1996), cash conversion cycle gathers both the information from balance sheet and income statement to create a time measure between the cash payout for resources and the cash receipts from product sales, so cash conversion cycle is a measure of ongoing liquidity management which stands at the point of cash flow rather than static ratios. Cash conversion cycle also measures the efficiency of working capital management (which indicates the time of current assets converted into cash) and operational efficiency (whether paying firm's liabilities on time), and it can reflect an overview of a critical financial process of a firm (Cristian and Raisa 2017, Yazdanfar and Öhman 2014). More specifically, cash conversion cycle shows the time of investment being locked in production before turning to cash, the efficiency of a firm in its payments, collection of payment, and selling of inventory (Cristian and Raisa 2017, Muscettola 2014).

Based on previous studies, Pais and Gama (2015) point out two approaches for working capital management: the first is aggressive policy with high level of non-current assets and low level of current assets (cash balances, inventories and granting credit to customers), where there exists the risk of insufficiency in funds for operation and short-term debt; the second is flexible and conservative policy with less non-current assets and more current assets. The aggressive approach of liquidity management means shorter cash conversion cycle (including decreasing the periods of inventory and accounts receivable as well as increasing the period of accounts payable), whereas the conservative approach means longer cash conversion cycle (Jose *et al.* 1996).

As summarized by Tauringana and Afrifa (2013), aggressive working capital management strategy means reducing the investment in working capital by decreasing the amount of inventory and accounts receivable, which may benefit firm's profitability through minimizing inventory holding costs (for example, warehouse storage costs and insurance costs) and releasing funds from accounts receivable to investing elsewhere; on the other hand, conservative strategy (which means to increase investment in working capital) may also increase sales and then profitability by virtue of reducing the risk of stock-out, production disruptions, and price fluctuations (through increasing inventories) and helping customers to obtain credit and to differentiate between products then to reduce the information asymmetry between buyers and sellers (through increasing receivables).

Baños-Caballero *et al.* (2010) point out that longer cash conversion cycle means more funds invested in working capital; and, according to the theory of Modigliani and Miller (1958) which proposes the independence between investment decisions and financing decisions and a perfect substitute relationship between internal and external funds in perfect capital markets, no opportunity cost would occur for longer cash conversion cycle in this situation because of obtaining external funds without problems and at a reasonable price. They further state that longer cash conversion cycle (which means investing more in inventories, increasing trade credit granted, or reducing supplier's financing to get discount for early payments) could promote firm's sales and then profitability, because of the effects of larger inventories on preventing the interruptions of production process and the loss of business as well as the effects of granting trade credit on helping customers to assess product quality before paying and on building long-term relationships with customers.

In spite of the above listed benefits, longer cash conversion cycle may cause opportunity costs (for example, forgoing other productive investments) and may harm profitability if causing high costs in holding more inventory or granting more trade credit (Baños-Caballero *et al.* 2010, Deloof 2003). By contrast, shorter cash conversion cycle means shorter period of operating cycle or longer period of payment; this can be advantageous to firms by financing from suppliers (Bieniasz and Gołaś 2011). As stated by Jose *et al.* (1996), shorter cash conversion cycle has many benefits: minimizing the holdings of relatively unproductive assets (like cash); preserving debt capacity by reducing the requirement of short-term borrowing; and corresponding to higher present value of net cash flow.

Most empirical studies support negative relationship between cash conversion cycle and profitability, indicating the effects of aggressive policy of working capital management on improving corporate profitability

(Cristian and Raisa 2017, Pais and Gama 2015). However, no consensus has been reached. For instance, though Jose *et al.* (1996) find positive impact of aggressive liquidity management (shorter cash conversion cycle) on profitability in several industries (natural resources, manufacturing, service, retail and wholesale, and professional services), their findings also show no significant relationship between cash conversion cycle and profitability in construction industry. The study of Muscettola (2014) shows that cash conversion cycle is not significantly related to profitability, whereas Yazdanfar and Öhman (2014) find inverse relationship between cash conversion cycle and profitability. The study of Baños-Caballero *et al.* (2010) on Spanish SMEs shows that there exists a target cash conversion cycle for firms and the process to adjust to the target is relatively quick.

As for the main components of working capital (accounts receivable, stocks or inventories, and accounts payable; Mazzarol 2014), Cristian and Raisa (2017) point out that: days to collect account receivables should be negatively related to profitability because of giving pressure on the available working capital; days of inventories show the time for inventories to be turned into cash, which should be negatively related to profitability; days of payables reflect the time to pay its suppliers and in most cases a prolonged period of payment (in an interest-free financing period) would benefit firms.

On the other hand, reducing inventory period may lead to the risk of lacking stocks and then losing sales; reducing receivable period may cause the decrease in credit to customers and then decrease in sales; increase in payable period may result in the loss of discount opportunity in early payment and the flexibility for future debt (Jose *et al.* 1996). Furthermore, Schwartzman (2013) points out that: the reasons for firms to hold inventories include avoiding stock-out and saving costs in moving goods (purchasing inputs or delivering outputs in batches); however, holding inventories can make firms forgo financial investments (due to purchasing inputs for generating future cash flows) and incur storage costs. In terms of payment period, although longer payment period can help firms control liquidity risk because of reducing working capital demand (Bieniasz and Gołaś 2011), late payment can be costly due to dropping the discount for early payment (Deloof 2003).

2. Data, variables, and methodology

From the Iberian Balance Sheet Analysis System (SABI) developed by Bureau Van Dijk) database, the SMEs from high technology and medium-high technology manufacturing sectors (where the technology classification is referred to the high-tech classification of manufacturing industries on NACE Rev. 2 2-digit level from Eurostat) are chosen as the research target. Referring to the criteria of EU, here the standards for identifying SMEs are: number of employees less than 250, turnover less than or equal to 50 million Euros and balance sheet total less than or equal to 43 million Euros. Considering the flow of employees, here the standard for SME (controlling number of employees, turnover and balance sheet total all) is tighter than the original criteria of EU; and there are also some researchers as Sogorb-Mira (2005) using the criteria that include all the restrictions on number of employee, turnover, and assets for defining SME. In the same vein, micro firms are identified as: number of employees less than 10, turnover less than or equal to 2 million Euros and balance sheet total less than or equal to 2 million Euros. Dropping the firms with missing data, outliers and errors (the problems of which in using panel data compiled from financial statements are especially pointed out by Yazdanfar and Öhman (2014), finally 1082 firms are chosen for building the total sample with the complete data from 2011 to 2016, where the studying period is from 2012 to 2016 and the data in 2011 are used for calculating (*e.g.* the growth between 2011 and 2012). Further, the total sample is classified into micro group and non-micro group as well as young group and mature group (according to the classification standard of Haltiwanger *et al.* (2013), where young firms are those no more than 10 years old and mature firms are those beyond 10 years old). The distribution of the sample firms in the classified groups is shown in Table 1.

Table 1. Distribution of the sample firms in manufacturing sectors

NACE Rev.2 (2-digit level)	Manufacturing sectors	Technology type	No of firms in total sample (1082)	No of obs. in total sample (5410)	No of micro firms (384)	No of obs. of micro firms (1920)	Number of non-micro firms (698)	No of obs. of non-micro firms (3490)	No of young firms (275)	No of obs. of young firms (1375)	No of mature firms (807)	No of obs. of mature firms (4035)
20	Manufacture of chemicals and chemical products	Medium-high technology	234	1170	90	450	144	720	50	250	184	920
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	High technology	27	135	2	10	25	125	8	40	19	95
26	Manufacture of computer, electronic and optical products	High technology	53	265	25	125	28	140	20	100	33	165
27	Manufacture of electrical equipment	Medium-high technology	178	890	59	295	119	595	50	250	128	640
28	Manufacture of machinery and equipment n.e.c.	Medium-high technology	409	2045	150	750	259	1295	105	525	304	1520
29	Manufacture of motor vehicles, trailers and semi-trailers	Medium-high technology	146	730	49	245	97	485	35	175	111	555
30	Manufacture of other transport equipment	Medium-high technology	35	175	9	45	26	130	7	35	28	140

Note: The technology type is referred to the high-tech classification of manufacturing industries on NACE Rev. 2 2-digit level from Eurostat.

Source: https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:High-tech_classification_of_manufacturing_industries

The reason for separately studying micro firms and non-micro SMEs as well as young SMEs and mature SMEs is that high-tech investment has some special financial features - skewness and uncertainty in returns, information asymmetries between firms and potential investors, and limitation in collateral value (Carpenter and Petersen 2002); and among these features, information asymmetries would cause financing constraints especially to SMEs (Martinez-Carrascal and Ferrando 2008). Financial constraints tend to negatively impact on working capital investment (Mielcarz *et al.* 2018); however, the impacts of credit constraints on micro firms are much less (even if they are more financially constrained), which is explained as micro firms relying more on internal funds (García-Posada 2018). Thus, it is reasonable to observe whether there are differences about the impacts of working capital management on profitability between micro firms and non-micro SMEs.

In fact, Afrifa *et al.* (2014) already point out this important question of working capital management: that is, whether there are differences between small and medium firms about the importance of working capital management to firm's performance; and the basis for them to propose this question is the problem of the difference in getting access to finance (that is, firm's working capital management strategy will be influenced by the availability of resources, and more resources can be helpful for firms to effectively and efficiently manage working capital). Aside from size, firm age is also an important factor impacting on the probability of financing constraints (Winker 1999). Ferrando and Mulier (2015) further stress the importance of firm age in explaining both the perceived and the actual financial constraints; thus, referring to the research of Bottazzi *et al.* (2014) who classify firms into different age groups to identify the difference in financial constraints, this paper also categorizes the total sample into different age groups (based on the possible financial constraints to high and medium-high technology SMEs caused by information asymmetries).

In the previous studies on the impacts of working capital on profitability, return on assets (ROA) usually works as dependent variable (for example in the studies of Pais and Gama (2015) as well as García-Teruel and Martínez-Solano (2007)), so ROA is chosen as the proxy of profitability. The explanatory variables and control variables are too chosen from the past research, for instance: García-Teruel and Martínez-Solano (2007), Deloof (2003), Pais and Gama (2015), Yazdanfar and Öhman (2014), and Korent and Orsag (2018): the period of receivables, the period of inventory, the period of payables, and cash conversion cycle as well as growth, firm size, debt level, firm age, annual GDP growth, and industry dummy; in particular, the ratio of intangible fixed assets to total assets is also chosen as a control variable, because of researching on high and medium-high technology sectors. The details of the definitions of variables are shown in Table 2.

Table 2. Definitions of variables

Dependent variable	Measurement
Return on Assets (ROA)	Economic profitability: Profits before tax/Total assets
Independent variables	Measurements
The period of receivables (Receivables)	(Average accounts receivable/sales)*365
The period of inventory (Stocks)	(Average inventories/purchases)*365
The period of payables (Payables)	(Average accounts payable/purchases)*365
Cash conversion cycle (CCC)	(Average accounts receivables/sales)*365 + (Average inventories/purchases)*365 - (Average accounts payable/purchases)*365
Growth	(The operating revenues in year t - The operating revenues in year t-1) / The operating revenues in year t-1
Firm size	Natural logarithm of total assets: Ln total assets in thousands of Euros
Leverage	Indebtedness: (Total shareholders' funds and liabilities — Shareholders' equity)/Total shareholders' funds and liabilities

Dependent variable	Measurement
Intangible assets (Intangibles)	The ratio of intangible fixed assets to total assets
Firm age	Natural logarithm of firm age based on 2012: Ln firm age (which changes with the increase in year)
GDP growth	GDP growth percentage in 2012, 2013, 2014, 2015, and 2016 (from the database of the World Bank. Available at: https://data.worldbank.org/
Industry sector	NACE Rev. 2 2-digit level: 20, 21, 26, 27, 28, 29, 30

Notes: The calculating formulas of the period of receivables, the period of inventory, the period of payables, and cash conversion cycle are adopted from the research paper of Baños-Caballero *et al.* (2010); Purchases are calculated by Material Costs plus Final Materials (inventories at the end of the year) minus Initial Materials (inventories at the beginning of the year); the average accounts receivable, the average accounts payable, and the average inventory are calculated by the sum of the amount at the beginning of the year and the amount at the end of the year divided by two. There are seven industry sectors, so six industry dummy variables are generated.

According to the statistics (Table 3), compared to non-micro SMEs, micro firms show lower ROA, lower growth rate, lower level of total assets, lower level of intangible assets, higher indebtedness, younger age, shorter period of receivables, longer period of inventory, shorter period of payables, and longer cash conversion cycle on average. Compared to mature SMEs, young SMEs show higher ROA, higher growth rate, lower level of total assets, higher indebtedness, higher level of intangible assets, younger age, shorter period of receivables, shorter period of inventory, shorter period of payables, and shorter cash conversion cycle on average.

Table 3. Statistics of the sample

Statistics of the total sample				
Variables (Observations: 5410)	Mean	Standard Deviation	Min	Max
ROA	0.053	0.133	-3.535	3.515
Growth	0.260	12.072	-0.796	887.409
Ln assets	6.801	1.642	1.19	10.552
Indebtedness	0.545	0.268	0.012	1.989
Intangibles	0.006	0.030	0	0.595
Ln age	2.915	0.751	0	4.804
GDP growth	-0.002	0.022	-0.040	0.018
Receivables period	126.900	67.402	0	362.202
Stocks period	167.465	227.829	0	3979.394
Payables period	114.938	68.51	0	364.924
CCC	179.427	232.205	-212.813	3793.945
Statistics of the micro group				
Variables (Observations: 1920)	Mean	Standard Deviation	Min	Max
ROA	0.043	0.160	-3.535	0.748
Growth	0.116	0.631	-0.745	10.836
Ln assets	5.189	0.931	1.190	7.508
Indebtedness	0.567	0.316	0.012	1.972
Intangibles	0.002	0.014	0	0.360
Ln age	2.673	0.790	0	4.585

Variables (Observations: 1920)	Mean	Standard Deviation	Min	Max
GDP growth	-0.002	0.022	-0.040	0.018
Receivables period	122.087	73.218	0	362.202
Stocks period	180.493	245.617	0	3244.145
Payables period	101.995	70.749	0	350.113
CCC	200.585	246.492	-212.813	3091.042
Statistics of the non-micro group				
Variables (Observations: 3490)	Mean	Standard Deviation	Min	Max
ROA	0.059	0.115	-1.184	3.515
Growth	0.339	15.024	-0.796	887.409
Ln assets	7.688	1.220	3.367	10.552
Indebtedness	0.534	0.236	0.040	1.989
Intangibles	0.008	0.036	0	0.595
Ln age	3.048	0.694	0	4.804
GDP growth	-0.002	0.022	-0.040	0.018
Receivables period	129.548	63.834	4.935	361.489
Stocks period	160.297	217.127	0	3979.394
Payables period	122.058	66.186	0	364.924
CCC	167.787	223.138	-183.965	3793.945
Statistics of the young group				
Variables (Observations: 1375)	Mean	Standard Deviation	Min	Max
ROA	0.069	0.128	-0.962	0.726
Growth	0.870	23.937	-0.664	887.409
Ln assets	6.130	1.544	2.219	10.132
Indebtedness	0.634	0.271	0.028	1.891
Intangibles	0.008	0.040	0	0.595
Ln age	1.912	0.553	0	2.639
GDP growth	-0.002	0.022	-0.040	0.018
Receivables period	114.068	63.252	0.535	361.489
Stocks period	121.511	191.473	0	3244.145
Payables period	108.334	72.355	0	364.924
CCC	127.245	189.013	-171.951	3091.042
Statistics of the mature group				
Variables (Observations: 4035)	Mean	Standard Deviation	Min	Max
ROA	0.048	0.135	-3.535	3.515
Growth	0.052	0.285	-0.796	7.466
Ln assets	7.030	1.612	1.190	10.552
Indebtedness	0.515	0.260	0.012	1.989
Intangibles	0.005	0.026	0	0.465
Ln age	3.257	0.438	2.398	4.804
GDP growth	-0.002	0.022	-0.040	0.018

Variables (Observations: 4035)	Mean	Standard Deviation	Min	Max
Receivables period	131.273	68.217	0	362.202
Stocks period	183.124	236.952	0	3979.394
Payables period	117.188	67.011	0	363.261
CCC	197.209	242.661	-212.813	3793.945

The Pearson correlation tests (Table 4) show that, except for the correlation between cash conversion cycle and the period of inventory, there is no strong correlation or collinearity (where the absolute value of coefficient is close to 1); the strong correlation between cash conversion cycle and the period of inventory does not influence the regressions, because cash conversion cycle and the period of inventory are separated into different regressions.

Referring to the research methods of Deloof (2003), Tauringana and Afrifa (2013), and especially Pais and Gama (2015), balanced panel data methods are used in this paper for analyzing the impacting factors on SME profitability; panel data method can help to control firm heterogeneity and reduce collinearity among the variables (Sogorb-Mira 2005). Here, in particular, the period of receivables, the period of inventory, the period of payables, and cash conversion cycle are studied respectively. Panel data regressions are also operated respectively on the total sample, micro group, non-micro group, young group and mature group; and the results of fixed effects model and pooled regression model (which is firstly for introducing industry sector dummy in and secondly as robustness test) are documented.

Table 4. Pearson correlation tests

Pearson correlation of the total sample										
Observations 5410	ROA	Growth	Ln assets	Indebtedness	Intangibles	Ln age	GDP growth	Receivables	Stocks	Payables	CCC
ROA	1										
Growth	0.001	1									
Ln assets	0.107	-0.013	1								
Indebtedness	-0.290	0.026	-0.117	1							
Intangibles	-0.019	0.266	0.131	0.006	1						
Ln age	-0.085	-0.062	0.343	-0.236	-0.012	1					
GDP growth	0.111	-0.025	0.052	-0.069	0.005	0.133	1				
Receivables	-0.124	-0.028	0.097	-0.093	-0.009	0.139	-0.053	1			
Stocks	-0.146	-0.014	-0.029	0.003	-0.002	0.159	-0.022	0.009	1		
Payables	-0.137	-0.028	0.109	0.267	0.002	0.046	-0.085	0.334	0.142	1	
CCC	-0.139	-0.014	-0.032	-0.103	-0.005	0.183	-0.012	0.201	0.942	-0.059	1
Pearson correlation of the micro group										
Observations 1920	ROA	Growth	Ln assets	Indebtedness	Intangibles	Ln age	GDP growth	Receivables	Stocks	Payables	CCC
ROA	1										
Growth	0.159	1									
Ln assets	0.193	-0.047	1								
Indebtedness	-0.283	0.079	-0.168	1							
Intangibles	0.012	0.038	0.088	-0.058	1						
Ln age	-0.118	-0.259	0.184	-0.184	0.011	1					
GDP growth	0.111	-0.069	0.075	-0.071	-0.021	0.165	1				
Receivables	-0.102	-0.147	0.207	-0.131	0.044	0.157	-0.037	1			
Stocks	-0.212	-0.113	0.021	0.112	-0.009	0.204	-0.042	-0.062	1		
Payables	-0.159	-0.112	0.078	0.251	-0.045	0.061	-0.093	0.345	0.119	1	

CCC	-0.196	-0.124	0.059	0.0004	0.017	0.232	-0.026	0.137	0.944	-0.066	1
				Pearson correlation of the non-micro group							
Observations 3490	ROA	Growth	Ln assets	Indebtedness	Intangibles	Ln age	GDP growth	Receivables	Stocks	Payables	CCC
ROA	1										
Growth	-0.004	1									
Ln assets	0.044	-0.031	1								
Indebtedness	-0.292	0.035	-0.081	1							
Intangibles	-0.039	0.277	0.102	0.034	1						
Ln age	-0.088	-0.079	0.293	-0.268	-0.049	1					
GDP growth	0.114	-0.029	0.077	-0.069	0.010	0.120	1				
Receivables	-0.151	-0.034	0.030	-0.056	-0.030	0.111	-0.063	1			
Stocks	-0.088	-0.015	-0.006	-0.092	0.005	0.154	-0.010	0.063	1		
Payables	-0.140	-0.035	-0.020	0.303	-0.004	-0.019	-0.081	0.320	0.169	1	
CCC	-0.087	-0.014	0.009	-0.195	-0.003	0.187	-0.003	0.253	0.941	-0.041	1
				Pearson correlation of the young group							
Observations 1375	ROA	Growth	Ln assets	Indebtedness	Intangibles	Ln age	GDP growth	Receivables	Stocks	Payables	CCC
ROA	1										
Growth	-0.008	1									
Ln assets	0.077	-0.012	1								
Indebtedness	-0.457	0.038	-0.027	1							
Intangibles	-0.003	0.394	0.127	0.016	1						
Ln age	-0.075	-0.103	0.236	-0.100	-0.048	1					
GDP growth	0.088	-0.052	0.111	-0.103	-0.001	0.418	1				
Receivables	-0.111	-0.046	0.168	-0.118	-0.064	0.146	0.014	1			
Stocks	-0.207	-0.020	0.050	0.028	-0.005	0.142	-0.019	-0.014	1		
Payables	-0.191	-0.045	0.224	0.215	-0.039	0.085	-0.054	0.413	0.218	1	

| CCC | -0.174 | -0.019 | 0.021 | -0.094 | -0.011 | 0.160 | 0.006 | 0.162 | 0.925 | -0.023 | 1 |

Pearson correlation of the mature group											
Observations 4035	ROA	Growth	Ln assets	Indebtedness	Intangibles	Ln age	GDP growth	Receivables	Stocks	Payables	CCC
ROA	1										
Growth	0.170	1									
Ln assets	0.143	0.008	1								
Indebtedness	-0.261	0.072	-0.091	1							
Intangibles	-0.031	-0.010	0.157	-0.009	1						
Ln age	-0.039	-0.048	0.270	-0.157	0.071	1					
GDP growth	0.119	0.074	0.035	-0.058	0.008	0.126	1				
Receivables	-0.119	-0.158	0.045	-0.059	0.023	0.060	-0.074	1			
Stocks	-0.122	-0.127	-0.088	0.026	0.005	0.099	-0.023	-0.002	1		
Payables	-0.114	-0.129	0.055	0.310	0.029	-0.035	-0.096	0.303	0.113	1	
CCC	-0.121	-0.133	-0.089	-0.076	0.003	0.124	-0.017	0.196	0.945	-0.081	1

3. Results and discussion

3.1. The results of fixed effects model at the significant level of 0.05 (Table A1-A5)

To sum up (shown in Table 5), the period of receivables shows statistically significant negative relationship to profitability in all the regressions, while the impacts of the period of inventory, the period of payables, and cash conversion cycle are instable. As for the other factors, when being statistically significant, growth shows positive relationship to profitability in micro and mature groups; total assets show positive relationship to profitability in nearly all the regressions; indebtedness shows negative relationship to profitability in all the regressions; intangible assets show negative relationship to profitability in total sample and young groups; age shows negative relationship to profitability in nearly all the regressions; GDP growth shows positive relationship to profitability in nearly all the regressions.

Table 5. The results of fixed effects model at the significant level of 0.05

	Period of receivables	Period of inventory	Period of payables	CCC	Growth	Ln assets	Indebtedness	Intangibles	Ln age	GDP growth
Total sample	negative					positive	negative	negative	negative	positive
						positive	negative	negative	negative	positive
						positive	negative	negative	negative	positive
				negative		positive	negative	negative	negative	positive
Micro group	negative				positive	positive	negative		negative	positive
		negative			positive	positive	negative		negative	positive
			negative		positive	positive	negative		negative	positive
				negative	positive	positive	negative		negative	positive
Non-micro group	negative						negative		negative	positive
		positive					negative		negative	positive
			positive				negative		negative	positive
				positive			negative		negative	positive
Young group	negative					positive	negative	negative	negative	
		negative				positive	negative	negative	negative	
			negative			positive	negative	negative	negative	
				negative		positive	negative	negative	negative	
Mature group	negative				positive	positive	negative			positive
		positive			positive	positive	negative			positive
			positive		positive	positive	negative			positive
				positive	positive	positive	negative			positive

3.2 The results of pooled regression model at the significance of 0.05 (Table A6-A10)

The results of pooled regression model show that (in Table 6): when being statistically significant, the period of receivables, the period of inventory, the period of payables, and cash conversion cycle all show negative relationship to profitability; in particular, the period of receivables, the period of inventory, and cash conversion cycle are statistically significant in all the pooled regressions, while the period of payables is statistically significant in all the pooled regressions except for in mature group.

In all the pooled regressions, total assets and GDP growth show positive relationship to profitability, while indebtedness and age show negative relationship to profitability. Growth shows positive relationship to profitability in the pooled regressions of micro and mature groups, whereas intangible assets show negative relationship to profitability in the pooled regressions of total sample, non-micro and mature groups. Industry dummy shows more significance in micro group compared to in non-micro group; and it also shows more significance in young group compared to in mature group.

Table 6. The results of pooled regression model at the significance of 0.05

	Period of receivables	Period of inventory	Period of payables	CCC	Growth	Ln assets	Indebtedness	Intangibles	Ln age	GDP growth	Industry dummy
Total sample	negative					positive	negative	negative	negative	positive	Yes
		negative				positive	negative	negative	negative	positive	Yes
			negative			positive	negative	negative	negative	positive	Yes
				negative		positive	negative	negative	negative	positive	Yes
Micro group	negative				positive	positive	negative		negative	positive	Yes
		negative			positive	positive	negative		negative	positive	Yes
			negative		positive	positive	negative		negative	positive	Yes
				negative	positive	positive	negative		negative	positive	Yes
Non-micro group	negative					positive	negative	negative	negative	positive	Yes
		negative				positive	negative	negative	negative	positive	Yes
			negative			positive	negative	negative	negative	positive	Yes
				negative		positive	negative	negative	negative	positive	Yes
Young group	negative					positive	negative		negative	positive	Yes
		negative				positive	negative		negative	positive	Yes
			negative			positive	negative		negative	positive	Yes
				negative		positive	negative		negative	positive	Yes
Mature group	negative				positive	positive	negative	negative	negative	positive	Yes
		negative			positive	positive	negative	negative	negative	positive	Yes
					positive	positive	negative	negative	negative	positive	Yes
				negative	positive	positive	negative	negative	negative	positive	Yes

3.3. Summary and discussion

Generally speaking, the results of fixed effects model and pooled regression model say that:

- the period of receivables shows negative relationship to profitability in all the regressions; the impacts of the period of inventory, the period of payables, and cash conversion cycle are instable in fixed effects model, while these three factors show negative effects in pooled regression model;

- the positive effects of total assets and GDP growth are manifest, and the negative effects of indebtedness and age are also obvious; growth shows positive relationship to profitability in micro and mature groups, while intangible assets show negative relationship to profitability in the total sample. So the period of receivables, total assets, indebtedness, age, and GDP growth could be seen as strong influential factors to profitability. Besides, industry sector (working as dummy variable in pooled regression model) does influence profitability.

The result that the period of receivables works as a strong indicator (showing negative relationship to profitability) corresponds to the finding of Deloof (2003) that reducing the number of days accounts receivable can increase profitability. The period of inventory too shows negative relationship to profitability in majority (excluding in the fixed model of non-micro group and mature group where positive relationship is shown). Thus, the above results tend to support the finding of Yazdanfar and Öhman (2014) that increasing average collection period (inventory turnover and average accounts receivable in days) could decrease profitability; and they attribute this inverse relationship to the increase in the costs of working capital maintenance.

Muscettola (2014) also states that longer period of receivables or inventory could be expensive (if not being adequately capitalized and then requiring a number of external sources) and that extending large trade credit may result in cash inflow difficulties, which is especially true for small firms due to the difficulties and expensiveness in obtaining short-term financing (Cristian and Raisa 2017). In fact, as pointed out by Bieniasz and Gołaś (2011), the time periods of inventory turnover cycle and receivables cycle represent the time passed from purchasing materials to the collection of accounts receivable from the sale of final products, which should be shortened to reduce the cost of capital. With regard to the period of payables, its negative impact on profitability is obvious for micro firms and young SMEs. In fact, this result is not surprising, because late payment means to forgo the discount of early payment (which would be costly, considering that young and small firms usually have difficulties to obtain external funds (Deloof 2003, Musso and Schiavo 2008). So the results here are similar to the research of Deloof (2003) who finds that reducing the number of days accounts receivable, inventories, and accounts payable can increase profitability (indicating negative relationships of the three factors to profitability). As for cash conversion cycle, although it shows statistical significance in all the regressions, its impact is instable: being negatively related to profitability in majority but being positively related to profitability in the fixed effects model of non-micro and mature groups. So the result here generally tends to follow most empirical studies (which support negative relationship between cash conversion cycle and profitability—here especially for micro firms and young SMEs—indicating positive effect of the aggressive policy of working capital management (Cristian and Raisa 2017, Pais and Gama 2015).

The strongly positive impact of total assets (as the proxy of firm size) and strongly negative impact of age are in accord with the research results of Yazdanfar and Öhman (2014) who find positive relationship between firm size and profitability and negative relationship between firm age and profitability. Traditionally, compared to smaller firms, larger firms have advantages in scale economies, diversification, market power and then in earnings and stability (Mills and Schumann 1985, Theodossiou *et al.* 1996). Considering the research target of high and medium-high technology SMEs, the importance of human capital (especially skilled employees) and advanced production technology should be highlighted: larger firms should be more attractive to skilled workers because of the capacity to proffer higher salaries and should have more funds to invest in advanced production

technology. The negative relationship between firm age and profitability (especially in high and medium-high technology sectors) can be explained by liability of obsolescence that illustrates the constraints caused by inertia on old firms to accommodate themselves to environmental changes as well as liability of senescence that reveals the negative effects of accumulated rules and routines on older firms (Barron *et al.* 1994).

The strongly negative impact of indebtedness and strongly positive impact of GDP growth correspond to the research results of Pais and Gama (2015) who find that financial debt level is negatively related to profitability while annual GDP growth is positively related to profitability. In addition, the result that growth shows positive relationship to profitability also to some extent corresponds to the finding of Pais and Gama (2015) about positive relationship between sales growth and profitability. The negative impact of intangible assets is also observed, which may be because the targets of investments in R&D and other intangible assets are to generate long-term (rather than immediate) benefits (Mateev and Anastasov 2010).

In terms of the explanation of the negative relationship between leverage and profitability, it can be attributed to agency theory (Yazdanfar and Öhman 2015), the repayment of debt consuming resource and negatively impacting on investment (Asimakopoulos *et al.* 2009), and higher borrowing costs and the constraints on valuable investments (Baños-Caballero *et al.* 2012). Regarding the positive relationship between growth and profitability, as summarized by Steffens *et al.* (2009), the theories from financial perspective supporting this relationship include: L-shaped cost curves and minimum efficient scale (Mansfield 1979, Gupta 1981) as well as experience curve effects about the negative relationship between cumulative output and total unit costs (Buzzell *et al.* 1975). The positive impact of GDP growth illustrates that good macro-economic environment can benefit SMEs.

Conclusion

With using panel data methods, this paper analyzes the impacts of working capital management (together with some other important factors) on the profitability of Portuguese SMEs in high technology and medium-high technology manufacturing sectors. In particular, regarding the impacts on profitability, research results show that:

- the negative effects of the period of receivables, the period of inventory, the period of payables, and cash conversion cycle are stressed, but not for non-micro and mature firms (where positive relationship exists for the period of inventory, the period of payables, and cash conversion cycle); so here the aggressive working capital management strategy and shorter cash conversion cycle are partially supported;
- the positive effects of total assets and GDP growth as well as the negative effects of indebtedness and age are highlighted.

The main contribution of this paper is that it enriches the empirical studies on working capital management (this traditional topic) of SMEs in some special sectors - namely high technology and medium-high technology manufacturing sectors, with a detailed analysis on SMEs in different size and different age groups. One possible limitation of this paper is the sample size (being not a large sample); and the reason behind is that in Portugal there are not a large number of SMEs in high technology and medium-high technology manufacturing sectors. Thus, future research could pay attention to SMEs in different countries firstly to enlarge sample size and secondly to observe working capital management in different countries.

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APPENDIX A

Receivables, stocks, payables, and CCC respectively represent the period of receivables, the period of inventory, the period of payables, and cash conversion cycle. All the results of F-test (Prob > F = 0.000) show that fixed effects model is better than pooled regression model, and all the results of Hausman-test (Prob>chi2 = 0.000) show that fixed effects model is better than random model. So there is no need to do Breusch-Pagan test to compare random model with pooled regression model. SS, dF, and MS respectively represent sum of squares, degree of freedom and mean square. With creating the cross variables between the independent variables and the dummy variables of micro and non-micro firms as well as young and mature firms, the results of Chow test (not shown here) support the statistically significant differences between the micro and the non-micro groups as well as the young and the mature groups.

Table A1. The results of fixed effects model of the total sample

Fixed-effects (within) regression	Number of groups: 1082			Number of observations: 5410				Dependent variable: ROA							
Independent variables	Coefficient	t	P>|t|	Independent variables	Coefficient	t	P>|t|	Independent variables	Coefficient	T	P>|t|	Independent variables	Coefficient	t	P>|t|
Receivables	-4.35×10^{-4}	-8.38	0.000	Stocks	-1.91×10^{-5}	-1.30	0.193	Payables	-3.50×10^{-5}	-0.83	0.408	CCC	-5.22×10^{-5}	-3.45	0.001
Growth	1.05×10^{-6}	0.01	0.994	Growth	9.93×10^{-6}	0.07	0.946	Growth	8.57×10^{-6}	0.06	0.954	Growth	1.04×10^{-5}	0.07	0.944
Ln assets	6.98×10^{-2}	9.35	0.000	Ln assets	6.52×10^{-2}	8.69	0.000	Ln assets	6.54×10^{-2}	8.71	0.000	Ln assets	6.54×10^{-2}	8.73	0.000
Indebtedness	-3.34×10^{-1}	-19.17	0.000	Indebtedness	-3.41×10^{-1}	-19.45	0.000	Indebtedness	-3.39×10^{-1}	-19.18	0.000	Indebtedness	-3.44×10^{-1}	-19.61	0.000
Intangibles	-3.05×10^{-1}	-2.30	0.021	Intangibles	-3.03×10^{-1}	-2.27	0.023	Intangibles	-3.01×10^{-1}	-2.25	0.024	Intangibles	-3.06×10^{-1}	-2.29	0.022
Ln age	-7.59×10^{-2}	-5.25	0.000	Ln age	-8.50×10^{-2}	-5.86	0.000	Ln age	-8.46×10^{-2}	-5.82	0.000	Ln age	-8.43×10^{-2}	-5.82	0.000
GDP growth	4.00×10^{-1}	4.26	0.000	GDP growth	5.20×10^{-1}	5.56	0.000	GDP growth	5.14×10^{-1}	5.45	0.000	GDP growth	5.11×10^{-1}	5.48	0.000
Constant	3.92×10^{-2}	0.72	0.473	Constant	4.92×10^{-2}	0.89	0.372	Constant	4.64×10^{-2}	0.84	0.399	Constant	5.33×10^{-2}	0.97	0.333
R-square				R-square				R-square				R-square			
within = 0.122				within = 0.108				within = 0.108				within = 0.111			
between = 0.202				between = 0.200				between = 0.196				between = 0.208			
overall = 0.114				overall = 0.109				overall = 0.107				overall = 0.113			
F(7,4321) = 86.04				F(7,4321) = 75.07				F(7,4321) = 74.91				F(7,4321) = 76.71			
Prob > F = 0.000				Prob > F = 0.000				Prob > F = 0.000				Prob > F = 0.000			
corr(u_i, Xb) = -0.781				corr(u_i, Xb) = -0.773				corr(u_i, Xb) = -0.772				corr(u_i, Xb) = -0.776			
F test that all u_i=0: F(1081, 4321) = 2.12				F test that all u_i=0: F(1081, 4321) = 2.08				F test that all u_i=0: F(1081, 4321) = 2.14				F test that all u_i=0: F(1081, 4321) = 2.05			
Prob > F = 0.000				Prob > F = 0.000				Prob > F = 0.000				Prob > F = 0.000			
Hausman test: chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)= 158.94				Hausman test: chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)= 166.84				Hausman test: chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)= 156.45				Hausman test: chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)= 157.81			
Prob>chi2 = 0.000				Prob>chi2 = 0.000				Prob>chi2 = 0.000				Prob>chi2 = 0.000			

Table A2. The results of fixed effects model of the micro group

Fixed-effects (within) regression	Number of groups: 384			Number of observations: 1920			Dependent variable: ROA							
Independent variables	Coefficient	t	P>|t|	Independent variables	Coefficient	T	P>|t|	Independent variables	Coefficient	t	P>|t|	Independent variables	Coefficient	t	P>|t|
Receivables	$-5.16{*}10^{-4}$	-5.23	0.000	Stocks	$-1.47{*}10^{-4}$	-5.60	0.000	Payables	$-1.70{*}10^{-4}$	-2.17	0.031	CCC	$-1.72{*}10^{-4}$	-6.43	0.000
Growth	$3.40{*}10^{-2}$	5.61	0.000	Growth	$3.69{*}10^{-2}$	6.19	0.000	Growth	$3.87{*}10^{-2}$	6.41	0.000	Growth	$3.60{*}10^{-2}$	6.06	0.000
Ln assets	$1.64{*}10^{-1}$	11.67	0.000	Ln assets	$1.65{*}10^{-1}$	11.73	0.000	Ln assets	$1.64{*}10^{-1}$	11.54	0.000	Ln assets	$1.65{*}10^{-1}$	11.74	0.000
Indebtedness	$-2.96{*}10^{-1}$	-10.27	0.000	Indebtedness	$-3.09{*}10^{-1}$	-10.79	0.000	Indebtedness	$-3.07{*}10^{-1}$	-10.57	0.000	Indebtedness	$-3.09{*}10^{-1}$	-10.83	0.000
Intangibles	$-5.37{*}10^{-1}$	-1.50	0.133	Intangibles	$-5.44{*}10^{-1}$	-1.52	0.128	Intangibles	$-5.02{*}10^{-1}$	-1.39	0.163	Intangibles	$-5.54{*}10^{-1}$	-1.56	0.120
Ln age	$-8.47{*}10^{-2}$	-3.48	0.001	Ln age	$-9.25{*}10^{-2}$	-3.81	0.000	Ln age	$-8.84{*}10^{-2}$	-3.61	0.000	Ln age	$-9.33{*}10^{-2}$	-3.85	0.000
GDP growth	$4.89{*}10^{-1}$	2.54	0.011	GDP growth	$5.21{*}10^{-1}$	2.72	0.007	GDP growth	$5.25{*}10^{-1}$	2.68	0.007	GDP growth	$5.43{*}10^{-1}$	2.84	0.005
Constant	$-3.56{*}10^{-1}$	-4.30	0.000	Constant	$-3.67{*}10^{-1}$	-4.46	0.000	Constant	$-3.83{*}10^{-1}$	-4.62	0.000	Constant	$-3.56{*}10^{-1}$	-4.33	0.000
R-square:				R-square:				R-square:				R-square:			
within = 0.181				within = 0.183				within = 0.168				within = 0.188			
between = 0.255				between = 0.269				between = 0.246				between = 0.274			
overall = 0.149				overall = 0.151				overall = 0.139				overall = 0.156			
F(7,1529) = 48.13				F(7,1529) = 48.80				F(7,1529) = 44.24				F(7,1529) = 50.51			
Prob > F = 0.000				Prob > F = 0.000				Prob > F = 0.000				Prob > F = 0.000			
corr(u_i, Xb) = -0.813				corr(u_i, Xb) = -0.840				corr(u_i, Xb) = -0.829				corr(u_i, Xb) = -0.837			
F test that all u_i=0: F(383, 1529) = 2.0				F test that all u_i=0: F(383, 1529) = 2.07				F test that all u_i=0: F(383, 1529) = 2.06				F test that all u_i=0: F(383, 1529) = 2.07			
Prob > F = 0.000				Prob > F = 0.000				Prob > F = 0.000				Prob > F = 0.000			
Hausman test: chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)= 114.66				Hausman test: chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)= 126.35				Hausman test: chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)= 115.79				Hausman test: chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)= 126.82			
Prob>chi2 = 0.000				Prob>chi2 = 0.000				Prob>chi2 = 0.000				Prob>chi2 = 0.000			

Table A3. The results of fixed effects model of the non-micro group

Fixed-effects (within) regression			Number of groups: 698			Number of observations: 3490			Dependent variable: ROA		
Independent variables	Coefficient	t	P>|t|	Independent variables	Coefficient	t	P>|t|	Independent variables	Coefficient	t	P>|t|	Independent variables	Coefficient	t	P>|t|
Receivables	$-2.80*10^{-4}$	-4.88	0.000	Stocks	$8.23*10^{-5}$	4.98	0.000	Payables	$1.04*10^{-4}$	2.21	0.027	CCC	$4.96*10^{-5}$	2.89	0.004
Growth	$-4.62*10^{-5}$	-0.36	0.715	Growth	$-3.34*10^{-5}$	-0.26	0.792	Growth	$-2.85*10^{-5}$	-0.22	0.822	Growth	$-3.88*10^{-5}$	-0.31	0.760
Ln assets	$1.04*10^{-2}$	1.25	0.210	Ln assets	$8.70*10^{-3}$	1.05	0.294	Ln assets	$6.81*10^{-3}$	0.82	0.412	Ln assets	$6.59*10^{-3}$	0.80	0.426
Indebtedness	$-3.79*10^{-1}$	-17.80	0.000	Indebtedness	$-3.72*10^{-1}$	-17.48	0.000	Indebtedness	$-3.86*10^{-1}$	-17.87	0.000	Indebtedness	$-3.71*10^{-1}$	-17.30	0.000
Intangibles	$-1.83*10^{-1}$	-1.46	0.144	Intangibles	$-1.97*10^{-1}$	-1.58	0.115	Intangibles	$-1.98*10^{-1}$	-1.57	0.115	Intangibles	$-1.90*10^{-1}$	-1.52	0.130
Ln age	$-4.20*10^{-2}$	-2.16	0.031	Ln age	$-4.81*10^{-2}$	-2.48	0.013	Ln age	$-4.67*10^{-2}$	-2.40	0.017	Ln age	$-4.66*10^{-2}$	-2.40	0.017
GDP growth	$3.86*10^{-1}$	3.82	0.000	GDP growth	$4.80*10^{-1}$	4.82	0.000	GDP growth	$4.91*10^{-1}$	4.88	0.000	GDP growth	$4.78*10^{-1}$	4.78	0.000
Constant	$3.47*10^{-1}$	4.99	0.000	Constant	$3.26*10^{-1}$	4.68	0.000	Constant	$3.44*10^{-1}$	4.93	0.000	Constant	$3.42*10^{-1}$	4.91	0.000
R-square:				R-square:				R-square:				R-square:			
within = 0.131				within = 0.132				within = 0.126				within = 0.127			
between = 0.210				between = 0.144				between = 0.177				between = 0.156			
overall = 0.137				overall = 0.106				overall = 0.120				overall = 0.110			
F(7,2785) = 60.18				F(7,2785) = 60.35				F(7,2785) = 57.10				F(7,2785) = 57.66			
Prob > F = 0.000				Prob > F = 0.000				Prob > F = 0.000				Prob > F = 0.000			
corr(u_i, Xb) = -0.572				corr(u_i, Xb) = -0.595				corr(u_i, Xb) = -0.574				corr(u_i, Xb) = -0.587			
F test that all u_i=0: F(697, 2785) = 2.43				F test that all u_i=0: F(697, 2785) = 2.53				F test that all u_i=0: F(697, 2785) = 2.53				F test that all u_i=0: F(697, 2785) = 2.45			
Prob > F = 0.000				Prob > F = 0.000				Prob > F = 0.000				Prob > F = 0.000			
Hausman test: chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)= 108.69				Hausman test: chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)= 180.01				Hausman test: chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)= 126.05				Hausman test: chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)= 158.31			
Prob>chi2 = 0.000				Prob>chi2 = 0.000				Prob>chi2 = 0.000				Prob>chi2 = 0.000			

Table A4. The results of fixed effects model of the young group

Fixed-effects (within) regression	Number of groups: 275				Number of observations: 1375			Dependent variable: ROA			
Independent variable	Coefficient	t	P>|t|	Independent variable	Coefficient	t	P>|t|	Independent variable	Coefficient	t	P>|t|
Receivables	-5.30×10^{-4}	-6.55	0.000	Stocks	-1.41×10^{-4}	-6.41	0.000	Payables	-1.44×10^{-4}	-2.18	0.029
Growth	-1.38×10^{-5}	-0.11	0.910	Growth	-2.14×10^{-5}	-0.17	0.862	Growth	-1.97×10^{-5}	-0.16	0.875
Ln assets	8.37×10^{-2}	8.81	0.000	Ln assets	7.77×10^{-2}	8.21	0.000	Ln assets	7.89×10^{-2}	8.18	0.000
Indebtedness	-3.87×10^{-1}	-15.64	0.000	Indebtedness	-4.04×10^{-1}	-16.40	0.000	Indebtedness	-3.98×10^{-1}	-15.80	0.000
Intangibles	-3.02×10^{-1}	-2.32	0.021	Intangibles	-2.67×10^{-1}	-2.05	0.041	Intangibles	-2.69×10^{-1}	-2.03	0.043
Ln age	-7.70×10^{-2}	-4.49	0.000	Ln age	-8.10×10^{-2}	-4.73	0.000	Ln age	-8.05×10^{-2}	-4.61	0.000
GDP growth	1.95×10^{-1}	0.95	0.344	GDP growth	2.18×10^{-1}	1.06	0.291	GDP growth	2.09×10^{-1}	0.99	0.321
Constant	1.15×10^{-2}	0.20	0.843	Constant	2.29×10^{-2}	0.40	0.692	Constant	1.00×10^{-2}	0.17	0.865
R-square:				R-square:				R-square:			
within = 0.259				within = 0.258				within = 0.233			
between = 0.209				between = 0.236				between = 0.218			
overall = 0.165				overall = 0.179				overall = 0.162			
$F_{(7,1093)} = 54.56$				$F_{(7,1093)} = 54.23$				$F_{(7,1093)} = 47.49$			
Prob > F = 0.000				Prob > F = 0.000				Prob > F = 0.000			
corr(u_i, Xb) = -0.793				corr(u_i, Xb) = -0.797				corr(u_i, Xb) = -0.796			
F test that all u_i=0: $F_{(274, 1093)} = 3.22$				F test that all u_i=0: $F_{(274, 1093)} = 3.1$				F test that all u_i=0: $F_{(274, 1093)} = 3.14$			
Prob > F = 0.000				Prob > F = 0.000				Prob > F = 0.000			
Hausman test: chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)= 97.00				Hausman test: chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)= 101.47				Hausman test: chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)= 96.64			
Prob>chi2 = 0.000				Prob>chi2 = 0.000				Prob>chi2 = 0.000			

Independent variable	Coefficient	t	P>|t|
CCC	-1.71×10^{-4}	-7.65	0.000
Growth	-1.5×10^{-5}	-0.12	0.902
Ln assets	7.84×10^{-2}	8.34	0.000
Indebtedness	-4.06×10^{-1}	-16.59	0.000
Intangibles	-2.80×10^{-1}	-2.17	0.031
Ln age	-8.20×10^{-2}	-4.83	0.000
GDP growth	2.54×10^{-1}	1.24	0.213
Constant	2.68×10^{-2}	0.47	0.641
R-square:
within = 0.269
between = 0.232
overall = 0.181
$F_{(7,1093)} = 57.48$
Prob > F = 0.000
corr(u_i, Xb) = -0.796
F test that all u_i=0: $F_{(274, 1093)} = 3.21$
Prob > F = 0.000
Hausman test: chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)= 101.27
Prob>chi2 = 0.000

Table A5. The results of fixed effects model of the mature group

Fixed-effects (within) regression			Number of groups: 807			Number of observations: 4035			Dependent variable: ROA						
Independent variables	Coefficient	T	P>|t|	Independent variables	Coefficient	t	P>|t|	Independent variables	Coefficient	t	P>|t|	Independent variables	Coefficient	t	P>|t|
Receivables	-1.96×10^{-4}	-2.94	0.003	Stocks	7.17×10^{-5}	3.92	0.000	Payables	1.82×10^{-4}	3.39	0.001	CCC	3.81×10^{-5}	2.01	0.044
Growth	7.63×10^{-2}	9.91	0.000	Growth	8.83×10^{-2}	11.83	0.000	Growth	9.04×10^{-2}	11.80	0.000	Growth	8.56×10^{-2}	11.47	0.000
Ln assets	4.98×10^{-2}	4.86	0.000	Ln assets	4.79×10^{-2}	4.69	0.000	Ln assets	4.75×10^{-2}	4.65	0.000	Ln assets	4.71×10^{-2}	4.60	0.000
Indebtedness	-3.23×10^{-1}	-14.43	0.000	Indebtedness	-3.25×10^{-1}	-14.52	0.000	Indebtedness	-3.38×10^{-1}	-14.94	0.000	Indebtedness	-3.24×10^{-1}	-14.43	0.000
Intangibles	-2.30×10^{-1}	-0.90	0.366	Intangibles	-2.25×10^{-1}	-0.88	0.377	Intangibles	-2.54×10^{-1}	-1.00	0.318	Intangibles	-2.31×10^{-1}	-0.91	0.364
Ln age	-3.14×10^{-2}	-0.56	0.579	Ln age	-3.78×10^{-2}	-0.67	0.503	Ln age	-3.84×10^{-2}	-0.68	0.497	Ln age	-3.76×10^{-2}	-0.66	0.507
GDP growth	3.43×10^{-1}	2.11	0.035	GDP growth	4.15×10^{-1}	2.57	0.010	GDP growth	4.42×10^{-1}	2.73	0.006	GDP growth	4.09×10^{-1}	2.52	0.012
Constant	-1.02×10^{-2}	-0.05	0.956	Constant	-1.44×10^{-2}	-0.08	0.938	Constant	-1.08×10^{-2}	-0.06	0.954	Constant	-4.30×10^{-3}	-0.02	0.982
R-square:				R-square:				R-square:				R-square:			
within = 0.117				within = 0.119				within = 0.117				within = 0.115			
between = 0.201				between = 0.168				between = 0.187				between = 0.179			
overall = 0.113				overall = 0.100				overall = 0.108				overall = 0.104			
F(7,3221) = 60.76				F(7,3221) = 61.84				F(7,3221) = 61.22				F(7,3221) = 60.02			
Prob > F = 0.000				Prob > F = 0.000				Prob > F = 0.000				Prob > F = 0.000			
corr(u_i, Xb) = -0.706				corr(u_i, Xb) = -0.698				corr(u_i, Xb) = -0.700				corr(u_i, Xb) = -0.695			
F test that all u_i=0: F(806, 3221) = 1.86				F test that all u_i=0: F(806, 3221) = 1.92				F test that all u_i=0: F(806, 3221) = 1.94				F test that all u_i=0: F(806, 3221) = 1.87			
Prob > F = 0.000				Prob > F = 0.000				Prob > F = 0.000				Prob > F = 0.000			
Hausman test: chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)= 76.76				Hausman test: chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)= 82.37				Hausman test: chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)= 96.60				Hausman test: chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)= 77.99			
Prob>chi2 = 0.000				Prob>chi2 = 0.000				Prob>chi2 = 0.000				Prob>chi2 = 0.000			

Table A6. The results of pooled regression model of the total sample

Number of observations: 5410			Dependent variable: ROA												
$F(13,5396) = 79.28$				$F(13,5396) = 75.20$				$F(13,5396) = 70.39$				$F(13,5396) = 78.40$			
Prob > F = 0.000 R-squared = 0.160				Prob > F = 0.000 R-squared = 0.153				Prob > F = 0.000 R-squared = 0.145				Prob > F = 0.000 R-squared = 0.159			
Adjusted R-squared = 0.158				Adjusted R-squared = 0.151				Adjusted R-squared = 0.143				Adjusted R-squared = 0.157			
Independent var	Coefficient	t	P>|t|	Independent var	Coefficient	t	P>|t|	Independent var	Coefficient	T	P>|t|	Independent var	Coefficient	t	P>|t|
Receivables	$-2.71*10^{-4}$	-10.74	0.000	Stocks	$-6.26*10^{-5}$	-8.36	0.000	Payables	$-1.06*10^{-4}$	-4.01	0.000	CCC	$-7.57*10^{-5}$	-10.27	0.000
Growth	$9.37*10^{-5}$	0.65	0.513	Growth	$1.09*10^{-4}$	0.75	0.450	Growth	$1.01*10^{-4}$	0.70	0.484	Growth	$1.12*10^{-4}$	0.78	0.435
Ln assets	$1.22*10^{-2}$	11.03	0.000	Ln assets	$1.06*10^{-2}$	9.55	0.000	Ln assets	$1.20*10^{-2}$	10.72	0.000	Ln assets	$1.02*10^{-2}$	9.20	0.000
Indebtedness	$-1.63*10^{-1}$	-25.30	0.000	Indebtedness	$-1.57*10^{-1}$	-24.33	0.000	Indebtedness	$-1.51*10^{-1}$	-22.21	0.000	Indebtedness	$-1.64*10^{-1}$	-25.37	0.000
Intangibles	$-2.19*10^{-1}$	-3.71	0.000	Intangibles	$-2.15*10^{-1}$	-3.62	0.000	Intangibles	$-2.19*10^{-1}$	-3.67	0.000	Intangibles	$-2.15*10^{-1}$	-3.64	0.000
Ln age	$-3.63*10^{-2}$	-14.70	0.000	Ln age	$-3.53*10^{-2}$	-14.07	0.000	Ln age	$-3.84*10^{-2}$	-15.44	0.000	Ln age	$-3.43*10^{-2}$	-13.69	0.000
GDP growth	$6.15*10^{-1}$	8.02	0.000	GDP growth	$6.51*10^{-1}$	8.47	0.000	GDP growth	$6.51*10^{-1}$	8.40	0.000	GDP growth	$6.47*10^{-1}$	8.45	0.000
Industry 1	$1.79*10^{-2}$	1.80	0.072	Industry 1	$8.20*10^{-3}$	0.82	0.411	Industry 1	$1.32*10^{-2}$	1.32	0.187	Industry 1	$8.18*10^{-3}$	0.82	0.411
Industry 2	$4.54*10^{-2}$	3.18	0.001	Industry 2	$4.31*10^{-2}$	3.01	0.003	Industry 2	$4.59*10^{-2}$	3.19	0.001	Industry 2	$4.23*10^{-2}$	2.96	0.003
Industry 3	$3.18*10^{-2}$	2.65	0.008	Industry 3	$2.43*10^{-2}$	2.01	0.044	Industry 3	$2.65*10^{-2}$	2.18	0.029	Industry 3	$2.48*10^{-2}$	2.07	0.039
Industry 4	$1.85*10^{-2}$	1.81	0.070	Industry 4	$9.49*10^{-3}$	0.93	0.352	Industry 4	$1.45*10^{-2}$	1.41	0.158	Industry 4	$8.71*10^{-3}$	0.86	0.392
Industry 5	$2.16*10^{-2}$	2.23	0.026	Industry 5	$1.02*10^{-2}$	1.04	0.296	Industry 5	$1.76*10^{-2}$	1.80	0.072	Industry 5	$8.68*10^{-3}$	0.90	0.370
Industry 6	$1.21*10^{-2}$	1.17	0.243	Industry 6	$7.06*10^{-3}$	0.68	0.496	Industry 6	$1.17*10^{-2}$	1.11	0.265	Industry 6	$5.45*10^{-3}$	0.53	0.599
Constant	$1.82*10^{-1}$	13.09	0.000	Constant	$1.72*10^{-1}$	12.36	0.000	Constant	$1.64*10^{-1}$	11.74	0.000	Constant	$1.79*10^{-1}$	12.89	0.000
Source	SS	df	MS	Source	SS	df	MS	Source	SS	Df	MS	Source	SS	df	MS
Model	15.392	13	1.184	Model	14.721	13	1.132	Model	13.915	13	1.070	Model	15.247	13	1.173
Residual	80.581	5,396	0.015	Residual	81.252	5,396	0.015	Residual	82.058	5,396	0.015	Residual	80.726	5,396	0.015
Total	95.973	5,409	0.018	Total	95.973	5,409	0.018	Total	95.973	5,409	0.018	Total	95.973	5,409	0.018
Root Mean Square Error=0.122				Root Mean Square Error=0.123				Root Mean Square Error=0.123				Root Mean Square Error=0.122			

Table A7. The results of pooled regression model of the micro group

Number of observations: 1920			Dependent variable: ROA									
$F_{(13,1906)} = 36.26$				$F_{(13,1906)} = 35.99$				$F_{(13,1906)} = 33.57$				$F_{(13,1906)} = 37.10$
Prob > F = 0.000 R-squared = 0.198				Prob > F = 0.000 R-squared = 0.197				Prob > F = 0.000 R-squared = 0.186				Prob > F = 0.000 R-squared = 0.202
Adjusted R-squared = 0.193				Adjusted R-squared = 0.192				Adjusted R-squared = 0.181				Adjusted R-squared = 0.197
Independent var	Coefficient	t	P>|t|	Independent var	Coefficient	t	P>|t|	Independent var	Coefficient	t	P>|t|	Independent var	Coefficient	t	P>|t|
Receivables	-2.92×10^{-4}	-6.17	0.000	Stocks	-8.36×10^{-5}	-5.93	0.000	Payables	-1.55×10^{-4}	-3.07	0.002	CCC	-9.55×10^{-5}	-6.85	0.000
Growth	3.49×10^{-2}	6.41	0.000	Growth	3.64×10^{-2}	6.71	0.000	Growth	3.69×10^{-2}	6.72	0.000	Growth	3.60×10^{-2}	6.64	0.000
Ln assets	3.49×10^{-2}	9.32	0.000	Ln assets	3.12×10^{-2}	8.46	0.000	Ln assets	3.24×10^{-2}	8.64	0.000	Ln assets	3.16×10^{-2}	8.59	0.000
Indebtedness	-1.54×10^{-1}	-14.18	0.000	Indebtedness	-1.40×10^{-1}	-12.72	0.000	Indebtedness	-1.40×10^{-1}	-12.26	0.000	Indebtedness	-1.46×10^{-1}	-13.47	0.000
Intangibles	-2.52×10^{-2}	-1.06	0.289	Intangibles	-2.89×10^{-1}	-1.22	0.224	Intangibles	-3.15×10^{-1}	-1.32	0.188	Intangibles	-2.61×10^{-1}	-1.10	0.270
Ln age	-3.30×10^{-2}	-7.28	0.000	Ln age	-3.00×10^{-2}	-6.50	0.000	Ln age	-3.47×10^{-2}	-7.60	0.000	Ln age	-2.90×10^{-2}	-6.29	0.000
GDP growth	7.71×10^{-1}	5.05	0.000	GDP growth	7.79×10^{-1}	5.10	0.000	GDP growth	7.96×10^{-1}	5.17	0.000	GDP growth	7.76×10^{-1}	5.10	0.000
Industry 1	2.46×10^{-2}	1.09	0.278	Industry 1	1.27×10^{-2}	0.56	0.576	Industry 1	2.09×10^{-2}	0.92	0.359	Industry 1	1.30×10^{-2}	0.57	0.566
Industry 2	1.35×10^{-1}	2.66	0.008	Industry 2	1.16×10^{-1}	2.28	0.023	Industry 2	1.41×10^{-1}	2.75	0.006	Industry 2	1.11×10^{-1}	2.19	0.029
Industry 3	6.01×10^{-2}	2.38	0.017	Industry 3	4.65×10^{-2}	1.84	0.066	Industry 3	5.54×10^{-2}	2.18	0.029	Industry 3	4.69×10^{-2}	1.86	0.063
Industry 4	2.44×10^{-2}	1.05	0.292	Industry 4	9.73×10^{-3}	0.42	0.675	Industry 4	1.92×10^{-2}	0.82	0.411	Industry 4	9.88×10^{-3}	0.43	0.669
Industry 5	3.32×10^{-2}	1.50	0.135	Industry 5	1.39×10^{-2}	0.62	0.533	Industry 5	2.95×10^{-2}	1.32	0.188	Industry 5	1.29×10^{-2}	0.56	0.574
Industry 6	1.65×10^{-2}	0.70	0.483	Industry 6	1.23×10^{-2}	0.52	0.601	Industry 6	1.88×10^{-2}	0.79	0.428	Industry 6	1.04×10^{-2}	0.44	0.659
Constant	4.18×10^{-2}	1.35	0.179	Constant	3.82×10^{-2}	1.23	0.220	Constant	3.41×10^{-2}	1.09	0.276	Constant	4.16×10^{-2}	1.34	0.180
Source	SS	df	MS	Source	SS	df	MS	Source	SS	df	MS	Source	SS	df	MS
Model	9.757	13	0.751	Model	9.698	13	0.746	Model	9.168	13	0.705	Model	9.936	13	0.764
Residual	39.450	1,906	0.021	Residual	39.510	1,906	0.021	Residual	40.040	1,906	0.021	Residual	39.271	1,906	0.021
Total	49.207	1,919	0.026	Total	49.207	1,919	0.026	Total	49.207	1,919	0.026	Total	49.207	1,919	0.026
Root Mean Square Error=0.144				Root Mean Square Error=0.144				Root Mean Square Error=0.145				Root Mean Square Error=0.144

Table A8. The results of pooled regression model of the non-micro group

Number of observations: 3490			Dependent variable: ROA									
$F_{(13,3476)} = 50.24$			$F_{(13,3476)} = 45.48$				$F_{(13,3476)} = 43.15$			$F_{(13,3476)} = 47.82$		
Prob > F = 0.000 R-squared = 0.158			Prob > F = 0.000 R-squared = 0.145				Prob > F = 0.000 R-squared = 0.139			Prob > F = 0.000 R-squared = 0.152		
Adjusted R-squared = 0.155			Adjusted R-squared = 0.142				Adjusted R-squared = 0.136			Adjusted R-squared = 0.149		
Independent var	Coefficient	t	P>|t|	Independent var	Coefficient	t	P>|t|	Independent var	Coefficient	t	P>|t|	Independent var	Coefficient	t	P>|t|
Receivables	-2.63×10^{-4}	-9.17	0.000	Stocks	-4.72×10^{-5}	-5.55	0.000	Payables	-6.37×10^{-5}	-2.15	0.032	CCC	-6.32×10^{-5}	-7.55	0.000
Growth	4.65×10^{-5}	0.37	0.710	Growth	6.25×10^{-5}	0.50	0.620	Growth	5.67×10^{-5}	0.45	0.654	Growth	6.68×10^{-5}	0.53	0.594
Ln assets	6.84×10^{-3}	4.29	0.000	Ln assets	6.18×10^{-3}	3.85	0.000	Ln assets	6.69×10^{-3}	4.16	0.000	Ln assets	6.01×10^{-3}	3.76	0.000
Indebtedness	-1.67×10^{-1}	-21.07	0.000	Indebtedness	-1.68×10^{-1}	-20.99	0.000	Indebtedness	-1.60×10^{-1}	-18.87	0.000	Indebtedness	-1.75×10^{-1}	-21.71	0.000
Intangibles	-1.96×10^{-1}	-3.63	0.000	Intangibles	-1.91×10^{-1}	-3.51	0.000	Intangibles	-1.93×10^{-1}	-3.53	0.000	Intangibles	-1.93×10^{-1}	-3.56	0.000
Ln age	-3.28×10^{-2}	-11.43	0.000	Ln age	-3.32×10^{-2}	-11.42	0.000	Ln age	-3.51×10^{-2}	-12.13	0.000	Ln age	-3.22×10^{-2}	-11.11	0.000
GDP growth	5.27×10^{-1}	6.37	0.000	GDP growth	5.75×10^{-1}	6.91	0.000	GDP growth	5.75×10^{-1}	6.86	0.000	GDP growth	5.69×10^{-1}	6.86	0.000
Industry 1	9.99×10^{-3}	0.98	0.326	Industry 1	1.82×10^{-4}	0.02	0.986	Industry 1	4.29×10^{-3}	0.42	0.676	Industry 1	-4.19×10^{-4}	-0.04	0.967
Industry 2	4.03×10^{-2}	2.98	0.003	Industry 2	3.87×10^{-2}	2.83	0.005	Industry 2	3.94×10^{-2}	2.88	0.004	Industry 2	3.83×10^{-2}	2.82	0.005
Industry 3	1.53×10^{-2}	1.17	0.241	Industry 3	8.26×10^{-3}	0.63	0.529	Industry 3	8.16×10^{-3}	0.62	0.537	Industry 3	9.12×10^{-3}	0.70	0.486
Industry 4	1.52×10^{-2}	1.47	0.142	Industry 4	7.73×10^{-3}	0.74	0.459	Industry 4	1.06×10^{-2}	1.01	0.313	Industry 4	6.73×10^{-3}	0.65	0.517
Industry 5	1.52×10^{-2}	1.54	0.124	Industry 5	5.90×10^{-3}	0.60	0.551	Industry 5	9.81×10^{-3}	0.98	0.329	Industry 5	4.52×10^{-3}	0.46	0.647
Industry 6	1.24×10^{-2}	1.18	0.239	Industry 6	5.99×10^{-3}	0.56	0.573	Industry 6	9.58×10^{-3}	0.89	0.371	Industry 6	4.42×10^{-3}	0.42	0.676
Constant	2.18×10^{-1}	12.36	0.000	Constant	2.06×10^{-1}	11.65	0.000	Constant	2.00×10^{-1}	11.31	0.000	Constant	2.12×10^{-1}	12.02	0.000
Source	SS	df	MS	Source	SS	df	MS	Source	SS	df	MS	Source	SS	df	MS
Model	7.347	13	0.565	Model	6.752	13	0.519	Model	6.454	13	0.496	Model	7.046	13	0.542
Residual	39.100	3,476	0.011	Residual	39.695	3,476	0.011	Residual	39.994	3,476	0.012	Residual	39.401	3,476	0.011
Total	46.447	3,489	0.013	Total	46.447	3,489	0.013	Total	46.447	3,489	0.013	Total	46.447	3,489	0.013
Root Mean Square Error=0.106			Root Mean Square Error=0.107				Root Mean Square Error=0.107			Root Mean Square Error=0.106		

Table A9. The results of pooled regression model of the young group

Number of observation: 1375			Dependent variable: ROA									
F(13,1361) = 40.93			F(13,1361) = 39.90				F(13,1361) = 36.84			F(13,1361) = 41.45		
Prob > F = 0.000 R-squared = 0.281			Prob > F = 0.000 R-squared = 0.276				Prob > F = 0.000 R-squared = 0.260			Prob > F = 0.000 R-squared = 0.284		
Adjusted R-squared = 0.274			Adjusted R-squared = 0.269				Adjusted R-squared = 0.253			Adjusted R-squared = 0.277		
Independent var	Coefficient	t	P>|t|	Independent var	Coefficient	t	P>|t|	Independent var	Coefficient	t	P>|t|	Independent var	Coefficient	T	P>|t|
Receivables	$-3.85*10^{-4}$	-7.79	0.000	Stocks	$-1.13*10^{-4}$	-7.12	0.000	Paybles	$-2.06*10^{-4}$	-4.56	0.000	CCC	$-1.30*10^{-4}$	-8.11	0.000
Growth	$3.51*10^{-5}$	0.26	0.794	Growth	$2.06*10^{-5}$	0.15	0.878	Growth	$1.97*10^{-6}$	0.15	0.885	Growth	$2.78*10^{-5}$	0.21	0.836
Ln assets	$1.02*10^{-2}$	4.96	0.000	Ln assets	$7.77*10^{-3}$	3.83	0.000	Ln assets	$9.86*10^{-3}$	4.66	0.000	Ln assets	$7.21*10^{-3}$	3.57	0.000
Indebtedness	$-2.28*10^{-1}$	-20.57	0.000	Indebtedness	$-2.16*10^{-1}$	-19.53	0.000	Indebtedness	$-2.07*10^{-1}$	-18.00	0.000	Indebtedness	$-2.27*10^{-1}$	-20.51	0.000
Intangibles	$-1.43*10^{-1}$	-1.64	0.101	Intangibles	$-1.12*10^{-1}$	-1.27	0.203	Intangibles	$-1.21*10^{-1}$	-1.36	0.173	Intangibles	$-1.16*10^{-1}$	-1.33	0.182
Ln age	$-3.68*10^{-2}$	-5.99	0.000	Ln age	$-3.64*10^{-2}$	-5.88	0.000	Ln age	$-4.02*10^{-2}$	-6.48	0.000	Ln age	$-3.49*10^{-2}$	-5.67	0.000
GDP growth	$5.46*10^{-1}$	3.69	0.000	GDP growth	$5.41*10^{-1}$	3.64	0.000	GDP growth	$5.59*10^{-1}$	3.71	0.000	GDP growth	$5.43*10^{-1}$	3.67	0.000
Industry 1	$4.09*10^{-2}$	2.05	0.041	Industry 1	$2.44*10^{-2}$	1.21	0.226	Industry 1	$3.72*10^{-2}$	1.84	0.067	Industry 1	$2.40*10^{-2}$	1.20	0.232
Industry 2	$6.62*10^{-2}$	2.44	0.015	Industry 2	$5.80*10^{-2}$	2.13	0.034	Industry 2	$6.39*10^{-2}$	2.32	0.020	Industry 2	$5.85*10^{-2}$	2.16	0.031
Industry 3	$5.61*10^{-2}$	2.58	0.010	Industry 3	$2.64*10^{-2}$	1.21	0.227	Industry 3	$4.72*10^{-2}$	2.15	0.032	Industry 3	$2.54*10^{-2}$	1.17	0.241
Industry 4	$6.35*10^{-2}$	3.19	0.001	Industry 4	$3.38*10^{-2}$	1.69	0.091	Industry 4	$5.38*10^{-2}$	2.67	0.008	Industry 4	$3.33*10^{-2}$	1.67	0.094
Industry 5	$6.02*10^{-2}$	3.11	0.002	Industry 5	$3.05*10^{-2}$	1.57	0.117	Industry 5	$5.44*10^{-2}$	2.77	0.006	Industry 5	$2.78*10^{-2}$	1.44	0.151
Industry 6	$3.03*10^{-2}$	1.48	0.138	Industry 6	$2.36*10^{-2}$	1.15	0.249	Industry 6	$3.41*10^{-2}$	1.64	0.100	Industry 6	$2.01*10^{-2}$	0.98	0.326
Constant	$2.16*10^{-1}$	8.82	0.000	Constant	$2.15*10^{-1}$	8.74	0.000	Constant	$1.94*10^{-1}$	7.81	0.000	Constant	$2.26*10^{-1}$	9.23	0.000
Source	SS	df	MS	Source	SS	df	MS	Source	SS	df	MS	Source	SS	df	MS
Model	6.281	13	0.483	Model	6.166	13	0.474	Model	5.817	13	0.447	Model	6.338	13	0.488
Residual	16.066	1,361	0.012	Residual	16.180	1,361	0.012	Residual	16.530	1,361	0.012	Residual	16.009	1,361	0.012
Total	22.347	1,374	0.016	Total	22.347	1,374	0.016	Total	22.347	1,374	0.016	Total	22.347	1,374	0.016
Root Mean Square Error=0.109			Root Mean Square Error=0.109				Root Mean Square Error=0.110			Root Mean Square Error=0.108		

Table A10. The results of pooled regression model of the mature group

Number of observation: 4035			Dependent variable: ROA								
F(13,4021) = 56.31			F(13,4021) = 53.91			F(13,4021) = 52.07			F(13,4021) = 55.63		
Prob > F = 0.000 R-squared = 0.154			Prob > F = 0.000 R-squared = 0.148			Prob > F = 0.000 R-squared = 0.144			Prob > F = 0.000 R-squared = 0.152		
Adjusted R-squared = 0.151			Adjusted R-squared = 0.146			Adjusted R-squared = 0.141			Adjusted R-squared = 0.150		
Independent var	Coefficient	T	P>|t|	Independent var	Coefficient	t	P>|t|	Independent var	Coefficient	t	P>|t|	Independent var	Coefficient	T	P>|t|
Receivables	$-2.02*10^{-4}$	-6.88	0.000	Stocks	$-3.86*10^{-5}$	-4.55	0.000	Payables	$-1.36*10^{-5}$	-0.42	0.671	CCC	$-5.24*10^{-5}$	-6.31	0.000
Growth	$7.54*10^{-2}$	10.80	0.000	Growth	$7.87*10^{-2}$	11.27	0.000	Growth	$8.21*10^{-2}$	11.67	0.000	Growth	$7.73*10^{-2}$	11.09	0.000
Ln assets	$1.27*10^{-2}$	9.81	0.000	Ln assets	$1.16*10^{-2}$	8.92	0.000	Ln assets	$1.24*10^{-2}$	9.47	0.000	Ln assets	$1.13*10^{-2}$	8.64	0.000
Indebtedness	$-1.45*10^{-1}$	-18.78	0.000	Indebtedness	$-1.41*10^{-1}$	-18.27	0.000	Indebtedness	$-1.42*10^{-1}$	-17.27	0.000	Indebtedness	$-1.46*10^{-1}$	-18.86	0.000
Intangibles	$-2.61*10^{-1}$	-3.37	0.001	Intangibles	$-2.68*10^{-1}$	-3.45	0.001	Intangibles	$-2.72*10^{-1}$	-3.48	0.001	Intangibles	$-2.68*10^{-1}$	-3.45	0.001
Ln age	$-3.66*10^{-2}$	-7.59	0.000	Ln age	$-3.52*10^{-2}$	-7.21	0.000	Ln age	$-3.83*10^{-2}$	-7.91	0.000	Ln age	$-3.36*10^{-2}$	-6.90	0.000
GDP growth	$5.74*10^{-1}$	6.36	0.000	GDP growth	$6.10*10^{-1}$	6.74	0.000	GDP growth	$6.18*10^{-1}$	6.80	0.000	GDP growth	$6.05*10^{-1}$	6.71	0.000
Industry 1	$1.66*10^{-2}$	1.47	0.142	Industry 1	$9.70*10^{-3}$	0.86	0.393	Industry 1	$1.19*10^{-2}$	1.05	0.296	Industry 1	$9.53*10^{-3}$	0.84	0.400
Industry 2	$4.71*10^{-2}$	2.84	0.005	Industry 2	$4.53*10^{-2}$	2.71	0.007	Industry 2	$4.73*10^{-2}$	2.83	0.005	Industry 2	$4.41*10^{-2}$	2.65	0.008
Industry 3	$3.28*10^{-2}$	2.27	0.023	Industry 3	$3.07*10^{-2}$	2.12	0.034	Industry 3	$2.87*10^{-2}$	1.98	0.048	Industry 3	$3.20*10^{-2}$	2.21	0.027
Industry 4	$1.17*10^{-2}$	1.00	0.318	Industry 4	$7.53*10^{-3}$	0.64	0.521	Industry 4	$7.93*10^{-3}$	0.67	0.502	Industry 4	$6.91*10^{-3}$	0.59	0.555
Industry 5	$1.54*10^{-2}$	1.39	0.164	Industry 5	$8.61*10^{-3}$	0.78	0.438	Industry 5	$1.02*10^{-2}$	0.91	0.363	Industry 5	$7.57*10^{-3}$	0.68	0.494
Industry 6	$1.19*10^{-2}$	1.00	0.317	Industry 6	$7.92*10^{-3}$	0.67	0.505	Industry 6	$9.11*10^{-3}$	0.76	0.445	Industry 6	$6.85*10^{-3}$	0.58	0.563
Constant	$1.62*10^{-1}$	7.65	0.000	Constant	$1.49*10^{-1}$	7.04	0.000	Constant	$1.47*10^{-1}$	6.95	0.000	Constant	$1.53*10^{-1}$	7.24	0.000
Source	SS	Df	MS	Source	SS	df	MS	Source	SS	df	MS	Source	SS	Df	MS
Model	11.268	13	0.867	Model	10.860	13	0.835	Model	10.542	13	0.811	Model	11.153	13	0.858
Residual	61.898	4,021	0.015	Residual	62.306	4,021	0.015	Residual	62.624	4,021	0.016	Residual	62.013	4,021	0.015
Total	73.166	4,034	0.018	Total	73.166	4,034	0.018	Total	73.166	4,034	0.018	Total	73.166	4,034	0.018
Root Mean Square Error=0.124			Root Mean Square Error=0.124			Root Mean Square Error=0.125			Root Mean Square Error=0.124		

International Financial Reporting Standards and Macroeconomic Indicators: Lessons from South Africa

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Abstract:

This paper evaluates the impact of International Financial Reporting Standards (IFRS) adoption and macroeconomic variables interaction with information asymmetry, analysts following and managerial opportunism. To that end, this research aims to find out whether South Africa's IFRS adoption brings economic benefits such as Foreign Direct Investment (FDI) inflows, economic growth, and other non-macroeconomic benefits to companies listed on the Johannesburg Stock Exchange (JSE). A sample of 49-listed JSE mining and manufacturing firms were drawn from the archival databases of INET BFA/IRESS SA, Morningstar, and Anupedia.

This paper used data from 2001-2014 covering forty-nine listed firms in South Africa to assess the impact of IFRS on economic growth, exchange rate, government borrowing and interest rate. The Fixed Effects (FE) regression technique was only used for the exchange rate model, while the Pooled Ordinary Least Square (POLS) regression technique was used for other macroeconomic factors. The study found that, while IFRS had non-statistically significant impact on the exchange rate, economic growth, and the interest rate; it rather had a positive and significant impact on government borrowing. The study therefore concluded that, the impact of IFRS on macroeconomic variables is mixed and hence policymakers should be circumspect with additional factors. South African adoption of IFRS appears more relevant in enhancing FDI in countries.

The study explores the credibility of annual financial statements with sufficient qualitative data to measure the extent of reduction on managerial opportunism, information asymmetry and increases of analysts following. In a moral hazard environment, company managers' manipulation of accounting numbers, cause agency problems and as a result, shareholders interest focuses on improving reporting standards to ensure the viability and stock market development. The research considers dual harmonizing facets first, that the interaction with IFRS adoption and macroeconomic factors impact; and second, that IFRS moderation with managerial opportunism, information asymmetry, and analysts following impacts on the business prospects in Sub- Saharan Africa. The findings should be meaningful to managers, analysts, policymakers, and supervisory bodies in nations with similar capital structure decisions and socioeconomic systems.

Keywords: IFRS; macroeconomic indicators; panel data regression; South Africa.

JEL classification: M41; F62; C33; N17.

Introduction

Accounting and Ffnance researchers have recognized global accounting standards with credible financial disclosure as a country's major development on institutional infrastructure and regulations around the world. This study examines whether macroeconomic factors relate to the International Financial Reporting Standards (IFRS) adopted by firms listed on the Johannesburg Stock Exchange (JSE). In the wake of the macroeconomic performance of any economy is an essential condition for economic development and hence poverty reduction. Pricope (2017) therefore highlighted the relevance to explore the impact of IFRS and FDI flows as moderated by analysts following, managerial opportunism and information asymmetry. The study examines the effect of IFRS on the efficient development with comprehensive investigation, which states the purpose of this paper.

One prudent qualitative issue with the conceptual framework of credible financial disclosure/ reporting (IASB 2010) is relevant. According to Akisik (2014), every country in the world prioritize goals of fiscal policy and economic

development. An increase in investor-capital flows across nations has been a prominent strategy that can cause global economic growth. Regardless of the decisions of local investors, there is an important decision among nations to increase Foreign Direct Investment (FDI)). FDI is critical to economic growth and progress (Anuchitworawong and Thampanishvong 2015, Iamsiraroj 2016). Developed, emerging and developing economies have been competing to increase their shares of FDI. From the perspective of dissimilarities between local accounting standard practices (GAAP) was a momentous informational obstacle to FDI (Chen, Ding and Xu 2014). It is a fact that potential investors prefer capital markets with a trustworthy financial disclosure that enables them to test and decide on which business opportunities to invest (Gordon, Loeb and Zhu 2012), (Castillo-Merino, Menéndez-Plans and Orgaz 2014).

Thus, various economies have devised strategies and policies to alter macroeconomic indicators such as economic growth, exchange rate, interest rate, government borrowing, and Foreign Direct Investment (FDI) inflow among others. FDI is determined by capital market-seeking opportunities that focus on improved and emerging economies with high growth prospects. In the light of firm value, participating countries in free trade agreements and regional integration, trade schemes would increase regional demand and expand financial market size. It is most likely that reliable and credible reporting quality is an added appeal to capital inflow. The mandate to gain international legitimization for foreign investment attraction, calls for an improved financial reporting quality. In a globalized economic system, it is relevant for standard-setters and capital market regulators to meet trade pressure by making relevant financial reports. Therefore, one of the major policies that various nations, including South Africa have adopted is IFRS, promoted by the International Accounting Standards Board (IASB). Thus, IFRS brings credibility to financial reporting and hence increase investment flows. Whenever FDI inflow increases, there is massive economic growth, the exchange rate would appreciate, and the government is compelled to resort to less inefficient borrowing. In highlighting the benefit of IFRS adoption is to make provision for comparable and credible financial statements by corporate managers. Zaidi and Huerta (2014) and Naranjo, Saavedra and Verdi (2013) support IFRS adoption to facilitate an improvement and sustainability of global trade, which in turn stimulates the economic growth of the adopting nations. IFRS adoption contributes towards ensuring appropriate investment decisions on the reduction of information costs, specifically to foreign investors who observe the relevance of IFRS adoption and enable a cross-country capital inflow (Gordon *et al.* 2012). With this backdrop, South Africa became the pioneer of African countries by making IFRS adoption mandatory for all listed firms in 2005, which is the reason for choosing this study together with it being the largest economy in Africa. However, concerning the effect of IFRS on macroeconomic indicators, it is startling to note that the empirical literature is skewed towards FDI with little knowledge about the effects of IFRS on other macroeconomic indicators such as economic growth, exchange rate, interest rate and government borrowing. The objective of this paper thus adds to accounting and finance literature on IFRS adoption with its macroeconomic consequences by revealing the influence on economic growth, exchange rate, interest rate and government borrowing in South Africa. Hence, it provides lessons for policymakers on how to devise strategies on merging IFRS with other macroeconomic indicators without endangering the economy.

The rest paper is structures are as follows: Section two outlines the empirical literature review on FDI and the determinants of IFRS. Section three utilized the methods that relate to a country's economic variables and IFRS adoption strategy. Section four considers sample research design and model specification. While Section five involves the findings, limitations, conclusions and future research recommendations.

2. Theoretical underpinnings, literature and hypotheses development

2.1. Accounting standard- settings in South Africa

South Africa is at the same time a code and a common-law nation where investor protection and insider/market positioning opened. Accounting Standards Board (ASB) establishes a legislative instrument with the aim to establish standards for all spheres of government, accompany by directives and guidelines. The Finance Ministries in collaboration with Auditor-Generals department, seek to implement the new standards and ensure complete compliance with the standards. The South African Institute of Chartered Accountants (SAICA) manages all accounts setting processes, because ASB is to examine the best accounting practices that have the quality to enhance capital markets for foreign investment (Liener 1995). Under this, listed firms prepare financial statements in compliance with IFRS after mandatory adoption in 2005. The new standards are to be of quality; therefore, it is an opportunity to examine the effect of macroeconomic factors after the adoption.

2.2. Conceptual backgrounds

IFRS adoption dwells on two theories, the bonding theory of adoption, which explains the increasing trend of individual firm's reputation associated with the financial markets (Coffee 2002), and the signaling theory which

stipulates that firm's commitment to quality financial reporting is a signal for IFRS adoption (Tarca 2002). Positive accounting theory-is a primary function to ensure financial information credibility for efficient resource allocation (Bushman and Smith 2001).

The International Accounting Standards Board (IASB) develops IFRS to foresee accounting activities, this promotes accounting rules harmonization. There is an extensive relationship between the quality of IFRS adoption on financial accounting information of listed South African manufacturing and mining companies and to increase FDI and also improve investment returns (Tweedie 2006 and Barth *et al.* 2008). Large numbers of accounting quality indicators associated with IFRS adoption by European countries have enhanced reporting credibility (Chen *et al.* 2010, Barth *et al.* 2008). Paramount to corporate decisions is an entity's cost, given this importance, a lot of policy recommendations have been an innovation to help companies reduce this cost (Easley and O'hara 2004). IFRS adoption is expected to enhance transparency and a reliable disclosure of financial reports (Christensen 2012, Lourenço and Branco 2015).

The quality of accounting numbers may reduce agency costs and information asymmetry, managerial myopia, estimation risk and cost of capital. IFRS enhances; comparability, information quality, quality accounting numbers, market liquidity, FDI and efficient capital market (Ball 2016; Gordon, Loeb and Zhu 2012). This entices equity from foreign investors and therefore reduces the barriers to cross-border equity flows. Second, corporate disclosure must improve when better-quality accounting standards are adopted by the local GAAP which is of lower quality. This enables outside investors to monitor investment returns when information asymmetry decreases. The interaction between IFRS adoption and macroeconomic variables has centered on influencing FDI inflow. However, if IFRS is expected to grow FDI inflows in a country, then increase in economic growth is expected to stabilize the exchange rate and also reduce government's indebtedness. Thus, increasing investments to increase the productive capacity of the economy (economic growth), increase the demand for the local currency (increasing the value of the local currency) due to rising FDI and also reduce the rate at which government borrows since there will be higher FDI inflows.

2.3. Literature review

Akpomi and Nnadi (2017) found IFRS to have a significant positive effect on FDI inflows among forty-five African countries for the period 1996 to 2011. Lungu, Caraiani and Dascălu (2017) studied emerging countries in the EU and found countries adopting IFRS to be more likely to obtain higher FDI flows compared to non-adopters. In addition, among firms who adopted IFRS, listed companies' had the highest impact of IFRS on FDI flows relative to unlisted companies. Pricope (2017) found a positive impact of IFRS on FDI flows in 38 poor countries from 2008 to 2014. Sherman and de Klerk (2015) found that firms that adopt IFRS had none significant positive relationship with foreign ownership levels in South African listed companies for the period of 2003-2007. Emeni (2014) found a positive, but insignificant effect of FDI on IFRS adoption in 46 African countries. Lasmin (2012) revealed that developing countries who adopted IFRS were less likely to have higher international trade and FDI inflows. Gordon, Loeb and Zhu (2012) found that IFRS adoption increased FDI flows in 124 countries. Ramalina and Sletten (2009) among others in a sample of 102 non-European Union countries found that a country is more willing to adopt IFRS if its trade partners or countries found in its geographical setting have adopted IFRS. In addition, Louis and Urcan (2014) found IFRS adoption to increase FDI. However, these studies concentrated on the effect of IFRS on FDI with none of the studies above considering the impact of IFRS on GDP growth, exchange rate, government borrowing, and interest rate. This study thus filled a major gap in the literature by being the first time study to the best of the author's knowledge, to have investigated the impact of IFRS on macroeconomic indicators aside FDI.

Manawadu, Che Azmi, and Mohamed (2019) examines the interaction effect of adopting IFRS on the moderation between conditional accounting conservatism and foreign direct investment (FDI) in Southern Asian countries. It added to existing literature and also provides new evidence for the policymakers to consider IFRS adoption. In the study of Lee (2019) makes available evidence to support the positive significances of the IFRS adoption. Considering the continuing argument on the influence of IFRS adoption on the financial reporting credibility, the study extend the prior findings directs foreign investors and financial analysts for investment in global markets may use the disclosure of earnings of Korean companies more proficiently, as IFRS adoption enhances firms sustainability. Houqe (2018) indicates success in IFRS implementation by reducing information asymmetry, quality of information improvement for investors and analysts, efficient comparability improving transparency and positively influencing capital markets. Generally, the positive effects of IFRS is related to firms in strong enforcement governments that are motivated to conform. Yousefinejad, Salleh and Azam (2019), using information asymmetry to mediate the interaction between IFRS and FDI inflows demonstrates that the adoption of IFRS is a contributing factor for FDI inflows and subsequently cause economic growth and development. Their study made evidence

regarding the results of IFRS adoption from the phases of a reduction in information asymmetry and enhancement FDI inflows. The positive relationship between IFRS and FDI inflows provides useful information for adopting and non-adopting nations to recognize the economic consequences of IFRS. Their findings provide significant inputs to policy makers of Vietnam and Indonesia who are anticipating adopting IFRS.

2.4. Hypotheses developments

Foreign Direct Investment: According to Larson and Kenny (1995), and Zaidi and Huerta (2014), one important issue that has received considerable research in the accounting literature in recent time centers on IFRS adoption to improve disclosure quality at the international level. IFRS forms the basis of accounting procedures that will enable countries to widen their growth to appear in a broader perspective. A comparability benefits among investors is a question of considerable interest and significance to the financial reporting community. However, the association between accounting information quality and macroeconomic indicators has mixed results. It is a fact that most of the benefits following IFRS adoption studies are links with Europe, it is not appropriate to accept that the results will be same in Africa context. To highlight the gap, this paper structure studies in four main periods, it concentrates on Macroeconomic indicators and IFRS adoption interaction with information asymmetry, analysts following and managerial opportunism. IFRS perceives to be the best world collection and presentation of credible annual reports of firms to ensure an efficient capital market.

Macroeconomic variables and IFRS interaction with information asymmetry

Economic results accounting reforms and practice identifying problems related to information asymmetry in financial markets and also illustrate how investors and policymakers can access credible information for investment decisions (Morris 1987, Sudweeks 1989). Agency theory heightens information asymmetry between those charged with governance and the owners of the business. Information asymmetry focuses on the disclosure of inside information to benefit managers at the expense of shareholders. IFRS mandatory enjoins the management to disclose all material items as part of the financial statements to avoid distortion of information for decision-making. An incentive to shift to IFRS may suggest a better economic performance and firm value, under reduced information asymmetry. This sort to reconcile with the modernization theory (Ben Othman and Kossentini 2015) characterizing a country's key institutional factors to enable internationalization of trade and investment activities.

In emerging economies, conjecture market situations wherein imperfect market information asymmetry cause risk factors (Armstrong *et al.* 2011). Chen, Ding, and Xu (2014) concludes that nations with a better information environment can contribute to a greater level of FDI. In relation to IFRS adoption, there have been mixed results from developed and emerging economies (Marquew- Ramos 2008, 2011). To establish an empirical link between IFRS adoption, Macroeconomic variables, and FDI, Marquez- Ramos (2011) finds that there has been a decrease in information cost after the adoption by European nations has enhanced foreign trade and exerted a positive effect on economic growth. There have been few studies about IFRS adoption in Sub- Sahara Africa and its attraction to FDI inflows. IFRS adoption by listed manufacturing and mining firms in South Africa to control information asymmetry, reduce inherent conflict of interest, reduce the costs of capital and increase FDI. The above debate leads to our first major hypothesis to expect a positive relationship between FDI and IFRS interaction with information asymmetry.

We hypothesize that:

Hypothesis 1: Macroeconomic evidence on combined effect of IFRS-adopted firms and information asymmetry.

Macroeconomic variables and IFRS interaction with analysts following

Both public and private sources of information needed by investors are provided by financial analysts, which are important to aid capital market perfection (*e.g.,* see Healy and Palepu 2001). Financial analysts serve as intermediaries between investors and firm managers (Schipper 1991). Investors rely on financial analysts to find out more about a firm and to make investment portfolio decisions. IFRS adoption improves public disclosure and reduces the cost to obtain information that increases analysts following such companies. Analyst following is a proxy used to estimate the richness of a firm's information environment (Lys and Soo 1995, Bae *et al.* 2008, Brown and Higgins 2005).

The peculiar problem of the investor is the developmental theory of analysts following responsibilities. This latter perspective underpins' analysts following reports to investors based on benefits and costs of getting confidential information. Consonance with the benefits is in relation to the situation where analysts follow a business that has a more integral doubt since they can contribute more. The above argument notwithstanding, companies' economic environment, this study measures IFRS adoption effects on interest rate, GDP growth, exchange,

government borrowing, etc. There has been an alternate view of the sell-side analysts following providing some "seal of approval" for firms. Financial analysts follow firms that have credible financial reports. By extension, there is a large body of research on transnational business, finance, and economics that explores issues regarding corporate governance and trading laws (Lang, Lins and Miller 2004; Bushman, Piotroski, and Smith 2005, 2011). In a more focused study, an increase in FDI is a combined function of analyst following forecast and IFRS enabling the environment to improve financial capital inflow.

The hypothesis is:

Hypothesis 2: Macroeconomic evidence on combined effect of IFRS-adopted firms and analyst following.

Macroeconomic variables and IFRS adoption interaction with managerial opportunism

Signaling theory identifies problems relating to managerial opportunism in capital markets and also illustrates how it causes alarm to investors (Morris 1987). Williamson (1985) noted that opportunism is "self-interest seeking with guile". Managerial opportunism is an inevitable consequence of costly information. In the world of no transaction cost, including the cost of determining the behavior and actions of stewards (managers), there would be opportunism. In another direction, the study examines whether the shift to IFRS reduces managerial opportunism. Quality of financial reporting expects under IFRS as the different standards heighten informative disclosure and promote investor protection mechanisms. We posit that IFRS adoption would lead to lowering managerial opportunism (Luez 2003, Latridis and Rouvolis 2010). To address why IFRS adoption and managerial opportunism have a negative relationship is because of the problems identified by Degeorge, Patel and Zeckhauser 1999 that corporate managers manipulate the earnings of the firm to circumvent the adverse earnings.
The hypothesis tested is:

Hypothesis 3: Macroeconomic evidence on the combined effect of IFRS-adopted firms Interaction with managerial opportunism are negatively associated.

Macroeconomic factors and IFRS adoption

Quality of macroeconomic factors under the IFRS adoption has a negative and positive effect on monetary factors (Wang and Welker 2011). This underlines the score that when macroeconomic factors are high, accounting systems would develop to motivate investors based on firms' performance, all things being equal (Li 2010 and Castillo-Merino *et al.* 2014). From all the studies above, none considered South Africa, we expect macroeconomic factors under IFRS adoption period to increase FDI inflow to the country. Based on this argument, we hypothesize that:

Hypothesis 4: Quality macroeconomic factors increase the FDI under IFRS adoption.

3. Research design

3.1. Sample and dataset selection

The population for this study is mining and manufacturing firms listed on the JSE. The characteristics of the listed firms enhance the research since they report in a similar format for the study periods. However, sample companies must meet the conditions below:

- the companies that has been consistently listed on the JSE for fifteen years prior to the research;
- firms that have consistently published annual reports within the study period;
- applying these standards resulted in a sample of 49 companies (refer to Table 1).

The empirical analysis was based on data retrieved from the annual financial statements of 49 listed companies on the JSE during a fourteen- year periods 2001- 2014. Fourteen years are appropriate to test before and after adoption. 686 firm-years reports, of listed manufacturing and mining companies for the period 2001-2014 were used. The sample companies are those firms that persistently publish annual reports and showed the existing information before and after the adoption periods.

The companies' annual financial data were downloaded from archival databases of INET BFA/IRESS SA, Morningstar, and Anupedia. Table 1 shows that sampled firms represent 75.39% of the total population.

Table 1. Sample selection process

	Firm/Year obs.	(%)
Initial sample of observations: Manufacturing	38	
Mining	27	
Total	65	100
Firms with insufficient observations: Manufacturing	(12)	-18.46
Mining	(4)	-6.15
Final sample	49	75.39

We use firm's own control variables as IFRS adoption in South Africa as mandatory for all listed reporting entities. There are no other firms that use alternative accounting standards after the mandatory adoption period for comparison. Therefore, we used the 49 listed firms in standardized firm-year observations to explain pre-adoption and the post-adoption periods. It is most likely that the change observed on firms' cost of equity capital is linked to IFRS adoption. Firm-specific factors are controlled by using the same requirements.

Four separate periods of data used in the study are; the pooled (2001-2014), a pre-adoption (2001-2004), the early post-adoption (2006-2009), and the late post-adoption period of 2011-2014. These approaches ensure that data covering the four reporting periods under IFRS for all firms have an equal number of observations for pre-IFRS and post-adoption periods (Chua *et al.* 2012), except for the pooled regression model which uses 2001 to 2014 years excluding 2005 period. Excluding 2005 as the adoption's transitional year is consistent with the work of Chua *et al.* (2012) and Zeghal *et al.* (2012).

Table 2. Description of variables and sources

Variables	Description/measurement	Source (s)
Dependent variables		
Macroeconomic factors	▪ Interest rate (LNIR) (bank rate: the rate at which Central Bank of South Africa lends to the commercial banks); ▪ Exchange rate (LNEX) (RAND to dollar rate); ▪ Gross Domestic Product (GDP)[GDP at constant price (% change)]; ▪ Bankruptcy (LNBR); ▪ Government borrowing (LNGOVB) (Government net debt as a % of GGP); ▪ Integrity (LNINTG). (All variables are in their natural logarithms)	Fred. Stlouisfed.org; Federalreserve.org; Resbank.co.za/World; Development Indicators; The Global Economy-South Africa; Worldwide governance indicators.
Managerial Opportunism (LNMO)	▪ Earnings management measured as discretionary accrual (i.e. residuals from total accrual) in natural logarithm formula: $DA = TA - (\beta_0 + \beta_{1t}\frac{1}{A_{i,t-1}} + \beta_{2t}\frac{\Delta Rev_{i,t}-\Delta Rec_{i,t}}{A_{i,t-1}} + \beta_{3t}\frac{PPE_{i,t}}{A_{i,t-1}})$	Modified Jones Model
Information Asymmetry (LNIA)	▪ Bid-Ask spread measured by high and Low share price in natural logarithm	Corwin and Schultz (2010)
Analyst Following (LNAF)	▪ Number of analysts actively tracking and publishing an opinion on firm and its stock; *i.e* handy collection in natural logarithm.	The INET BFA Database
IFRS	▪ Pre-adoption (2001-2004), early adoption (2006-2009) and late-adoption (2011-2014).	Author's Design
Control variables	▪ Leverage (LNLEV) equal to total debt divided by total asset) in natural logarithm; ▪ Liquidity (LQ): ratio of current asset to current liability in natural logarithm; ▪ Tangibility (TANG): Ratio of net plant proper equipment to total asset in natural logarithm;	Badertscher *et al.* (2015, 2018); Baker and Martin (2011); Breuer *et al.* (2012)

3.3. Control variables

Under previous literature, we applied three control variables to avoid biased results. The control variables used includes; Leverage, liquidity, and tangibility, these control variables are expected to correlate with macroeconomic variables estimation as their exclusion from the tests may bias the coefficients estimated.

Leverage (LEV)

Important governance mechanism includes management of debt (Shleifer and Vishny 1997). Due to the interest and principal payments on debts, managers' responsibility is to generate cash flow to meet them. Therefore, it

ensures a credible financial reporting standard to manage liability arrangements. To meet such commitments, managers create an incentive programme to increase earnings. We used the ratio of total debt divided by total assets (Zamri *et al.* 2013) to calculate Leverage (LEV) (Mahoney *et al.* 2008). Lower leverage level expected under IFRS adoption as full disclosure of information is mandatory, therefore corporate value would be higher (Tu 2012, Daske *et al.* 2008).

Liquidity (LQ)

It shows how companies could meet their financial obligations in the short-term when they fall due (Fabozzi *et al.* 2010)). Liquidity heightens if there are fewer costs to convert the company's assets into cash. Higher firm value is as a result of IFRS adoption when the adoption limits managerial accounting manipulations, but can maintain cash flow for satisfying short-term commitments (Gitman 2004).

Asset tangibility (TANG)

Akintoye (2009) stipulates that keeping large investments tangible assets of firm's associates with smaller costs of financial distress, which affect the optimum performance. This enhances and generates more revenue from sales. We measured Tangibility as the Net Property, Plant, and Equipment divided by Total Assets and in percentages form. The IFRS adoption shows a positive relationship between asset tangibility and the counties macroeconomic factors that influence FDI.

4. Methods and empirical models

Given the panel nature of the data used, the pooled ordinary least square regression (POLS), the fixed effects (FE) and the random effects (RE) estimation techniques were used depending on which one was the best. Thus, the Breusch and Pagan Lagrangian multiplier test choose between the RE and the POLS regression, and if the RE was the best choice, the Test of over-identifying restrictions (Sargan-Hansen statistic) select between the RE and the FE. The Test of over-identifying restrictions was used since the study automatically controlled for heteroscedasticity by using robust standard errors and hence the Hausman test would not have been suitable. Notwithstanding, choosing between POLS and the RE, the F-test makes the best model. In comparing the POLS to FE, the FE runs without the robust standard error option to get the F-test result, hence if the test chose the FE model ahead of the POLS, the FE was re-run with the robust standard error option. Therefore, in this study all standard errors were robust catering for any heteroscedasticity. Thus, the empirical models used are as shown in equations 1 and 2, where equation 1 represents 2001-2014 period, excluding 2005 and equation 2 is for the 2001-2004 period.

$$MI_{it} = \alpha_0 + \alpha_1 \, tang_{it} + \alpha_2 \, LQ_{it} + \alpha_3 \, lev_{it} + \alpha_4 \, IA_{it} + \alpha_5 \, AF_{it} + \alpha_6 \, MO_{it} + \alpha_7 \, IFRS * IA_{i,t} + \alpha_8 \, IFRS * AF_{it} + \alpha_9 \, IFRS * MO_{i,t} + \alpha_{10} \, INTG_{it} + \alpha_{11} \, MC_{it} + \alpha_{12} \, BR_{it} + \alpha_{13} \, IFRS_{it} + \varepsilon_{it} \quad (1)$$

$$MI_{i,t} = \alpha_0 + \alpha_1 \, tang_{it} + \alpha_2 \, LQ_{it} + \alpha_3 \, lev_{it} + \alpha_4 \, IA_{it} + \alpha_5 \, AF_{it} + \alpha_6 \, MO_{it} + \alpha_7 \, INTG_{it} + \alpha_8 \, MC_{it} + \varepsilon_{it} \quad (2)$$

MC represents a vector of the macroeconomic indicators excluding the macroeconomic dependent variable as used in a model. The meanings of all the remaining notations is already defined. All the variables use their natural logarithm forms (LN) except IFRS and its interactions with other variables. In addition, the 2006-2009 period excludes integrity in order to obtain good results.

5. Results and discussion

This section tackled the analysis and discussion correlation results, as well as regression results.

5.1. Correlation analysis

In Table 3, the correlation analysis reveals the direction and strength of association among variables used in the study. Furthermore, if the correlation coefficient is closer to 1, it shows the greater strength of association and if it is closer to zero, it shows the weaker strength of association. Hence, the same variables would have a perfect correlation coefficient (1.0000) as seen in Table 3. Regarding the correlation between different variables, only the correlation (coefficients in parenthesis) between Exchange rate and integrity (-0.6653) and interest rate and bankruptcy (0.8358) were stronger. However, the extents of association between the remaining variables show weak results generally.

Table 3. Correlation Analysis of

Variable	gdpg	EX	govb	IR	Tang	LQ	Lev	IA	AF	INTG	MO	BR
gdpg	1.0000											
EX	-0.3350	1.0000										
govb	0.0474	-0.1648	1.0000									
IR	0.2095	-0.0025	-0.3045	1.0000								
tang	0.0260	0.0308	-0.0041	0.0099	1.0000							
LQ	-0.0757	0.0159	0.0279	-0.0876	0.0425	1.0000						
lev	-0.0402	0.0422	0.0094	-0.0776	0.1660	0.0064	1.0000					
IA	-0.0667	0.0738	-0.0201	-0.0892	-0.0238	-0.0159	0.0711	1.0000				
AF	0.1269	-0.0816	0.0654	0.1374	-0.0241	-0.0344	0.0341	-0.0817	1.0000			
INTG	0.1244	-0.6653	0.1186	0.1352	0.0050	0.0026	-0.0383	-0.0539	0.0545	1.0000		
MO	-0.0943	0.1062	0.0198	-0.0083	-0.0149	-0.1991	0.0180	0.0173	-0.0176	-0.0181	1.0000	
BR	0.2382	-0.1677	-0.1898	0.8358	0.0074	-0.1016	-0.1003	-0.0936	0.1011	0.1968	-0.0460	1.0000

Source: Author's Computation from Anupedia, INET BFA/IRESS SA, and Morningstar 2019. Obs=636

5.2. Regression results

The results from the pooled OLS regression and FE model are shown in table 4, which explains the differences in the results in terms of the time periods, etc. Concerning the 2001-2014 period, excluding 2005 (the impact of IFRS on the macroeconomic variables) as seen in Table 4, the tests showed that, the POLS estimation technique was the best for the government borrowing (LNgovb), economic growth (LNgdpg), and interest rate (LNIR) models with the FE technique being the most suitable for the exchange rate (LNEX) model.

Table 4. Multivariate regression results for the impact of IFRS on GDP, exchange rate, government borrowing and interest rate in South Africa (2001-2014)

	(POLS)	(FE)	(POLS)	(POLS)
	LNgdpg	LNEX	LNgovb	LNIR
LNtang	0.00428	0.00667	-0.393	-0.00270
	(0.0228)	(0.0108)	(0.547)	(0.0139)
LNLQ	-0.00891	0.0101	0.0478	-0.00705
	(0.0221)	(0.0163)	(0.480)	(0.0130)
LNlev	-0.0238	-0.00418	0.185	0.000234
	(0.0189)	(0.00923)	(0.422)	(0.0108)
LNIA	-0.0138	0.000598	1.015***	0.0186
	(0.0183)	(0.00935)	(0.269)	(0.0121)
LNAF	0.0139	-0.00495	0.878***	0.0638***
	(0.0341)	(0.0169)	(0.330)	(0.0136)
LNMO	-0.0132	-0.00496	0.0472	0.00494
	(0.00883)	(0.00410)	(0.175)	(0.00632)
IFRSIA	0.0876	0.0147	-3.780***	-0.114
	(0.0746)	(0.0542)	(1.262)	(0.0767)
IFRSAF	0.00828	0.00250	0.0685	-0.0120***
	(0.00852)	(0.00414)	(0.130)	(0.00414)
IFRSMO	0.0825	0.0257	0.195	0.0101
	(0.0585)	(0.0494)	(0.228)	(0.0362)
LNINTG	-0.813***	-0.750***	3.437*	0.288***
	(0.174)	(0.0360)	(2.001)	(0.101)
LNIR	0.502***	0.324***	-12.63***	
	(0.0987)	(0.0301)	(2.013)	
LNEX	-1.484***		1.671	0.637***
	(0.159)		(2.457)	(0.111)
LNgovb	0.00234	0.000686		-0.0110***
	(0.00218)	(0.000999)		(0.00108)
LNBR	0.150*	-0.121***	5.928***	0.542***
	(0.0784)	(0.0258)	(1.174)	(0.0288)
IFRS	0.0952	0.0233	2.330**	0.0671
	(0.0660)	(0.0308)	(0.983)	(0.0465)
LNgdpg		-0.273***	0.958	0.178***
		(0.0220)	(0.915)	(0.0373)
_cons	3.418***	3.293***	-7.322	-2.413***
	(0.601)	(0.0682)	(8.435)	(0.343)
N	322	322	322	322
R^2	0.680	0.818	0.269	0.830
adj. R^2	0.665	0.809	0.233	0.821
F	51.63	432.9	4.215	200.3

*Note: Standard errors are in parentheses + p < 0.10, * p < 0.1, ** p < 0.05, *** p < 0.01. LNTANG represents tangibility in natural logarithm, LNLQ represents natural logarithm of liquidity, LNLEV represents natural logarithm of leverage, LNIA represents natural logarithm of information asymmetry, LNAF represents natural logarithm of analyst following, LNMO represents natural log of managerial opportunism, LNINTG represent natural log of integrity, LNIR represents natural log of interest rate, LNEX represents natural log of exchange rate, LNGOVB represents natural log of government borrowing, and LNBR represent bankruptcy*

Regarding Economic Growth (LNgdpg), the result demonstrates that when integrity (LNINTG) increased by 1%, economic growth fell by 0.813%. In a related result, a 1% increase in interest rate, exchange rate, and bankruptcy lead to a 0.502% increase, 1.484% fall and 0.150% increase in economic growth. However, IFRS and

its interactions with other variables find no significant effect on economic growth in South Africa. On the exchange rate (LNEX) model, 1% increase in interest rate, integrity, economic growth, and bankruptcy lead to a 0.324% increase, 0.750% fall, 0.273% fall and 0.121% fall in the exchange rate.

Regarding the government borrowing model, a 1% increases in analyst following, information asymmetry, the interaction of IFRS with information asymmetry, integrity, interest rate, bankruptcy and IFRS led to a 0.878% increase, 1.015% increase, 3.780% decrease, 3.437% increase, 12.63% fall, 5.928% increase and 2.330% increase in government borrowing. Therefore, while analyst following, information asymmetry, integrity, bankruptcy, and IFRS had increased impacts on government borrowing, interest rate and the interaction of IFRS with information asymmetry had decreased impacts. On the interest rate model, 1% increases in analyst following, integrity, exchange rate, government borrowing, bankruptcy and economic growth led to 0.0638% increase, 0.0120% fall, 0.288% increase, 0.637% increase, 0.0110% decrease, 0.542% increase and 0.178% increase in interest rate. Hence, while IFRS had none significant impact on the exchange rate, economic growth, and the interest rate; it rather had a positive and significant impact on government borrowing. The finding on the effect of IFRS on government borrowing is as that of Emalereta and Akandu (2017), Lungu *et al.* (2017) and Pricope (2017), who revealed IFRS to obtain a positive influence on FDI, though they used different variables.

Regarding the determinants of economic growth, government borrowing, interest rate and the exchange rate in South Africa for the Pre-IFRS period (2001-2004), the tests revealed the POLS technique to be the best for the interest rate model, while the FE is the best for all the remaining models. Regarding the economic growth model, one percent increase in analyst following, Leverage, integrity, interest rate, exchange rate and government borrowing to increase by 0.0850%, decrease by 0.0519%, and decrease by 0.558%, and decrease by 0.700%, and decrease by 1.843% and increase economic growth by 2.112%. On the exchange rate model, 1% increase in integrity, government borrowing, and economic growth lead to 0.303% fall, 0.866% increase, and 0.234% fall in the exchange rate. Regarding the government-borrowing model, it states that 1% increase in Leverage led to a 0.0241%, a 1% increase in integrity led to 0.198%, a 1% increase in interest rate led to 0.174%, a 1% increase in exchange rate 0.892% and 1% increase in economic growth led to a 0.276% increase in government borrowings respectively. Regarding the interest rate model finds that, when an analyst following, integrity, exchange rate and economic growth increased by one percent, the interest rate would increase by 0.0611%, increase by 0.259%, increase by 0.652% and decrease by 0.270% respectively.

On the determinants of economic growth, government borrowing, interest rate and exchange rate in South Africa for the early-IFRS period (2006-2009), the tests showed the FE technique to get the best for all the models. Concerning the economic growth model during the early-IFRS period (2006-2009), a 1% increase tangibility, liquidity, information asymmetry, analyst following, managerial opportunism, interest rate, exchange rate and government borrowing increased by 0.289%, increased by 0.0765%, decreased by -0.0287%, increased by 0.134%, decreased by -0.00760%, decreased by -1.191%, decreased by -0.455% and increased economic growth by 1.361% respectively.

On the exchange rate model, 1% increase tangibility, liquidity, interest rate, government borrowing and economic growth lead to 0.161% fall, 0.0639% fall, 0.531% fall, 1.109% increase and 0.328% fall in the exchange rate. Regarding the government-borrowing model, one percent increase in managerial opportunism, interest rate, exchange rate and economic growth lead to a 0.00280% fall, 0.438% increase, 0.174% and 0.154% increases in government borrowing. In the interest rate model, it reveals that, if tangibility, exchange rate, government borrowing and economic growth increases by one percent; interest rate would increase by 0.153%, decrease by 0.327%, increase by 1.726% and reduce by 0.531%. On the determinants of economic growth, exchange rate, government borrowing and interest rate in South Africa for the late-IFRS (2011-2014), the tests showed the POLS technique to be the best for all the models except the exchange rate model in which the FE technique was the most suitable.

Concerning the economic growth model, it was found that 1% increase in analyst following, interest rate, exchange rate, and government borrowing led to a 0.0336% decrease, 1.650% decrease, 171% decrease, and 0.0284% increase in economic growth respectively. Thus, analyst following, exchange rate and interest rate had decreased effects on economic growth apart from government borrowing that had a positive effect. Moreover, on the exchange rate model, it was found that 1% increase in analyst following, integrity, interest rate, government borrowing and economic growth led to 0.0154% increase, 0.921% decrease, 0.318% increase, 0.00626% fall and 0.106% fall in exchange rate respectively. Regarding government borrowing, it was found that a 1% increase in analyst following, interest rate, and economic growth increased government borrowing by 1.571%, 49.82%, and 28.83% respectively. Last but not the least, one percent increase in analyst following, government borrowing, and economic growth was found to lead to 0.00674% fall, 0.0123% increase and in 0.415% fall in interest rate respectively.

Table 5. Multivariate regression results for the Pre-IFRS period (2001-2004), Early Post Adoption Period (2006-2009) and Late Post Adoption Period (2011- 2014)

Variables	Panel A:Pre-IFRS adoption 2001-2004				Panel B: Early Post-IFRS adoption 2006-2009				Panel C: Late Post-IFRS adoption 2011-2014			
	(FE)	(FE)	(FE)	(POLS)	(FE)	(FE)	(FE)	(FE)	(POLS)	(FE)	(POLS)	(POLS)
	LNgdpg	LNEX	LNgovb	LNIR	LNgdpg	LNEX	LNgovb	LNIR	LNgdpg	LNEX	LNgovb	LNIR
LNtang	0.0173	0.00232	-0.0174	-0.00239	0.289**	-0.161*	-0.0440	0.153*	0.00430	-0.00418	-0.240	0.000569
	(0.0466)	(0.0166)	(0.0139)	(0.0233)	(0.117)	(0.0898)	(0.0382)	(0.0852)	(0.00993)	(0.0118)	(0.356)	(0.00445)
LNliquid	0.00400	0.00738	0.000783	-0.0215	0.0765**	-0.0639*	-0.00641	0.00334	-0.00872	0.00714	0.184	-0.00310
	(0.0428)	(0.0154)	(0.0140)	(0.0231)	(0.0369)	(0.0346)	(0.0152)	(0.0281)	(0.00948)	(0.0120)	(0.306)	(0.00396)
LNlev	-0.0850***	-0.0161	0.0241**	-0.0122	0.00761	-0.0426	0.00130	-0.00112	-0.0113	0.00675	0.380	-0.00255
	(0.0288)	(0.0123)	(0.0108)	(0.0153)	(0.0299)	(0.0273)	(0.00660)	(0.0159)	(0.00802)	(0.00646)	(0.273)	(0.00388)
LNIA	-0.00580	0.000875	-0.00192	0.0180	-0.0287***	-0.000560	-0.00446	-0.00464	-0.000539	0.00565	0.133	-0.00186
	(0.0201)	(0.00677)	(0.00639)	(0.0116)	(0.00962)	(0.0139)	(0.00328)	(0.00758)	(0.00721)	(0.00539)	(0.189)	(0.00290)
LNAF	0.0519*	-0.00594	-0.0102	0.0611***	0.134***	-0.0497	0.0124	0.0260	-0.0336***	0.0154**	1.571***	-0.00674**
	(0.0276)	(0.0115)	(0.0122)	(0.0165)	(0.0377)	(0.0297)	(0.0108)	(0.0240)	(0.00862)	(0.00723)	(0.266)	(0.00303)
LNMO	-0.0123	-0.00355	0.00421	-0.00308	-0.00760*	-0.00140	-0.00280**	0.00131	0.00164	-0.00124	-0.0324	0.00124
	(0.0141)	(0.00446)	(0.00460)	(0.00925)	(0.00416)	(0.00358)	(0.00125)	(0.00308)	(0.00527)	(0.00394)	(0.166)	(0.00240)
LNINTG	-0.558***	-0.303***	0.198***	0.259***					0.130	-0.921***	-2.652	0.0858
	(0.132)	(0.0569)	(0.0485)	(0.0800)					(0.120)	(0.0267)	(3.068)	(0.0556)
LNIR	-0.700***	0.0136	0.174***		-0.191***	-0.531***	-0.438***		-1.650***	0.318***	49.82***	
	(0.123)	(0.0724)	(0.0564)		(0.208)	(0.139)	(0.0409)		(0.126)	(0.0829)	(4.284)	
LNEX	-1.843***		0.892***	0.652***	-0.455**		-0.174**	-0.327**	-0.171**		0.876	-0.0150
	(0.255)		(0.0405)	(0.161)	(0.216)		(0.0834)	(0.169)	(0.0762)		(1.213)	(0.0162)
LNgovb	2.112***	0.866***		0.199	1.361**	1.109***		1.726***	0.0284***	-0.00626***		0.0123***
	(0.250)	(0.0709)		(0.147)	(0.518)	(0.257)		(0.184)	(0.00134)	(0.00177)		(0.000816)
LNgdpg		-0.234***	0.276***	-0.270***		0.328**	0.154***	-0.531***		-0.106**	28.83***	-0.415***
		(0.0336)	(0.0272)	(0.0529)		(0.131)	(0.0454)	(0.0789)		(0.0508)	(1.331)	(0.0138)
_cons	0.589	0.00786	0.318*	0.207	0.716	0.0160	0.1566***	-1.740*	3.647***	2.983***	-100.6***	1.872***
	(0.504)	(0.220)	(0.169)	(0.209)	(1.290)	(0.775)	(0.225)	(0.871)	(0.871)	(0.162)	(7.220)	(0.0995)
N	104	104	104	104	68	68	68	68	121	121	121	121
R^2	0.772	0.970	0.959		0.975	0.828	0.943	0.977	0.952	0.979	0.931	0.771
adj. R^2	0.747	0.966	0.954		0.971	0.801	0.934	0.974	0.948	0.977	0.925	0.750
F	42.95	717.6	402.3		188.6	59.26	203.2	620.8	486.8	533.1	378.4	158.4

Note: Standard errors are in parentheses $^+$ p < 0.10, * p < 0.1, ** p < 0.05, *** p < 0.01. LNTANG represents tangibility in natural logarithm, LNLQ represents natural logarithm of liquidity, LNLEV represents natural logarithm of leverage, LNIA represents natural logarithm of information asymmetry, LNAF represents natural logarithm of analyst following, LNMO represents natural log of managerial opportunism, LNINTG represent natural log of integrity, LNIR represents natural log of interest rate, LNEX represents natural log of exchange rate, LNGOVB represents natural log of government borrowing, and LNBR represents bankruptcy.

Conclusion

This study attempted to find out the impact of IFRS on macroeconomic variables (economic growth, exchange rate, interest rate and government borrowing). FDI is given a lot of attention in current finance and economics literature. Thus, the study posits that, since IFRS could affect economic growth, exchange rate, interest rate and government borrowing, it is worth investigating its impact on them. The effect of IFRS on many macroeconomic indicators is indirect, however, its effect will emanate from FDI and that impact depends on the strength of FDI and other indicators. Therefore, by using panel data regression techniques, the study concluded that while IFRS had none significant impact on the exchange rate, economic growth, and the interest rate; it had a positive and significant impact on government borrowing. Therefore, policymakers should be circumspect in adopting IFRS by bearing in mind the targeted and other macroeconomic indicators.

Limitations of this study

Foremost, the sample was limited to only mining and manufacturing firms with a consistent financial statement published data and hence, the findings may not be a generalization to the entire population of JSE listed companies. Last but not the least results may also be different if interest variables needed to be measured in our model specifications.

Conflict of Interest

Authors have declared that no competing interests exist.

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*** World Investment Report 2007 (WIR07) is the seventeenth in a series published by the United Nations Conference on Trade and Development (UNCTAD).

Table 1. Selected listed Companies

Names of Listed Manufacturing Companies	Names of Listed Mining companies
Allied Electronics	African Rainbow Ltd
Aveng	Drdgold
African Oxygen Ltd	Oceana
AECI	AngloGold Ashanti
NAMPAK	Anglo American Plc
Arcelor Mittal	BHP Billiton Plc
SABMiller	Sasol Ltd
Impala Platinum Holdings Ltd	Reunert
PPC Limited	Harmony Gold Mining
Murray & Roberts Holdings Ltd	Tongaat
Sappi Ltd	Omnia
Illovo Sugar Ltd	Group Five
Aspen Pharmacare Holdings	Growth Point
Datatec	Sentula
Mustek	York timbers
Metair	Netcare
Argent	Basil
Assore	Hosken
Astral Food	Iliad
Astrapak	Jasco
AVI	Merafe
Barlo World	
Bidvest	
Sovereign	
Crookes	
Distell	
Grindrod	
Beige	

Source: JSE Website (2018)

The Participatory Budgeting for Local Governance. Case study Municipality of Korca (Albania)

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Abstract:

This paper provides the implementation process of the participatory budgeting model showing that it increased public participation in the process of public decision making, increased local tax revenues collection, channeled larger fractions of public budgets to services stated as top priorities by citizens, and increased satisfaction levels with public services. This study describes the conceptual framework, key building blocks and the partecipatory budgeting cycle as it was implemented in Albania especially in Municipality of Korca. The aim of this process is to strength the community participation and civil society in governance through their engagement at all stages of the budget cycle.

Keywords: participatory budgeting; budget transparency; municipal council; accountability; prioritization criteria; civil society.

JEL Classifications: H11; H41; H43; H70.

Introduction

Participatory budgeting is an approach that brings local communities closer to the decision-making process around the public budget. This innovative financial practice has the potential to enhance citizen voice in budget decision making and to help government improve budget transparency, efficiency, and accountability. Cooperation between citizens, non-governmental organizations, business sector representatives and local government brings more transparent, fair and effective financial policies.

Albanian municipalities are already operating in an open and competitive environment both at national and international level. Municipal councils and mayors need an organization that functions in a versatile, coordinated, professional way and where each segment of the organization is complementary to policy implementation and service delivery. Not all albanian municipalities have a well-developed organization where decision-making, control, management and enforcement levels are clearly stratified and overlapping, where responsibilities and functions are separate, and where each segment of the organization has a clear scope for exercising its activity and relations with other segments.The aim of this process is to strength the community participation and civil society in governance through their engagement at all stages of the budget cycle related to identification of investments according to local needs, evaluation the capacity to support projects, preparation of budget proposal in council, overseeing the process of budget approval, monitoring and evaluating public works and continuity of the process.

1. Understanding of participatory budgeting

Participatory budgeting (PB) is a mechanism that allows the citizens of a specific jurisdiction to participate in decisions on the allocation and management of all or part of the local government's available public financial resources. Participatory Budgeting aims to increase transparency, accountability, and social inclusion in local governance.
A participatory budgeting process requires citizen engagementin all phases of the budget cycle, briefly described below:

- identifying capital investments and projects to address the most pressing local needs;

- preparing feasibility studies to support the appraisal of such investments and projects;
- preparing a budget proposal for submission, through the local mayor, to the local council;
- overseeing the budget approval process (review, discussion, and voting);
- monitoring budget execution;
- monitoring procurement (tendering, bidding, and contracting);
- monitoring and evaluating the execution of public works.

Participatory budgeting involves the direct participation of citizens and civil society. It also actively engages local government actors such as the mayor, the local council, the treasurer, and the directors of the local finance, urban and rural planning, and local services departments. In designing PB, special efforts are made to include citizens who have traditionally been excluded as stakeholders. PB creates opportunities for citizen involvement in policy decisions, improves the efficiency of resource allocation, and enhances the quality and delivery of public goods and services.

The Participatory budgeting process provides the tools and procedures that assist local government to overcome the difficulties it faces in government. The Participatory Budgeting process offers citizens, especially those politically and socially excluded, an opportunity to raise their voice in political decision-making.Participation increases the efficiency of resource use by local authorities:Participation enables a continuous communication process between decision-makers and communities, enabling decision-makers to be coherent and recognize the needs and priorities of local communities by orienting the use of resources according to community needsParticipation is a tool to fight corruption: The most important element is mutual information between the community and local authorities. Continuous information significantly reduces the chances of corruption, while the low level of corruption brings the full use of local resources to the community. Participation generates new ideas for development:

Communicating between the community and decision-makers or authorities provides the opportunity for generating new ideas coming from community members, who are properly implemented to improve the quality of community lifeParticipation, increases the support of community members to the political system:

2. Actors that participate in the participatory budgeting process

Participatory budgeting is a mechanism through which state and non-state actors come together to allocate, spend, and account for public resources. If the PB process is to achieve its objectives, all stakeholders should be involved. This includes citizens, representatives from local civil society, government, local councils and the business community.

The citizen'srole is to communicate their needs for public goods and services. Citizens discuss these needs with other community members and with local authorities, reach a consensus, and set their priorities. Citizens also contribute to the definition of the rules and procedures that guide the PB process. After the budget has been approved, citizens participate in overseeing budget execution, the local government procurement process and monitoring and evaluating public works.

Local governmenthas the role of overall management. Local government provides citizens with information about the PB process and budget information. It also organizes the public meetings. Based on feedback from those meetings, it analyzes citizen investment priorities and ensures that the final PB proposals are incorporated into the budget document submitted to the local councilors for approval. Early in the budget process, the local government executive branch provides training to citizens and civil society on the PB process and sets the "rules of the game." These rules govern the PB process and should be agreed on by all the stakeholders. Local government also plans out the PB process in different geographical areas, and thus should come up with an effective geographical division of the communes or municipalities to ensure thorough coverage of PB activities.Process should ensure that vulnerable groups (usually citizens from low income groups, women, youth, children, and immigrants) are directly engaged in all the PB phases.In societies with weak social capital, such as Albania, NGOs can play a supportive role to mobilize citizens and community-based organizations to participate in the PB process. NGOs can reach out to vulnerable groups who have been traditionally excluded from public debates. In situations where local government lacks the capacity to manage the PB process, NGOs can be contracted to fill this gap. NGOs can help moderate public meetings to ensure that all stakeholders have the opportunity to voice an opinion, negotiate, and make decisions free of pressure. They can conduct public awareness campaigns, help demystify budget documents, and build local capacity of the local government, citizens and local civil society.

The role of the local councilorsis to discuss and approve the budget. Once the local council approves the budget, the local government executive branch co-manages budget implementation with citizens. Local councils also play an oversight role in this phase. One of the main characteristics of the participatory budget process in

Albania is that citizens can participate directly and do not need to be represented by an official entity. Although such organizations play an important role in the process, they do not have formal privileges. In fact, the mobilized citizenry makes all significant decisions. When it has been necessary to choose participants or delegates, they have generally been chosen by lottery or voting.

Table 1. Phases of participation

Level	Type of participation	Outcomes
Basic	Consultation	Local government solicits public views, but do not necessarily consider those views in the final decision.
Intermediate	Token participation	Local government consults citizens but makes final decisions.
Advanced	Citizen empowerment	Citizens jointly make decisions with local government

Source: Justus Mika, "The Conceptual Framework in Participatory Budgeting" (draft), 13 p.

Some limitations of this process are: citizens are less interested in learning about their rights, the mandate of government, or broader social policies; and are more focused on obtaining a project or investment for their neighborhood. Delivering tangible goods and services to citizens is vital for building citizen trust and enthusiasm. However, when PB programs focus solely on this aspect, public learning and citizen empowerment are diminished. Civic education should be provided throughout the PB program to ensure wider learning.

Raising expectations of the citizens that means the local government staff must disclose accurate information about the budget and provide realistic revenue forecasts to citizens so that the PB process aligns with local fiscal realities. This is crucial in the Albanian context, as several donor-funded participatory activities have raised citizen expectations and not delivered. Disclosing accurate budgetary constraints to citizens also makes them aware of the fragile financial plight of their local government. Often resources barely cover operational costs, leaving limited room for investment.

Citizens may not be able to attend public meetings for a variety of reasons. Some locations may be difficult to access due to distance or security problems. Inadequate advertisement of events may result in citizens being unaware of upcoming meetings. Citizens may also be tired of participating in frequent meetings. A more extensive and targeted communications campaign could help avoid these problems.

Government may not have enough resources and time to devote to the PB process. Civil servants are busy with their routine responsibilities. Without adequate motivation and incentives, civil servants will not participate in the PB meetings, which often take place after normal business hours. The local government needs to manage its human resources; otherwise it will not be able to allocate adequate staff to support the PB process.

Tension with elected representatives means thatelected members of the local council may fear losing their citizen representative power. As the budget arrives in the local council with a substantial degree of popular legitimacy, some legislators may fear that their role in the budgeting process becomes a mere formality. Without broader political support, elected councilors may block the PB process.

A final limitation is lack of sustainability. Citizens have a tendency to abandon PB after their demands are met. Election periods usually undermine the quality of participation as discussions turn into political debates. Political changes in the administrations can potentially disrupt the PB process, particularly when the PB is used for pushing narrow political agendas.

3. Criterias for prioritization of resources

Local government needs to forecast the expected amount of resources to plan for potential investments. The local finance department identifies the percentage of current or capital revenues that will be available for the PB program. The amount of financial resources may vary, but they generally consist of unconditional central government transfers and resources from local taxes. Most current revenues are usually committed for the financing of recurrent expenditures (such as administration and operational costs). A proportion of capital revenues may be already committed for works in progress or earmarked for specific projects (conditional grants or loans), and, of course, these resources cannot be, in practice, available for PB. Consequently, a fixed percentage or pre-determined optimal proportion of the budget is not typically allocated for PB. It all depends on the specific financial circumstances of each local government, the political will of the municipality, and the pressure brought to bear by its citizens. Common criteria include: population, local priorities (i.e., housing, streets, education, health, sewage), basic needs (*i.e.*, water, electricity, or sanitation), the degree of citizen participation, the degree of tax evasion or arrears, investment rich or neglected considerations, impact of a project on the community as a whole, and, impact on disadvantaged or vulnerable groups.

Each geographic zone will have competing investment priorities. These need to be ranked according to prioritization criteria. Such criteria involve issues of affordability, extent of the community support, alignment with established goals. The types of criteria that can be applied to rank competing investments are: Does the project support other community or economic goals? Does the project fit with the community's long-term goals? Is the project a community need or a community "want"? If the project is a want, what is compelling about it? Will the project put any individual or group at a disadvantage? Can the community afford to maintain and operate the project after it is built? Is there strong support for the project in the community across factions? If this project is undertaken, will it be a duplication of other efforts? Does the community fully understand the project and its implications? Does the project resolve any compliance issues? What is the project's internal rate of return as compared to that of other local projects? What is the project's present value as compared to that of other local projects?

4. Implementation participatory budgeting process. Case study municipality of Korca

Korca Region neighbours the Elbasan Region to the Northwest, the Berat Region to the West, the Gjirokaster Region to the Southwest, while it shares borders with Macedonia to the Northeast and Greece to the Southeast. Korca is part of a regional network of small and medium size Albanian cities, while historically it has been part of an interregional network including Ohrid, Bitola, Kastoria, Florina and other urban centres located in Macedonia and Greece, including Skopje and Thessaloniki.

Figure 1. Korca region neighbours

Korca Municipality is the major economic centre in Korca Region and Albania's southeast. It is organized in 8 administrative units, 1 city and 62 villages.The municipality has a consolidate economy and a lot of businessesbut increase the number of the population as a result of the displacement of residents from rural areas has also increase the number of unemployed persons by raising the need for finding employment solutions and qualifying these persons for different profiles.In rural areas, agriculture and fruit growing are developed on the one hand, and on the other, mountainous tourism where residents have self-assured the way of organizing the facilities and culinary as well as winter activities as an attraction for tourists. The deeper areas such as Lekas and Vithkuqi due to the harsh climate and isolation in winter have undergone massive population shifts, which has also minimized services for the rest of the population, ranging from education, medicine, infrastructure, transportation, etc.

Which are the steps of budgeting formulation? PB is launched through an extensive communications campaign, designed to disseminate information on the PB program and mobilize all stakeholders to participate in the activities. The campaign is conducted by local governmen in partnership with local civil society. These means include information stands, open meetings, workshops, leaflets, newsletters, and posters or visual illustrations, and they are intended to provide information and encourage participation. Prior to the public meetings, the local government and community jointly select individuals to serve as facilitators. Facilitators receive training to mobilize communities and moderate public meetings. Local government department heads and councilors are typically briefed on the PB program prior to the implementation of the PB cycle. At the end of the workshop, a detailed implementation plan should be prepared by the local government, agreed on by all stakeholders, and disseminated to the public. Village or neighborhood meetings take place in two rounds. At the meetings citizens, discuss prioritization criteria for selecting new investments. Communities often informally meet prior to these meetings to pre-identify new investment needs and projects. The first village/neighborhood meetings are formally opened by the Mayor. Local council heads and relevant department directors often participate in these meetings. Local government staff members disseminate the following information to citizens at these meetings. These meetings also provide citizens with an opportunity to propose local investment projects and develop a list of priorities. Citizens discuss and evaluate the priorities based on specific prioritization criteria. The proposed budget is subsequently submitted for review by the mayor and his staff. Once the mayor reviews the budget, the local government conducts

open meetings to discuss the proposed budget with PB Council delegates. Subsequently, the local finance department or budget director finalizes the budget and submits it to the local council for review, discussion, and approval. The budget should be distributed to every council member and to every local council delegate for review and evaluation. Subsequently, the budget commission should schedule budget discussions and public hearings within the given timeframe of the agreed-on budget cycle. The local council should debate and discuss the budget in an open session. During the budget revision phase, commission members, councilors, and citizen delegates will be able to ask the local government technical for clarifications. These discussions can lead to requests for changes, which should be incorporated into the proposedbudget by the local government.

Figure 1. Key participatory budget actors and their Interrelationships
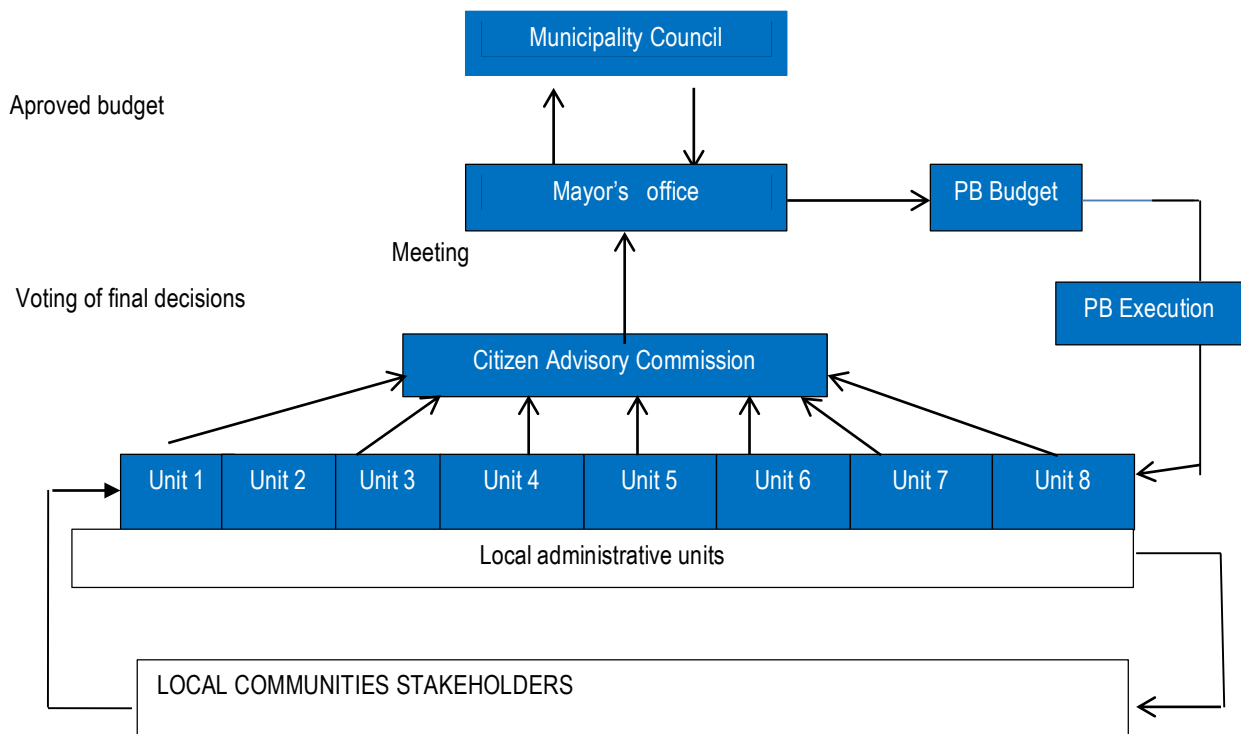
There aresuccessful cases of citizen involvement in decision making. The participatory budgeting is a project implements by the Municipality of Korça, which aims to get citizens' opinion about the destination that will have the municipal budget, how it will be allocated for the implementation of different projects and ranking according to citizens' priorities in relation to them.Participatory budgeting also includes the participation of small and medium enterpricesin relation to taxes, that is a process of consulting investment priorities with residents of all neighborhoods of the city. Citizens vote on the list proposed by the municipality and the projects that receive the highest number of votes the municipality passes for funding and implementation.

The Citizen Advisory Commissionis an active structure composed by 70 members from administrative units, who are a group of citizens from different professions, members of national and international NGOs. This commission plays an important role in the discussions and solutions to the challenges and problems of the citizens, holds two meetings a month, one of which is done with the presence of the representative of Korça Municipality. Significant impact of citizen involvement has shown in discussed about rehabilitation of Korca old Pazar and construction of the pedestrian street, where everything has been done taking into account the opinion given by the citizens. The involvement of the community has had impact on decision-making policies in the ART project in Libonik, which has affected the opening of the Children's Center (CPU).

Korça Municipality has contact with all existing NGOs in the city and has had ongoing collaborations and support for the implementation of some social programs. Within the "Social City" program, projects were carried out as: summer camp "Friendship"; "Housing Bonus for Families in Need"; day centers for the elderly and children. In case of Korça's pedestrian street, which was contested by the businesses that carried out their activity in that area, civil society has influenced the awareness of the business for the important role it would have this intervention of the municipality transforming this area into an important business development pole and a tourist attraction for visitors. Establishment of the Citizen Commission with the assistance of USAID, as one of the most effective consultative mechanisms with citizens.

The Municipality of Korça uses all means of communication for dissemination of information such as website, local and national media announcements, publication of all decisions of the Municipal Council on the official website of Korça Municipality; social remedies; meetings with citizens (public hearing); email, press releases etc. Among the most prominent are the following tools: The "Improve the City" digital platform, an application where citizens participate in regulating and improving public works and services, giving information to Korça Municipality regarding damage to public space, damage to the city lighting system, pollution, *etc*. A total of 46 complaints were filed, of which only 18 were solved. Korça magazine, is one of the citizens' information tools, a periodical magazine of the municipality, which is published every two months and contains summaries of social projects, projects devoted to the infrastructure sector, artistic and cultural activities etc. The Roma community has participated in local council meetings only in cases where the interest has been or has been violated, eg the time when the apartments was distributed, the allocation of economic assistance, the breakdown of the shopping center, the decisions taken to reduce the small business tax. Successful co-operation between NGOs is with Dorkas and Emanuel Foundation for third-generation community centers and day care centers for children in need.

Conclusions

Partecipatory Budgeting builds trust and improves the quality of citizens' governance. Ensures that local government finances are properly calculated, reducing the potential for abuse by individuals inside and outside the local administration. Local governments have improved the efficiency of budget execution, particularly in purchasing goods and contracts. The creation of budget monitoring groups improved the quality of public investment and infrastructure maintenance. For the first time, isolated communities participated directly in public hearings and means how their priorities took their place in the final budget. These groups have no strong political voice and in the past have been discriminated against in allocating budget resources. Citizens emphasized the importance of Participatory Budgeting as a tool to exercise their civil rights, raise awareness and improve local government accountability. Local participation increases the democratic culture, promote civil engagement and support human capital development.

The model of participatory budgeting is considered the most important for several reasons:

- makes transparency with citizens for investments; objectives are implemented according to the priorities of the main stakeholders; ensure transparency. Actors are called responsible for their roles by those who choose them, costs and benefits are distributed in the most equitable way opportunities among the main actors involved. Some improvements were also made in the management of local government. Local governments have improved the efficiency of budget execution, especially in purchasing goods and contracts.
- creating budget monitoring groups improved the quality of public investment and infrastructure maintenance. The Albania experience has shown that the principles and values of public participation are embedded in the Law on Local Government Functioning to guarantee democracy and transparency at local level. It provides the basic protocols for public information disclosure and public hearings on local government decision making processes.

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