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## Assessment of the Effectiveness of an Initial Public Offering by Russian Companies

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### Abstract:

*This article is dedicated to the analysis of the calculation of the efficiency of the IPO carrying out at stock exchanges in Russia and abroad and the impact on the companies' market value. The novelty of approaches consists in solving important theoretical and organizational-methodological problems of an economic analysis of the company's market value growth by attracting initial public offerings for stable growth, achieving better credit conditions, obtaining the status of a public company to enter foreign markets. Results of the study show that a successful IPO is characterized by a combination of achieved capitalization and the subsequent growth of shares of the issuer. In addition, the increase must be gradual. This behavior characterizes the profitable sale of the issuing company to the underwriter, and investors are able to make a profit for their participation in the offering. Earlier studies have considered only the cost of capital, but not the economic value added, which makes this work unique and innovative. The results can help build the correct development strategy and allow investors to increase the confidence in the success of the companies, and the company itself will be able to actively develop.*

**Keywords:** performance assessment, bond-like paper, emission, IPO (Initial Public Offering), stock market.

**JEL Classification:** D22, D53, F21, G12, O16.

### 1. Introduction

IPO in Russia is popularized with the beginning of the rapid economic growth in the period from the 2000s to 2007. This is noticeable in scientific environment due to publications related to IPO in the Russian segment from 2004. The IPO (Initial public offering) term is a procedure for the initial public offering of shares to the public organized through financial market. In other words, a closed private enterprise for the first time decided to sell their shares to the public in the financial markets. This explanation is scientific and popular, which is typical in foreign literature. In the Russian practice the IPO is interpreted as a "fund-raising based on the first output of the company on the open market and the offering of shares among investors" (Mirkin and Mirkin 2008). The essence of the IPO consists in that this is the form of attracting to finance companies, and not as offering. Part of the share capital in

the form of shares issued on the stock exchange considering a blocking stake preserving among the owners, plays the role of the transfer of rights to a company to other people through the offer to purchase in this case, attracting investments.

**2. Main text**

Technically, as a procedure, IPO can be considered in Russia as the situation when the company is renamed to open joint stock company in which the shares are held by the owners or a limited number of persons, later property is transferred from one holder to another through the civil-law transactions by a public offering not only on stock exchanges. In the context meaning, the key factor of determining the IPO is listing or public subscription, where regulators are set by legislation and the inclusion in the quotation list, that is, both IPO (Initial Public Offering to a wide range of people) and SPO (Secondary Public Offering) are equivalently intended as the initial public offering to a wide range of people. Thus, in the Russian context, the IPO concept is wide enough, which implies other public offerings. Zhukov (2012) identifies the following types of offerings.

Table 1 - Types of bond-like paper offerings

PO TYPES	FEATURES
1) private offering (PO)	<ul style="list-style-type: none"> <li>▪ a private placement among a wide range of investors, who were selected by the issuer before.</li> </ul>
2) primary public offering (PPO) or follow-on)	<ul style="list-style-type: none"> <li>▪ a private placement among a narrow circle of investors, who were selected by the issuer before.</li> </ul>
3) secondary public offering (SPO)	<ul style="list-style-type: none"> <li>▪ typical of the public sale of a large block of shares by existing shareholders.</li> </ul>
4) direct public offering (DPO)	<ul style="list-style-type: none"> <li>▪ placement from the issuer (and the issuer's forces) directly to primary investors, by passing the stock market.</li> </ul>

IPO process consists of three main stakeholders: 1) company, 2) selling shareholder and 3) investors. During a structured consideration of the participants' motives the following key points are highlighted:

- 1) For the company it is necessary to enlarge and build a stable ownership base, which undoubtedly indicates on expansion of profiles with the sphere of influence. In the future, new horizons will ensure maximization of profit, which plays a role in the attraction in order to facilitate fundraising in the long term. The attractiveness from the point of view of the success of the IPO may also play a significant role in ensuring high liquidity in the secondary market, which in the future will have an impact on future absorption.
- 2) Shareholder, who sells, pursues motives of income provision from participation in the transaction, and maximizing the value of the remaining assets in the portfolio.
- 3) Investors, as well as the seller, also seek to increase revenue by maximizing the profitability and share prices both in the short and in the long term perspective. The participation of the investor in the IPO process is motivated by the accumulation of positions that are profitable to be purchased in the primary market, in general, influencing the expansion of the investment portfolio.

Summarizing the economic content of the initial public offering (IPO) from the point of view of the issuer, the following characteristics are highlighted:

- in the Russian legislation the initial public offering, as well as a secondary sale by additional issue of bond-like papers is counted as the IPO, unlike the understanding of this term in the West;
- the process involves three players: the company (owners), the underwriter, investors;
- provision of the share capital to investors through a public sale of shares on the stock market to raise funds for business expansion;
- acts as the denationalization and privatization of large state-owned companies;
- it is a costly procedure due to the additional costs incurred in its carrying out, restructuring of the management, involvement of highly qualified consultants and specialists.

When considering the life cycle of the company the following steps according to Greiner (1972) are indicated: The first stage is the stage of creation, where the current priority is the creation of a "product"; informal relations, very modest incomes. The second stage is the stage of the team formation, in which the organization structuring is the key element: setting tasks to employees, the introduction of accounting rules and the formation of the company's policy. The third stage is the stage of the delegation, which consists of specialization and demarcated area of



responsibility among employees, controlling crisis of leadership in connection with decentralization. The fourth stage is the stage of coordination. At this stage the long-term planning, divisions are combined into product groups, a complex system of means are created. The fifth stage is the stage of cooperation, in other words bureaucratization; teamwork interaction of senior staff and personnel, design and introduction of new ideas.

The complexity of the system at the last stage of any company is the distinctive feature of uniqueness. The latest enterprise's level of development should apply qualitatively different approaches to their development. Financing of the organization is experiencing a qualitative evolution. The Russian financial market in 2002-2007 was developed to diversify sources of funding, greater equity in the investment. The appearance of alternative capital will raise mechanisms among Russian companies.

The main goal of IPO for the company is to attract cheap capital for further development, when the cost of capital is lower than profitability of anticipated investment projects. This may occur as a result of both the emission of additional shares and the sale of shares held by shareholders. To attract investment through IPO it is necessary to accompany a further (secondary) emissions of the company. Emission of additional shares at the expense of funds increases the capital of the company and provides receiving financial resources. Open sale of shares by public subscription will serve the company in the way that the shares will be available to the public. The above-described important tasks require building a coherent strategy for conducting the IPO, with several goals, namely: attracting financial resources, accessing Western capital market, creating a positive reputation of the company, advertising on domestic and foreign markets.

Creating a positive image of the company is caused by the publicity. Disclosure of private company's information is already a major step in the qualitative intensification of internal capacity.

Company advertisement on domestic and foreign markets cannot only declare itself to a wide range of investors, but also assess the interest from foreign investors. Also advertisement will affect the dynamics of the actual price per share in the global arena.

Capitalization is considered in terms of return on equities, which is achieved after the listing of the company on the stock exchange and the bidding procedure. Determining the price of shares is a complicated procedure, because of insufficiency of only accounting and financial reporting. The process of finding the share price consists of the following stages: a) determination of the price range by banks organizers, b) establishment of the final bid price, b) determination of the market share price on the secondary market (Sharpe *et al.* 2014). Some researchers (Weiss 1988, Brau and Fawcett 2006) analyze such indicator as the underestimation of the shares of the first day of trading and subsequently treat the efficiency of the IPO with the help of this indicator. Therefore, it is important that after the purchase of company's shares on the market the new shareholders were not disappointed in the company and did not put the stock for sale, because the massive sale will reduce the company's value. For a company that has a good reputation, it is important to continue to follow its own quotes, to avoid losing capitalization. Teoh, Welch and Wong consider in terms of the investor and come to the conclusion that the issuing company itself adds manipulation to its financial performance in order to achieve better prices in consequence of attracting profitable amount of capital (Teoh *et al.* 1998). Brau, Fawcett, Cicon, McQueen consider this issue as an offering at inflated estimates that will cause a low return in the long term (Brau and Fawcett 2006, Brau *et al.* 2012).

The need for conducting an IPO is primarily due to the development strategy developed by the company, evaluation of the benefits which it intends to draw from the public offering, the presence of investor interest in the company's shares, as well as the ability of the company to carry out the offering itself. The high price per share at the moment of company's offering and a high market value is not always effective (Weiss 1988). Efficiency as a result of IPO, in particular, retention and development of the share price in the secondary market, are identified by monitoring indicators prices.

Up to 2014, totally 123 companies from 21 sectors placed their shares. Most leading segments in the IPO are mining companies and hi-tech technology companies, telecommunications and media, both tied for first place with 13.82% of offerings in the history of Russian public offerings.

The second position is shared by financial services market with the real estate market and development, indices are 10.57%. The fourth place is taken by the sphere of retail trade – 8.94%. The fifth position went to oil and gas sector with the index 7.32%. The offering of shares on stock markets across sectors in Russia is shown in Figure 1.



Figure 1 - Number of companies which carried out the IPO by sectors

The most interesting sectors are those of hi-tech technology, telecommunications and media, mining companies and oil and gas sector: MegaFon OJSC, STS Media, RusAlyuminiy OJSC, RusPetro, Gosneft, ALROSA OJSC.

Jain and Omesh (2011), Megginson *et al.* (2000), Weiss (1988), Brau and Fawcett (2006) analyze such indicator as the underestimation of the shares in the first day of trading and subsequently treat the efficiency of the IPO with the help of this indicator. This is due to the fact that the higher the average offering rate compared to the middle of the price range, the greater the underestimation of the IPO. These indicators are calculated as follows:

$$UN = (P_{c1} - P_o) / P_o, \quad (2.1)$$

where  $UN$  – initial underestimation of IPO,  $P_{c1}$  – closing price of the first day of trading,  $P_o$  – price of initial public offering.

$$PRI = (P_o - P_e) / P_e, \quad (2.2)$$

where  $PRI$  – index of offering price change,

$$P_e = (P_h + P_l) / 2 - \text{expected offering price}, \quad (2.3)$$

where  $P_o$  – initial offering price,  $P_h$  – upper limit of the price range,  $P_l$  – lower limit of the price range.

Brau and Fawcett investigate the price formation process at the start of trading (Brau and Fawcett 2006). In this case, the relationship of quotes and subsequent changing in price is revealed. The price of the first transaction explains the bigger part of the profitability of the first day. For the reason that the share is available for the first time, the identification of the fair market price makes fluctuations.

The next stage of evaluation is capitalization analysis of a company in terms of creditworthiness. Reducing the rates on bank loans to issuers is reflected in the work of Pagano *et al.* (1998). The authors argue that open access to information about the borrower, the increased bargaining power of a public company is beneficial to reducing the cost of capital through savings on interest payments. The efficiency of both the relation of costs and results (benefits) in IPO market should be considered from the perspective of the key players in this market and with taking into account those benefits that the company receives on the availability of public trading in shares on the stock exchange, the liquidity of its bond-like papers. Pereverzev (2006) considers IPO efficiency in terms of WACC (weighted average cost of capital). It means that the public offering for the company will be economically viable only if in the medium term perspective, the cost of attracted investments will be lower or equal to the weighted average cost of capital of the company prior to IPO. Teplova (2012) finds that the identification of effectiveness by comparisons: WACC after IPO is less than WACC after IPO.

The equation for calculating the coefficient of weighted average cost of capital (WACC) is:

$$WACC = (r_{dc} \times (1 - \%_{tr}) \times V_{dc} + r_{ec} \times V_{ec}) / (V_{dc} + V_{ec}) \quad (2.4)$$

where:  $r_{dc}$  – cost of debt capital sources,  $r_{ec}$  – equity cost of capital,  $V_{ec}$  – equity capital,  $V_{dc}$  – debt capital,  $\%_{tr}$  – tax rate (24% before 2006, 20% after 2006). Equity cost of capital ( $r_{ec}$ ) is calculated based on CAPM model (capital asset pricing model), which was proposed by W.F. Sharpe (Sharpe 1964).

$$r_{dc} = R_f + \beta \times ERP \quad (2.5)$$

where:  $R_f$  – risk-free rate,  $\beta$  – systematic risk, ERP – equity risk premium. Systematic risk of industry, and in this scientific work of the enterprise, is calculated by the covariance ratio of considered profits to the market index (market index, in which bond-like paper are traded):

$$\beta = \text{Cov}(R_{a,rp}) / \text{Var}(r_p) \quad (2.6)$$

The time quotations interval is 1 month. Profit is considered from the beginning to the end of the investigated period for each enterprise. Pursuing the increase in market value, business owners conduct an initial public offering on the stock exchange for further evaluation and designation of a fair price. DeAngelo (1990), Kim *et al.* (1995) in their studies showed that high rates of revenue growth and profitability of the enterprise is a long-term guarantee of high equity.

The third stage is calculation of economic value added (EVA), as an indicator of the company's growth dynamics. The formula for calculating an economic value added (EVA):

$$EVA = \text{NOPAT} - \text{EC} \times \text{WACC} \quad (2.7)$$

where, NOPAT is net operating profit after tax, IC is invested capital, WACC is weighted average cost of capital. Economic value added is created when an enterprise obtains higher returns where the market costs exceed achieving of such return. Stable long increase in this indicator characterizes the growth of the enterprise value as a whole. In this analysis not so much the unit is important, but EVA index dynamics.

The fourth stage is the identification of the return on invested capital (ROIC), as an indicator of the return of each unit of capital invested. This coefficient is calculated as follows:

$$\text{ROIC} = (\text{NP} - \text{D}) / \text{EC} + \text{LTL} + \text{STL} \quad (2.8)$$

where NP – net profit, D – dividends paid, EC – equity capital, LTL – long-term liabilities, STL – short-term liabilities of the company.

This coefficient measures how much cash is brought as a profit of each invested capital. Identification of underestimation in early trading allows highlighting the IPO efficiency from the point of view of shareholders and investors. Identification the dynamics of change in the coefficient of average cost for capital points to the “debt capital cheapening”, in the future will give the issuing company more favorable bank lending, thus, improving the financial state in contrast to competitors. Dynamics of change in the market value-added indicator shows growth or fall in the price of the investigated company.

### 3. Results and discussion

In the course of the research work we explored the possibility of estimating an IPO in terms of impact on the cost of capital of one of the largest company in both national and global importance for the extraction of diamonds ALROSA OJSC, as well as a number of other companies of three industries such as the mining industry (RusAl, ALROSA), oil and gas extraction (Rosneft, RusPetro), media and telecommunications (STS media, MegaFon).

#### STS Media

Trends of increase in net operating income characterize as previously noted, the efficient operation of the company. This factor affects the market value of the shares. By the correlation model constructed by the authors, an underestimation of STS Media in the coefficient of 5.54% is revealed; it indicates the profit, which investor received investing means in the bond-like papers of this issuer. Consequently, this phenomenon points to the increase in the price of the shares offered. Offering the company is effective for investors.

WACC (Table 2) describes a declining trend, thus, indicating a lower dependence on the various sources of funding. Thus, conducting IPO is effective for companies.

Table 2 - Calculation of key indicators to determine the effectiveness of STS Media Company's IPO

INDICATORS	2005	2006	2007	2008
Net operating income, in USD mln	67.74	128.17	163.94	3.52
Invested capital, in mln. USD	192.88	438.43	636.46	502.30
Return on invested capital (ROIC) (%)	21.15	21.94	19.41	2.15
Weighted average cost of capital (WACC) (%)	24.39	23.87	20.63	3.88
Economic value added (EVA), in USD mln	20.69	23.50	32.67	-15.96
Market nominal value, in USD mln	1.54	1.54	1.58	1.58
Market value, in USD mln	3,000.47	2,157.09	4,781.02	759.30

Note: \*Compared by authors

### MegaFon OJSC

Trends of net operating income range at the end of each year. In the IPO year indicators are negative compared to the previous year. Despite of this, the market responded positively to the demand for issuer's shares. Offering value with USD 20 at the end of the first day of trading was USD 27 per unit. Underestimation of the company amounted to 35% in accordance with the correlation model. Therefore, investing was justified for investors, as the issuer, having more information on the real value of his bond-like papers, lowered the price to investors as compensation for the risks.

WACC indicators (Table 3), characterizing the growing dynamics before the IPO, in year of IPO carrying out and after it, point to the increasing costs of debt capital. Thus, the company's capital became more expensive. Only in 2014, the weighted average cost of capital decreased by 3.97%. The effectiveness of the company's initial public offering during the market recovery period showed its negative impact for MegaFon Company.

Table 3 - Calculation of key indicators to determine the effectiveness of MegaFon Company's IPO

INDICATORS	2011	2012	2013	2014
Net operating income, in RUB mln	44,724	39,913	53,749	40,294
Invested capital, in RUB mln	333,495	267,067	314,245	341,664
Return on invested capital (ROIC) (%)	11.36	-32.44	3.39	-0.37
Weighted average cost of capital (WACC) (%)	11.85	12.10	13.14	9.18
Economic value added (EVA), in RUB mln	5,188.88	7,603.39	12,441.58	8,932.07
Market nominal value, in RUB mln	62	62	62	62
Market value, in RUB mln	404,116	428,110	529,976	509,640

Note: \*Compared by authors

### Telecommunications and media sector

The IPO multiplier indicator performs the function of measuring the effect caused by the attraction of capital in terms of revenue. Despite the efficient performance of IPO of STS Media, raised funds are not strongly influenced by the share of revenue. On the other hand, the MegaFon Company has a significant impact from the sale of shares.

Table 4 describes the following trends: in the IPO year economic value added of STS Media steadily increased by 13.55% from 20.7 to USD 23.5 million and by 39.01% from 23.5 to USD 32.7 million next year. EVA coefficient in this case is influenced by the growth in return before tax; in the IPO year it increased by 13% and in 2007 by 39%, due to the increase in net operating return. Subsequently, the coefficient took a negative value of almost 149% in 2008, with very low profits of the company. Return on invested capital keeps decreasing from year to year as well as the weighted average cost of capital by increasing share capital and short-term liabilities. The difference between these two values demonstrates that annually company had no opportunity to create value.

Table 4 - IPO multiplier of the telecommunications and media sector companies

INDICATORS		Before IPO	In the IPO year	DIFFERENCE
STS Media	Revenue, in USD mln.	237	371	133
	Net funds raised through the IPO, in USD mln		346	346
	IPO multiplier			0.39
MegaFon	Revenue, in RUB mln	242,608	272,637	30,029
	Net funds raised through the IPO, in RUB mln			1,800
	IPO multiplier			16.68

MegaFon is also characterized by the rising trend of EVA from the previous to IPO year before the end of the 1st year after the IPO: from RUB 5.19 bln to RUB 12.44 bln with an average growth of 151%. Reducing the invested capital in 2012 by 20% compared to 2011 played a significant role in this indicator. In 2014, the dependence on capital caused a decline in economic value added due to lower operating return and higher dividend payments, invested capital growth and capital appreciation (WACC). ROIC has a strong dependence on the increase in dividend payments. The difference between ROIC-WACC was the lowest in the IPO year due to the inability to create value because of the approval of the dividend policy and the huge outflow of RUB 151 bln. Although in 2014 the coefficient takes a relatively equal importance from 2013.

By the third and fourth method it was revealed that conducting IPO of two companies in telecommunications and media sector is inefficient. Offering in the sector of telecommunications and media is effective from the investors' point of view. There is an underestimation of the companies. The ability to create value for the companies has a subject to antiskid dynamics that affect the market value. For companies in general, IPO is ineffective.

#### Russian Aluminum JSC

The trend of a sharp increase in net operating income (Table 5) describes, as previously noted, the IPO influence. This factor affects the market value of the shares. By constructed correlation model, the author reveals an underestimation of RusAl in the coefficient of 1.44%, indicating the increase in the initial price of the offered share. Enterprise offering for investors was neutral.

Table 5 - Calculation of key indicators to determine the effectiveness of RusAl Company's IPO

INDICATORS	2009	2010	2011	2012
Net operating income, in USD mln	671	2 409	488	-249
Invested capital, in USD mln	18,918	23,557	22,889	22,633
Return on invested capital (ROIC) (%)	5.38	6.550	0.94	-1.33
Weighted average cost of capital (WACC) (%)	10.02	4.660	9.67	10.61
Economic value added (EVA), in USD mln	-1,223.48	1,310.120	-1,726.38	-2,651.26
Market nominal value, in USD mln	127.532	150.678	151.908	151.887
Market value, in USD mln	6 707	20,944.310	7 365	8 859

Note: \*Compared by authors

In the year when attracting highly liquid funds, there is a sharp decline in WACC rate. A year before IPO and in a year after IPO also there is a negative difference, indicating the reduction of the cost of capital. The IPO efficiency is little noticeable.

#### ALROSA OJSC

The revealed underestimation of the issuer's shares in 4.55% indicates that investors received their share of the returns from the growth of the market value of the bond-like papers. Therefore, investing in this company is effective for investors. Capital appreciation compared to the years before entering the stock market is noticeable. The difference of ratios on invested capital profitability with the weighted average cost of capital is positive. In the year of offering (2013) characteristic change is especially distinguished – 2.36%.

Indicators of economically added value in RusAl company value do not behave consistently (See Table 6). The company cannot create value. WACC is decreased from 10.02% to 53.43% in a year of offering and amounted to 4.66%, but the next year it returned to the level of near to 2009. ALROSA, on the other hand, shows the stable ability of creating value, thus, EVA indicators demonstrate an increase: 2012 – 20.39%, 2013 – 39.36%. The decrease in net operating return in 2014 affected the drop in EVA. Profitability of RusAl Company's invested capital

has a negative trend. ALROSA shows a positive tendency; in addition, WACC is less than ROIC, which gives a positive result of their differences.

Conclusion: an IPO for the RusAI Company is not effective, and is positive for the ALROSA both for investors and the company.

Table 6 - Evaluating the effectiveness of IPO of the mining sector companies

INDICATORS		Before IPO	In the IPO year	The 1 <sup>st</sup> year after IPO	The 2 <sup>nd</sup> year after IPO	Change (%) before/ IPO year	Change (%) IPO year/ the 1 <sup>st</sup> year after IPO	Change (%) the 1 <sup>st</sup> / 2 <sup>nd</sup> year after IPO
RusAI	IPO share in the invested capital, %		9.13					
	Share of equity capital in the invested capital, %	33.47	48.63	46.04	48.26	45.29	-5.32	4.82
	EVA, USD mln	-1,223.5	1,310.1	-1,726.4	-2,651.3	-207.08	-231.77	53.57
	Share of equity capital (with IPO) in the total invested capital, %	33.47	48.63	46.04	48.26	45.29	-5.32	4.82
	ROIC, %	5.38	6.55	0.94	-1.33	21.70	-85.73	-241.88
	WACC, %	10.02	4.66	9.67	10.61	-53.43	107.43	9.72
	ROIC-WACC, %	-4.63	1.89	-8.74	-11.94	-140.77	-562.79	36.64
INDICATORS		2011	Before IPO 2012	The IPO year 2013	The 1 <sup>st</sup> year after IPO 2014	Change (%) 2012/ 2011	Change (%) 2013/ 2012	Change (%) 2014/ 2013
ALROSA OJSC	Share of IPO in invested capital, %			15.81				
	Share of equity capital in the invested capital, %	6.31	5.04	4.78	4.14	-20.13	-5.24	-13.41
	EVA, RUB mln	13,362	16,087	22,419	-34,330	20.39	39.36	-253.13
	Share of equity capital (with IPO) in the total invested capital, %	57.58	55.88	61.06	45.48	-2.95	9.26	-25.51
	ROIC, %	10.15	8.41	6.49	3.72	-17.15	-22.79	-42.63
	WACC, %	8.75	7.77	4.13	9.31	-11.15	-46.88	125.63
	ROIC-WACC, %	1.40	0.64	2.36	-5.59			

Source: authors' calculations

#### Oil and gas sector

IPO multiplier notes that raising funds through an initial public offering of shares in the share of revenue remains low (Table 7).

Table 7 - Calculation of key indicators to determine the effectiveness of ALROSA Company's IPO

INDICATORS	2011	2012	2013	2014
Net operating income, in RUB mln	30,650.00	35,321.00	33,201.00	-6,238.00
Invested capital, in RUB mln	197,654.00	247,479.00	261,164.00	301,595.00
Return on invested capital (ROIC) (%)	10.15	8.41	6.49	3.72
Weighted average cost of capital (WACC) (%)	8.75	7.77	4.13	9.31
Economic value added (EVA), in RUB mln	13,361.80	16,086.80	22,419.35	-34,330.25
Market nominal value, in RUB mln	2,567.40	2,567.40	2,567.40	2,567.40
Market value, in RUB mln	326,731.00	192,512.00	258,125.00	276,367.00

Note: \*Compared by authors

## OJSC Rosneft

The underestimation of IPO is amounted to 0.79% (Table 8), which shows the efficiency of setting the price. Investors did not receive compensation for the risks. From the investor's point of view, IPO is not effective. Increased net operating return after the offering is an effective activity, as previously noted. The growth of the invested capital is caused by the increase in assets. WACC low trend in the IPO year and thereafter in 2007 is noticeable. Reducing WACC in the IPO year compared with the previous means a significant reduction in price of capital. But in 2008 WACC increased to 40.09%.

Table 8 - IPO multiplier of the oil and gas sector companies

	INDICATORS	Before IPO	In IPO year	DIFFERENCE
Rosneft	Revenue, in USD mln.	23,863.00	33,099.00	9,236.00
	Net funds raised through the IPO, in USD mln			10,700.00
	IPO multiplier			0.86
RusPetro	Revenue, in RUB mln	38.72	76.23	37.51
	Net funds raised through the IPO, in RUB mln			214.00
	IPO multiplier			0.18

Note: \*Compared by authors

## JSC RusPetro

Underestimation of the company, calculated from the opening price (USD 2.05 per share) and closing price (USD 2.25) in the first day of trading, occurs at the level of 9.76% (Table 9), which was beneficial for investors in the purchase of the bond-like papers for resale.

Table 9 - Calculation of key indicators to determine the effectiveness of Rosneft Company's IPO

INDICATORS	2005	2006	2007	2008
Net operating income, in USD mln	4,971.20	3,332.00	14,231.20	10,495.20
Invested capital, in mln. USD	21,771.00	35,856.00	52,681.00	56,108.00
Return on invested capital (ROIC) (%)	14.55	6.68	16.56	13.63
Weighted average cost of capital (WACC) (%)	9.34	5.60	5.59	8.20
Economic value added (EVA), in USD mln	2,937.53	1,325.44	11,286.65	5,897.12
Market nominal value, in USD mln	196.90	196.90	105.98	105.98
Market value, in USD mln	118,140.0	71,928.85	80,809.47	70,929.22

Note: \*Compared by authors

Negative return values indicate ineffective activity. In addition, WACC growth trend and negative coefficient of ROIC of this company demonstrates a lack of opportunity to create value. As a result, the enterprise can be an example of the situation when current shareholders decide to sell their shares of the share capital to cash out their investments, due to which, subsequently, the market reacts with the loss of interest. The decline in demand for the company's shares reflects the negative trend.

In comparative Table 10 the positive and growing trends of Rosneft Company's capacity to create value (EVA), the dynamics of change of growth are highlighted: in the year of offering of shares in 2006 – 54.88%, 2007 – 751.54%, 2008 – 445% compared to 2006. In addition, after IPO in 2007 the profitability on the invested capital increased by 148%. WACC indicators are lower than ROIC ratio; the reduction of WACC in the IPO year indicates the effectiveness of the public offering.

Table 10 - Calculation of key indicators to determine the effectiveness of RusPetro Company's IPO

INDICATORS	2011	(IPO) 2012	2013	2014
Net operating income, in USD mln	-70.93	-22.48	-59.40	-210.71
Invested capital, in mln. USD	597.68	455.43	589.60	618.22
Return on invested capital (ROIC) (%)	-16.38	-3.96	-13.01	-6.75
Weighted average cost of capital (WACC) (%)	8.68	8.23	10.65	11.34
Economic value added (EVA), in USD mln	-122.81	-59.97	-122.20	-280.83
Market nominal value, in USD mln	686.77	686.77	686.77	686.77
Market value, in USD mln	-	17,337.04	3,939.63	2,313.20

Note: \*Compared by authors

## Conclusion

Based on a comprehensive assessment of the IPO (initial public offering of shares) effectiveness leads us to the following conclusions:

Firstly, a successful IPO is characterized by a combination achieved by market capitalization and the subsequent growth of the issuer's shares. Thus, the increase must be gradual. This behavior characterizes the returnable sale of the issuing company to the underwriter, and investors are able to make a return for their participation in the offering. The analysis revealed that the company needs to stay at the peak of demand for shares on the stock market.

Secondly, the efficiency of IPO can be identified by examining the 4-year period. Weighted average cost of the company's capital at a successful IPO is lower than in the previous year. The obtained results indicate that the two companies (STS Media and MegaFon) of the telecommunications and media sector successfully conducted IPO. RusPetro Company of the oil and gas sector held a successful IPO just in the short time.

Third, IPO creates a special status; a public company needs to interact with investors, to publish reports regularly, to maintain corporate website, to disclose and properly apply relevant facts from the company's life.

IPO for the company is first and foremost, an additional source of funding. After the IPO, it is able to attract it at a lower price due to the distribution of risks among a greater number of shareholders. Moreover, the improvement in the balance sheet structure allows the company to attract significant additional debt financing, as well as to carry out additional issue in the longer term.

Thus, it should be noted that any public fund-raising is, above all, the sale of the company's future in the way as it is seen by the current owners. For its success their goals and strategies should be articulated and brought to the market participants' attention. Companies often direct all their efforts to achieving short-term results, which, as it seems to them, the market expects from them. But it is much more effective to focus on long-term goals and to help investors believe in the company's ability to achieve them. Building a proper development strategy and realization of IPO as the next step towards its implementation will be exactly the factor that will allow investors to believe in the company's success and will open up new horizons to the company.

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## The Dynamics of the Wage-Price Setting Behaviour in Countries of Eurozone

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### Abstract:

*The literature review clearly indicates that there are significant differences concerning analytic approaches and inferences on the dynamics, patterns, and methods applied in examining the wage-price relationship. Regardless of the fact that there have been enormous efforts invested in trying to untangle the complexities surrounding the wage-price setting process, this paper provides new and statistically robust evidence on the wage-price setting process in Germany, Spain, France, Italy, Netherlands and Austria, covering the period of time 2000:Q1–2015:Q4. The data suggests that wage setters in all the countries, except in Austria, have under-adjusted for inflation in the post 2008 period, as probably the costs of such behaviour were low. Specifically, the cointegration tests provide strong evidence in favour of hypothesis that wages and prices in the respective countries are strongly cointegrated. Moreover, the results produced by VECM models provide statistically robust evidence in favour of a long-run relationship between wages and prices. However, the price elasticity coefficients suggest that there may be a valid case in favour of fully rational wage-price setting behaviour in these countries of Eurozone.*

**Keywords:** inflation, rational expectation, causality, co-integration.

**JEL Classification:** C32, E31, J31.

### 1. Introduction

In principle, it is hard to reject the hypothesis that connection between wages, prices and economic activity is more akin to a tangled web than a straight line. Specifically, in the United States (US) wages and prices have tended to move together, even though the causal relationships are difficult to identify (Knotek and Zaman 2014). Nonetheless, this paper will attempt to examine the wage-price relationship in six countries of the Eurozone, i.e. Germany (DE), Spain (SP), France (FR), Italy (IT), Netherlands (NE) and Austria (AT), and try to untangle the issue by employing the Vector Error Correction Model (VECM). In addition to this, this paper will attempt to examine why following the events of global recession in the year 2008, the wage setters in the respective countries of Eurozone have responded with wage moderation and not with demands for higher wages.

The rest of the paper is organized as follows: section 2, presents a brief literature review on the determinants of wage-price relationship, and on the role of labour market institutions in determining the respective relationship; section 3, briefly describes the mathematical and econometric modelling issues; section 4, describes the variables and examines the stationary properties of data; section 5, provides the analysis of the rate of growth of wage, price and productivity series; section 6, presents results of specification tests; section 7, presents results of VECM analysis and of relevant diagnostic tests; finally, section 8, concludes by summing up the main findings.

### 2. Literature review

Although there is an abundant stock of papers, providing diverse arguments on the issue of wage, price and productivity relationship, as well as the corresponding link to the labour market institutions, this section will only present a brief review of selected number of papers. In the first place, it is evident that different sample lengths, number of explanatory variables, measures of time series data, different models etc., produce different inferences on the respective issue (Hess and Schweitzer 2000). Moreover, the adjustment process may also depend on the reaction of monetary policy authorities, and their willingness to accommodate certain expansionary fiscal policies (Mehra 2000). Additionally, one may also list other relevant dimensions to the complex nature of the wage-price setting process, such as the market competition, export shares, collective wage agreements, employment protection legislation, as well as the reaction of temporary unemployment (Bertola *et al.* 2010). Furthermore, it is a well known fact in the literature that the levels of nominal and real rigidities are not universal across the countries, (HM Treasury 2003, OECD 2004).

In particular, over time the economy is subjected to structural changes (Marcellino and Mizon 2000), however, the failure to take into account those changes (i.e. structural changes or regime shifts), which are often observed in the economic and financial time series data, has led many authors to view it as the main cause of forecast failures (Pesaran *et al.* 2004). Moreover, in a study of a large set of macroeconomic time series, Stock and Watson (1996) have reported that majority of the series have displayed evidence of instability, thus in their view,

such structural breaks pose a difficult challenge to economic forecasting. Additionally, Clements and Hendry (1996) have argued that, although the modelling and forecasting of wages, prices and unemployment with Vector Autoregressive (VAR) models performs well in some cases, it is evident that Vector Error Correction Model (VECM) provides a better description of the data within sample, and additionally, the equilibrium terms are significant at conventional significance levels. Furthermore, considering that structural changes are pervasive in economic time series relationships, it can be quite perilous to ignore them. Certainly, under those circumstances, inferences about economic relationships can go astray, forecasts can be inaccurate, and policy recommendations can be misleading or worse (Hansen 2001).

In addition to this, in order to provide an effective answer to the puzzle of the wage-price setting dynamics in the respective countries in the post-2008 period, it is necessary to assess the validity of arguments supported by Akerlof *et al.* 2000, and of Kromphardt and Logeay (2007). Specifically, Akerlof *et al.* 2000 have argued that in setting wages and prices, the lay public does not use the same model of the economy as economists. Given the complexity of their decisions, and for the most part their lack of training as economists, indeed, it would be surprising if they did. It is thus highly unlikely that the welter of interdependent, intuitively based decisions of a real economy will produce a coefficient of inflationary expectations on wage and price inflation that is always exactly equal to one. In fact, they have offered a theory for such a departure as price and wage setters under-adjust for inflation, when it is not very salient, and when the cost of such behaviour is low. Correspondingly, in their view, this theory factually yields the lowest sustainable rate of unemployment and an accompanying rate of inflation. On the other hand, Kromphardt and Logeay (2007) have argued that wage and price setters should accept the rigor of monetary policy authorities, meaning that they should neither try, nor do they have the market power, due to ever increasing level of globalization and international competition, to pursue a policy which raises the inflation rate significantly above the target inflation rate of the Central Bank, or alternatively as Akerlof *et al.* 2000 have suggested, above the rate of inflation that minimizes the sustainable rate of unemployment. Next, the analysis will continue with very brief review of methodological issues.

### 3. Methodology

The mathematical relationship of wages, prices and productivity can be expressed in various functional forms. First, wages can be expressed as function of prices and marginal productivity of labour,

$$W = P \cdot MPL \quad \text{or} \quad W = f(P, MPL) \quad (3.1)$$

where,  $W$  - wages,  $P$  - prices, and  $MPL$  - productivity. Second, prices can be expressed as function of wages and productivity,

$$P = W / MPL \quad \text{or} \quad P = f(W, MPL) \quad (3.2)$$

Third, real wages (wages/prices) can be expressed as function of productivity,

$$W / P = MPL \quad \text{or} \quad W / P = f(MPL) \quad (3.3)$$

Additionally, one may transform these equations using natural logarithms, thus obtaining the following forms: first,  $\ln W = \ln P + \ln MPL$ , i.e. wage equation indicates that wages are positively related to prices as well as to marginal productivity of labour; second,  $\ln P = \ln W - \ln MPL$ , i.e. price equation indicates that prices are positively related to wages and negatively related to productivity; and third,  $\ln(W/P) = \ln MPL$ , i.e. real wages are positively related to productivity. Moreover, wages and prices will be treated as endogenous variables due to the fact that when they enter the model their values are determined from within the model or the system of equations (see for example Emery and Chang 1996, and Hess and Schweitzer 2000). In contrast, productivity will be set as exogenous variable. Other variables may also be considered and included in the model, though increasing the number of variables and equations does not necessarily lead to a better model, as by doing so it becomes harder to capture the dynamic and inter-temporal relations between relevant variables due to loss of power (Lütkepohl and Krätzig 2004).

*Applied econometric models* – Initial analysis will begin with inspection of stationary properties of the time series data. After that the analysis will proceed with examination of the rate of growth of respective time series data, in order to examine the dynamics of each series, as well to possibly derive some useful information on the pattern, dynamics and potential structural changes in the relationship. Finally, the analysis will conclude with VECM model as it certainly provides a more comprehensive framework for obtaining economically and statistically robust results. The respective model selection criteria for determining the number of lagged differences, as well as the tests for the rank of cointegration, will be carefully performed prior to estimating the VECM models. Additionally, section 7

will provide a detailed explanation of diagnostic tests, which will facilitate in assessing the economical and statistical robustness of the respective VECM models. Nevertheless, only the relevant results will be presented and discussed very concisely.

#### 4. The data

The focus now shifts on explanation of data that will represent the respective variables, as well as in conducting the analysis of their stationary properties. Specifically, this study will use quarterly data covering period 2000:Q1-2015:Q4. First, wage variables (WDE, WSP, WFR, WIT, WNE and WAT) represent labour cost index (LCI), i.e. nominal value, seasonally adjusted and adjusted data by working days for business economy. Second, price variables (PDE, PSP, PFR, PIT, PNE and PAT) represent the Harmonized Index of Consumer Prices (HICP). Third, productivity variables (QDE, QSP, QFR, QIT, QNE and QAT) represent the real labour productivity per person. The source of data for all three variables is EUROSTAT. Detailed description of all variables has been provided in Table 4 in appendix. Accordingly, in Figure 3 in appendix the plots of log-levels and first difference of log-levels have been presented. The visual (informal) analysis of the plots of log-levels clearly indicate that time series data may not be stationary, i.e. series may be integrated of order 1, or  $I(1)$ , and that deterministic trend may be present in the levels of respective data. In contrast, the first differences of log-levels indicate that time series data are integrated of order zero, or  $I(0)$ .

Besides, there are several formal unit root tests available such as Augmented Dickey-Fuller (ADF), Schmidt-Phillips, Phillips-Perron test for processes with level shift, or Kwiatkowski, Phillips, Schmidt and Shin (KPSS) tests. However, this study will only employ ADF and Schmidt-Phillips test procedures. Comprehensive theoretical account of all these tests is provided in Lütkepohl and Krätzig (2004), however, for the purpose of maintaining space restrictions the results of tests will be presented and analyzed in very concise way. Additionally, a decision on the autoregressive (AR) order has to be made, or equivalently, on the number of lagged differences (LD) of respective series used in the relevant tests. This choice may rely on the model selection criteria (AIC – Akaike Information Criterion; FPE - Final Prediction Error; HQC – Hannan-Quinn Criterion; and SC – Schwarz Criterion), or a sequential testing procedure may be used to eliminate insignificant coefficients sequentially starting from some high-order model (Lütkepohl and Krätzig 2006).

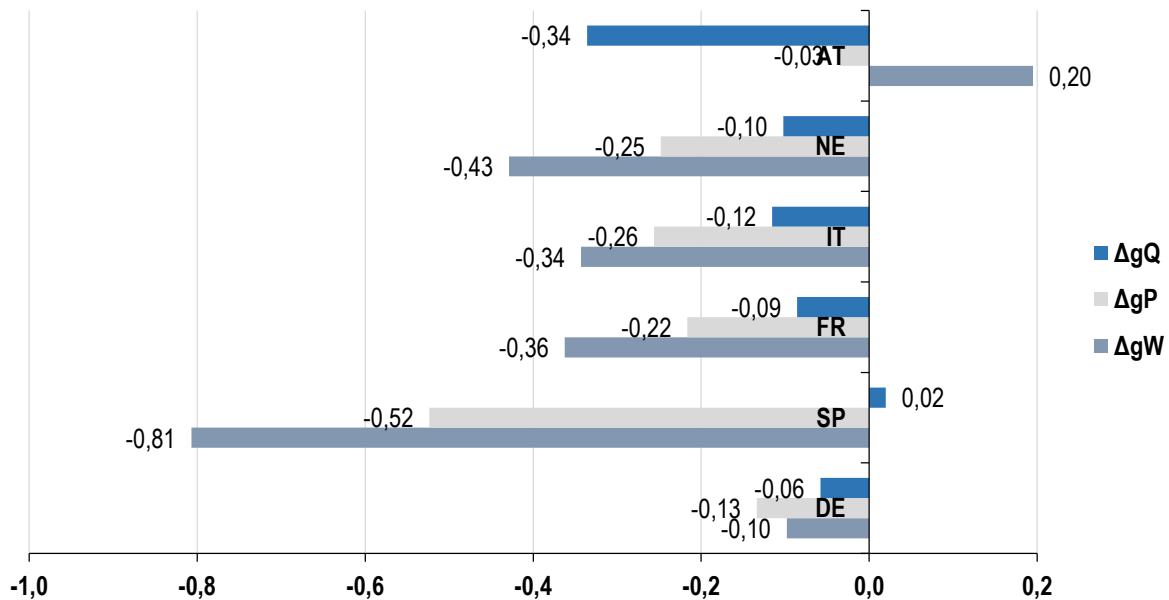
The numbers of LD have been determined by utilising both model selection criteria and sequential testing procedure. The ADF test procedure has been performed for log-levels and first differences of log-levels while using a) constant, (b) constant and seasonal dummies, c) constant and trend, and d) constant, trend and seasonal dummies. The relevant test results have been presented in Tables 5 to Table 10, respectively, in order for Germany, Spain, France, Italy, Netherlands and Austria. In the same way as plots, the comprehensive evidence derived from formal tests suggests that log-levels of all three times series data need to be differenced once in order to render them into stationary time series. Specifically, the test value of -0.30 for LWDE in column 3 of Table 5 indicates that  $H_0$  on the presence of unit root in the series cannot be rejected at any reasonable level of significance (l.s.), whereas the test value of -7.54 for DLWDE in column 6 of Table 5 indicates that  $H_0$  can be rejected at 1 % l.s. Remarkably, in some cases, the  $H_0$  can also be rejected at reasonable levels of significance for the levels of the series if trend and/or seasonal dummies are not fitted in the test procedures, though if trend and/or seasonal dummies are fitted, then one may not reject the  $H_0$  in the respective levels of series. All other ADF test results can be interpreted in similar way.

Correspondingly, the Schmidt-Phillips tests have been performed using the same number of LD as in the case of ADF test, and the results that have been presented in Table 11, produce, more or less, the same inferences as the ADF tests. Specifically, the test value of -2.37 for LWDE in column 3 of Table 11 indicates that  $H_0$  cannot be rejected at any reasonable l.s., whereas the test value of -7.78 for DLWDE in column 6 of Table 11 indicates that  $H_0$  can be rejected at 1 % l.s. In contrast to the ADF procedure though, on the basis of values of test statistics, it can be argued that both log-level and first differences of log-levels of productivity series, as well as the levels of prices LPIT for Italy, appear to be stationary. In summary, based on the comprehensive results provided by the formal unit root tests, it can be clearly argued, that unlike log-levels, only the first differences of time series data are stationary beyond reasonable doubt.

#### 5. Analysis of the rates of growth of wages, prices and productivity

The Figure 4 and 5 in appendix show the rates of growth, respectively the cross-plots of wages, prices and productivity series. The cross plots in panel (a) of Figure 5 indicate that wages and prices have a very strong positive relationship in all the countries. Moreover, on the basis of cross-plot evidence, there is a linear relationship between wages and productivity (panel b), as well as between prices and productivity (panel c). In contrast, the

cross-plot evidence for Italy suggests that there is negative relationship between wages and productivity, as well as between prices and productivity. Furthermore, it appears that in post 2008 period the relationships are less stable, and in addition to this, there is a greater variance in distribution of data. In fact, these changes have been possibly induced by the global economic recession that began in year 2008. Specifically, in statistical terms, the change can be perhaps explained by the fact that during 2000:Q1-2008:Q4 period the average quarterly rates of growth of wages, prices and productivity have been higher than the respective average rates of growth during 2009:Q1-2015:Q4 period. Regardless of the observed decreases in the respective rates of growth of these series, there is little evidence of any significant structural change in the pattern of the wage-price setting relationship.

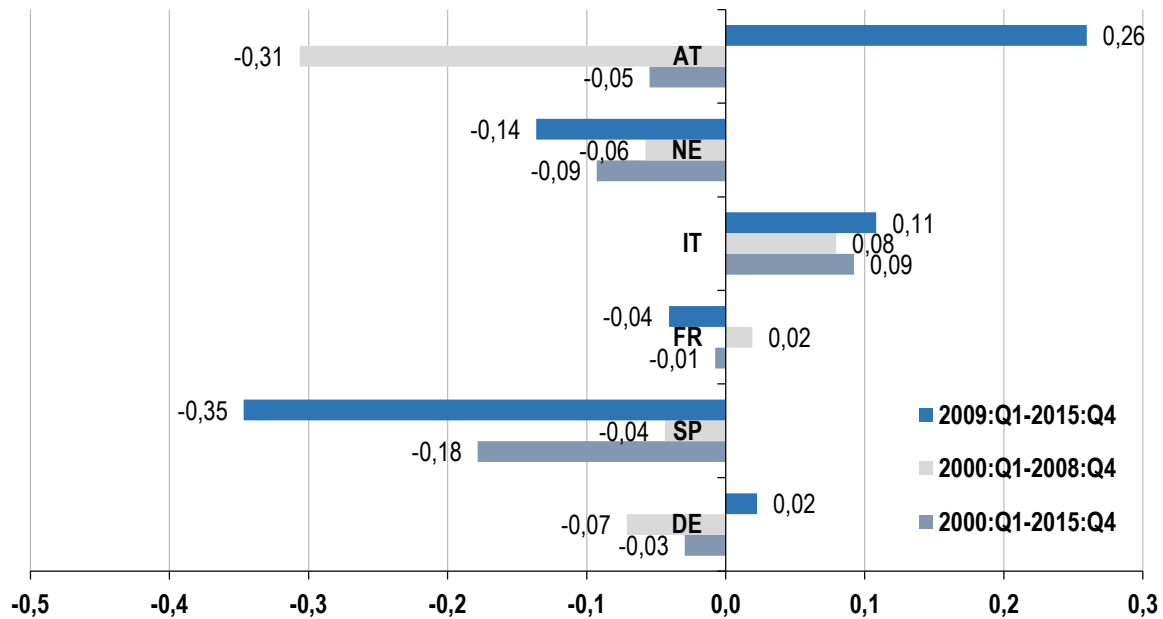


Note 1:  $\Delta gW = gW_{09-15} - gW_{00-08}$ ,  $\Delta gP = gP_{09-15} - gP_{00-08}$ ,  $\Delta gQ = gQ_{09-15} - gQ_{00-08}$ .

Figure 1 - The changes in the rate of growth of wages, prices and productivity series in percentage points (pp)

The evidence presented in Figure 1 shows the differences in the average quarterly rates of growth ( $\Delta g$ ) of all series between the two sub-periods (2000:Q1-2008:Q4 and 2009:Q1-2015:Q4). Obviously, the data indicate that the average rates of growth of wages, prices and productivity have decreased in all the countries in the post 2008 period, with exception of wages in Austria and productivity in Spain. Simultaneously, Spain has recorded the highest decline in wages and prices, whereas Germany the lowest. The highest decline of productivity has been recorded in Austria, whereas Spain in fact has recorded an increase in the rate of growth of productivity. For example, the average quarterly rate of growth of wages in Germany ( $gW_{DE}$ ) has decreased by 0.10 pp, the average quarterly rate of growth of prices ( $gP_{DE}$ ) by 0.13 pp, and the average quarterly rate of growth of productivity ( $gQ_{DE}$ ) by 0.06 pp. All other rates can be interpreted in similar way.

In contrast, Figure 2 shows the respective dynamics in the equilibrium of wage, price and productivity relationship (equation). The results clearly indicate that during the whole period 2000:Q1-2015:Q4 the average rates of growth of wages (in the left hand side of equation) in Germany, Spain, France, Netherlands and Austria, though not in Italy, have been lower than the sum of average rates of growth of prices and rates of growth of productivity (in the right hand side of equation). Nonetheless, during the second period the results clearly indicate that in Spain, France, and Netherlands the average rates of growth of wages have remained lower than the sum of the average rates of growth of prices and rates of growth of productivity. In contrast, in Germany, Italy and Austria the average rates of growth of wages have been higher than the sum of the average rates of growth of prices and productivity. A plausible cause for higher decreases in rates of growth of wages in the former countries may be the acceptance of rather more 'flexible' bargaining mechanisms, whereas the opposite is true for the latter countries. In principle, as Meager and Speckesser (2011) have argued, it is expected that wage moderations should improve and/or restore the international competitiveness, as well as result in more output and employment.



Note: For example, the equilibrium in the wage, price and productivity equation for Germany is calculated as follows: (gWDE = gPDE + gQDE). Specifically, if values in the graph are negative, then the right hand side of equation is greater than the left hand side, and vice versa.

Figure 2 - The growth rates and equilibrium in wage, price and productivity equation

## 6. The model specification

Prior to conducting any VECM regression analysis, it is necessary to perform certain specification tests in order to determine the respective model setup. Specifically, Johansen Trace Test, as well as Saikkonen and Lütkepohl test, have been carefully utilized in examining the cointegration properties of the wage and price variables of respective countries (Lütkepohl and Krätzig 2004). The tests have been performed using quarterly seasonal dummies as well. Furthermore, as suggested by information criteria, the tests have been performed taking into account the suggested number of LD for each country. Additionally, the case with a) intercept, b) intercept plus trend, and c) orthogonal trend (the trend that is confined to some individual variables, but is absent from the cointegration relations) have been performed for both types of cointegration tests. Simultaneously, the tests have been carried out with and without impulse dummies fitted in the test procedure. The complete results of cointegration tests have been presented in Table 12 and Table 13.

The comprehensive evidence from Johansen test strongly suggests that  $rk(\Pi) = 1$ . For example, the test value of 42.73 in column 3 of Table 12 for the test with two LD included in the test procedure for LWDE and LPDE, clearly suggests rejection of  $H_0$  that  $rk(\Pi) = 0$ , in favour of  $H_1$  that  $rk(\Pi) = 1$ , with LR statistic being significant at 1% l.s. Likewise, the comprehensive evidence from Saikkonen and Lütkepohl test strongly suggests that  $rk(\Pi) = 1$ . For example, the test value of 16.68 in column 3 of Table 13 for the test with two LD included in the test procedure for LWDE and LPDE, clearly suggests rejection of  $H_0$  that  $rk(\Pi) = 0$ , in favour of  $H_1$  that  $rk(\Pi) = 1$ , with LR statistic being significant at 1% l.s. All other results can be interpreted in similar way. In summary, the comprehensive results produced by both cointegration tests, suggest that there is sufficient evidence to proceed ensuing analysis with one cointegration relation in the VECM models, i.e.  $rk(\Pi) = 1$ .

Table 1 - Determination of the optimal number of lagged differences

Model / Criterion	AIC	FPE	HQC	SC
(1)	(2)	(3)	(4)	(5)
VECM <sub>0</sub> <sup>DE</sup>	0	0	0	0
VECM <sub>0</sub> <sup>SP</sup>	10	10	0	0
VECM <sub>0</sub> <sup>FR</sup>	1	1	1	0
VECM <sub>2</sub> <sup>IT</sup>	10	10	2	2
VECM <sub>0</sub> <sup>NE</sup>	0	0	0	0
VECM <sub>0</sub> <sup>AT</sup>	8	6	6	0

Note: For example, in VECM<sub>0</sub><sup>DE</sup> the subscript indicates the number of LD for endogenous variables, whereas superscript indicates the country, i.e. LD = 0, and DE – Germany.

*Number of lagged differences* – The test results on suggested number of LD has been presented in Table 1. Normally, whereas AIC overestimates the true number of LD, it is the SC that provides the most consistent estimates. Nonetheless, taking into account the comprehensive evidence provided by information criteria, cointegration tests, as well as by sequential tests of the VECM regression coefficients, zero LD have been used for Germany, Spain, France, Netherlands and Austria, and two LD for Italy. Moreover, zero lags of exogenous variables have been used in the respective models. Furthermore, the quarterly seasonal dummies ( $s_1$ ,  $s_2$ , and  $s_3$ ) and trend ( $\mu_1$ ) have been fitted in the models. Intercept term ( $\mu_0$ ) is not included in the models as in the first place it is explicitly absent in the mathematical model, hence no significant information is lost if it is excluded from the wage-price-productivity model. Additionally, the impulse dummy variables have been included in the VECM models, (see Note 1 of Table 14). The reason for inclusion of impulse dummies is that a shift in the mean of the original series is converted to an impulse in the differenced series.

## 7. Results

*Estimated coefficients of cointegration matrix ( $\Pi = \alpha \cdot \beta$ )* - It has to be emphasized that the first coefficient in the cointegrating relation,  $\beta_1$ , has been normalized to 1 by JMulTi software, i.e.  $\beta_1 = 1$ . With this normalization, it may be possible to verify whether the estimated cointegrating relation,  $\beta_2$ , is close to what one would expect on the basis of prior considerations, by using the asymptotic distribution of the second coefficient. In general, the *loading coefficients* are arbitrary to some extent, because they are determined by normalization of cointegrating vectors, though their *t* ratios can be interpreted in the usual way as being “conditional on the estimated cointegration coefficients”. Hence, the estimated loading coefficients can be used to evaluate whether the cointegration relations resulting from this normalization enter a specific equation significantly. The estimators of the parameters associated with LD of the variables (short-run parameters) may be interpreted in the usual way. Their *t* ratios are asymptotically normal under these assumptions. The same is not necessarily true for the parameters associated with deterministic terms, as their *t* ratios are provided just for completeness (Lütkepohl and Krätzig 2004, Lütkepohl and Krätzig 2005).

Although the full sample includes data from 2000:Q1 to 2015:Q4, i.e. sample size is  $T = 64$  observations, considering that one observation has been lost due to the first difference transformation, only the data covering period 2000:Q2-2015:Q4 have been included in the estimated VECM models, i.e.  $T = 63$ . In contrast, in the case of Italy two additional observations have been lost as two LD of endogenous variables have been fitted in the model, thus the sample covers the period 2000:Q4-2015:Q4, i.e.  $T = 61$ . The results of parsimonious models have been presented in Table 2 and Table 14. Specifically, all VECM regressions have been performed using the Two Stage procedure, i.e. Johansen procedure in the first stage, and Generalized Least Squares (GLS) procedure in the second stage. Additionally, the System Sequential Elimination of Regressors (SER) procedure using SC has been employed, in order to eliminate those regressors that lead to the largest reduction of respective information criteria. Consequently, all the coefficients with *t* ratios lower than two have been eliminated or restricted to zero in the second stage of estimation. (Lütkepohl and Krätzig 2004, Lütkepohl and Krätzig 2005)

Table 2 - VECM estimated coefficients

Model	VECM <sub>0</sub> <sup>DE</sup>	VECM <sub>0</sub> <sup>SP</sup>	VECM <sub>0</sub> <sup>FR</sup>	VECM <sub>2</sub> <sup>IT</sup>	VECM <sub>0</sub> <sup>NE</sup>	VECM <sub>0</sub> <sup>AT</sup>
(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\alpha_{11}$	***-0.14	***0.06	***-0.03	***-0.07	***-0.24	***-0.34
	[-3.07]	[12.92]	[-3.02]	[-3.65]	[-5.43]	[-4.75]
$\alpha_{21}$	***-0.06	***0.07	***0.16	***0.10	***-0.05	-
	[-3.16]	[10.35]	[4.86]	[4.054]	[-2.993]	
$\beta_{11}$	1.00	1.00	1.00	1.00	1.00	1.00
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
$\beta_{12}$	***-0.97	***-0.88	***-0.93	***-0.94	***-0.96	***-0.96
	[-446.26]	[-210.53]	[-411.62]	[-230.31]	[-376.42]	[-354.70]

Note: Level of significance: \*\*\* - 1%; \*\* - 5%; \* - 10%. [t ratios].

The evidence provided by the values of  $t$  statistics suggests that cointegration relations resulting from normalization of cointegration vectors enter in statistically significant way in all the equations of respective countries, except for Austria in the second equation. Furthermore, the very high values of  $t$  statistics of respective cointegration coefficients,  $\beta_2$ , indicate that estimated coefficients are highly statistically significant, and thus, provide robust evidence in favour of a strong long-run equilibrium relationship between wages and prices in the respective members of the Eurozone. For example, on the basis of estimated loading coefficients of VECM<sub>0</sub><sup>DE</sup> model in column 2, it can be argued that cointegration relation resulting from normalization of cointegration vector enters significantly in both equations. The loading coefficient  $\alpha_1 = -0.14$  for the wage equation has  $t$  statistic of -3.07, and the other loading coefficient  $\alpha_2 = -0.06$  for the price equation has a  $t$  statistic of -3.16, and both are significant at 1% l.s. By selecting LWDE<sub>t</sub> (or LWSP<sub>t</sub>, LWFR<sub>t</sub>, LWIT<sub>t</sub>, LWNE<sub>t</sub>, and LWAT<sub>t</sub>) as the first variable(s) in the model, it means that coefficient(s) of this (these) variable(s) in cointegration relation has (have) been normalized to 1 in the maximum likelihood estimation procedure. For instance, the respective models from Table 2 can be simply expressed as,

$$\text{VECM}_0^{\text{DE}}: \quad \text{LWDE}_t = 0.97 \text{LPDE}_t + \text{ec}_t \quad (7.1)$$

[-446.26]

where  $\text{ec}_t$  is error correction term and the numbers in brackets shows  $t$  ratio. For instance, taking into account that logs of variables have been used, the relation in formula (7.1) expresses the elasticity of wages on prices, hence the coefficient of 0.97 is the estimated wage elasticity. Accordingly, if log of prices increases by 1%, on average and ceteris paribus, it is expected that the log of wages would increase by 0.97 %. Importantly, this coefficient is statistically significant at 1 % l.s. The corresponding price elasticity is calculated as  $1 / \beta_2 = 1 / 0.97 = 1.03$  whereas the equation can be expressed as,

$$\text{VECM}_0^{\text{DE}}: \quad \text{LPDE}_t = 1.03 \text{LWDE}_t + \text{ec}_t \quad (7.2)$$

The coefficients associated with lagged variables can be interpreted in the usual way. In contrast, the coefficients associated with deterministic terms, such as those of impulse or seasonal dummies and trend, are presented just for completeness, (see Table 14). All other coefficients that do not appear in Table 14 have been restricted to zero as their  $t$  ratios had low values, thus during the SER procedure have been eliminated in the second stage of VECM estimation when the GLS procedure was employed. All other coefficients of respective models for other countries can be interpreted in similar way.

*Evaluation of theoretical assumptions* - Subsequently, the values of estimated cointegration coefficients,  $\beta_2$ , of each model are going to be compared with the values that one would expect on the basis of prior theoretical considerations. In a simple theoretical model, the rational expectations approach assumes that people use all relevant information in forming expectations of economic variables. For example, changes in the price level as a result of increase in money stock leave output and employment unchanged. Money and wages will rise, but since the real wage is unchanged, neither the quantity of labour supply nor that demand will change, (Muth 1961, Sargent and Wallace 1976). Nonetheless, Akerlof *et al.* 2000 have emphasized that there is a difference between how expectations are formed, and how are used. According to them, it is highly unlikely that the welter of interdependent, intuitively based decisions of a real economy will generate a coefficient of inflationary expectations on the wage and price inflation that is always exactly equal to one.



Table 3 - Testing the hypothesis on validity of rational vs. near-rational behaviour

Model	VECM <sub>0</sub> <sup>DE</sup>	VECM <sub>0</sub> <sup>SP</sup>	VECM <sub>0</sub> <sup>FR</sup>	VECM <sub>2</sub> <sup>IT</sup>	VECM <sub>0</sub> <sup>NE</sup>	VECM <sub>0</sub> <sup>AT</sup>
(1)	(2)	(3)	(4)	(5)	(6)	(7)
est. $\beta_2$	0.973	0.884	0.925	0.941	0.960	0.957
std. of $\beta_2$	0.002	0.004	0.002	0.004	0.003	0.003
<i>t</i> statistic	-13.50	-29.00	-37.50	-14.75	-13.33	-14.33

Note: Right-tail test:  $H_0: \beta_2 \leq 1$ , i.e. hypothesis of rational expectations is valid;  $H_1: \beta_2 > 1$ , i.e.  $H_0$  is not true if  $t > t_{\alpha,df}$ . Level of significance: \*\*\* - significant at 1 %; \*\* - 5 %; \* - 10 %. Equivalently, the values of price elasticity are: 1.03, 1.13, 1.08, 1.06, 1.04, and 1.04.

Thus, provided that the assumption of rational expectations holds true, it is expected that wage elasticity is going to have the value of less than or equal to or one. Equivalently, 1% increase in log-wages, on average and ceteris paribus, is expected to induce 1%, or more, increase in the log-prices. In contrary, if the value of wage (price) elasticity is higher (lower) than one, then the assumption of near-rational wage-price setting behaviour is valid, as 1% increase in log-wages, on average and ceteris paribus, is expected to induce less than 1 % increase in the log-prices. The hypothesis testing has been performed and presented in Table 3. Specifically, 1% increase in log-wages in Germany implies 1.03% increase in log-prices, respectively 1.13% increase in log-prices in Spain, 1.08% in France, 1.06% in Italy, and 1.04% in Netherlands and Austria. Hence, the evidence clearly supports the hypothesis of rational wage-price setting behaviour in these countries of Eurozone, as  $H_0$  on the rational wage-price setting behaviour cannot be rejected in any of the estimated models.

*Diagnostic tests* –The plots of residuals have been presented in Figure 6, whereas the formal diagnostic tests, (see Lütkepohl and Krätzig 2004 for details), have been presented in Table 15. In summary, the visual inspection of the plots of residuals raises no serious concerns regarding statistical adequacy of respective VECM models, with exception of some larger deviations in particular periods. Obviously, the formal diagnostic tests enable a better comparison of the models. Specifically, the VECM model statistics indicates whether any information is lost if restrictions are imposed by the SER procedure. Low values of LR test statistics and high  $p$  values, clearly suggest that no significant information is lost if restrictions are imposed on the respective VECM models. For example, the LR test value for VECM<sub>0</sub><sup>DE</sup> in column 2 is 4.00, whereas  $p$  value is 0.86. Additionally, the Breusch-Godfrey test with 5 lags suggests no problems concerning the presence of residual autocorrelation in any of the estimated models, given that LM test values are low and  $p$  values are above critical levels. For example, for VECM<sub>0</sub><sup>DE</sup> the LM statistic is 13.23, whereas  $p$  value is 0.87.

Likewise, the tests for non-normality (Doornik and Hansen, Lütkepohl, and Jarque-Bera), clearly indicate that there are no issues with respect to normal distribution of residuals, considering that test statistics of the respective tests have low values, as well as high  $p$  values. Additionally, the evidence suggests that there are no problems with respect to Autoregressive Conditional Heteroscedasticity (ARCH), considering that values of LM tests are low and  $p$  values are high, for example, in the case of VECM<sub>0</sub><sup>DE</sup> for  $u_1$  the LM statistic is 14.93 and  $p$  value is 0.53, whereas for  $u_2$  the LM is 13.52 and  $p$  value is 0.63. Finally, the Multivariate ARCH test indicates no potential issues with this criterion. For instance, for VECM<sub>0</sub><sup>DE</sup> the LM statistic is 40.39 and  $p$  value is 0.67. The diagnostic tests for all other models can be interpreted in similar way.

## Conclusion

The purpose of this paper has been to analyze the pattern and the dynamics of relationship between wages and prices in some of the countries of Eurozone during the period of time 2000:Q1-2015:Q4. The data clearly suggest that the average quarterly rates of growth of wages, prices, and productivity have decreased in the post 2008 period, with exception of wages in Austria and productivity in Spain. Undoubtedly, the empirical evidence from VECM models strongly suggests that there is strong long run equilibrium relationship between wages and prices in all the countries that have been considered. Moreover, the estimated price (wage) elasticity coefficients provide a valid case for rational wage-price setting behaviour. Additional issue that this paper has attempted to investigate and explain is, why in the post 2008 period the decrease in the rate of growth of wages has been higher than the decrease in the rate of growth of prices and productivity.

Certainly, it is reasonable to argue that wage-setters in Germany, Spain, France, Netherlands and Italy, though not in Austria, have for several reasons not reacted with demand for higher real wages in the post 2008

period. The first reasoning can rely on Akerlof *et al.* 2000 proposition that the rate of growth of price inflation has still been modest, hence the wage setters have under-adjusted for that modest increase in the rate of growth of prices as it has not been very salient, and additionally, the cost of engaging in such a behaviour has been low. Second reasoning can rely on Kromphardt and Logeay (2007) explanation that wage and price setters have unconditionally accepted the rigor of monetary policy authorities in the post-2008 period, and have not tried to pursue a policy which raises inflation rate significantly above the target inflation rate of the monetary policy authorities. Third reasoning can rely on Meager and Speckesser (2011) argument that by holding wage growth below productivity increases (or even reducing wages while productivity growth continues) can enhance the level of competitiveness and improve the economic/employment situation. Specifically, the increased level of wage moderation has certainly had a positive impact on the stability of the wage-price setting dynamics. Furthermore, the flexibility of the wage-price setting process may also be attributed to more flexible and efficient labour market, which is considered as a precondition for higher employment, as well as fairer, more competitive and more productive economy. Additionally, that labour market flexibility may also entail an economy that is better able to adapt to the changing economic environment, and thus it may be considered as a central element in producing better overall economic performance.

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## APPENDIX

Table 4 - Description of variables

VARIABLE/S	DESCRIPTION
(1)	(2)
WDE <sub>t</sub> , WSP <sub>t</sub> , WFR <sub>t</sub> , WIT <sub>t</sub> , WNE <sub>t</sub> , WAT <sub>t</sub>	Wages
LWDE <sub>t</sub> , LWSP <sub>t</sub> , LWFR <sub>t</sub> , LWIT <sub>t</sub> , LWNE <sub>t</sub> , LWAT <sub>t</sub>	Log-wages
DLWDE <sub>t</sub> , DLWSP <sub>t</sub> , DLWFR <sub>t</sub> , DLWIT <sub>t</sub> , DLWNE <sub>t</sub> , DLWAT <sub>t</sub>	First differences of log-wages
PDE <sub>t</sub> , PSP <sub>t</sub> , PFR <sub>t</sub> , PIT <sub>t</sub> , PNE <sub>t</sub> , PAT <sub>t</sub>	Prices
LPDE <sub>t</sub> , LPSP <sub>t</sub> , LPFR <sub>t</sub> , LPIT <sub>t</sub> , LPNE <sub>t</sub> , LPAT <sub>t</sub>	Log-prices
DLPDE <sub>t</sub> , DLPSP <sub>t</sub> , DLPFR <sub>t</sub> , DLPIT <sub>t</sub> , DLPNE <sub>t</sub> , DLPAT <sub>t</sub>	First differences of log-prices
QDE <sub>t</sub> , QSP <sub>t</sub> , QFR <sub>t</sub> , QIT <sub>t</sub> , QNE <sub>t</sub> , QAT <sub>t</sub>	Productivity
LQDE <sub>t</sub> , LQSP <sub>t</sub> , LQFR <sub>t</sub> , LQIT <sub>t</sub> , LQNE <sub>t</sub> , LQAT <sub>t</sub>	Log-productivity
DLQDE <sub>t</sub> , DLQSP <sub>t</sub> , DLQFR <sub>t</sub> , DLQIT <sub>t</sub> , DLQNE <sub>t</sub> , DLQAT <sub>t</sub>	First differences of log-productivity
c or $\mu_0$	Constant or intercept
t or $\mu_1$	Trend term
S <sub>1</sub> , S <sub>2</sub> , S <sub>3</sub>	Seasonal dummy variables
u <sub>1t</sub> and u <sub>2t</sub>	Residuals
ec <sub>t</sub>	Error correction term
gWDE <sub>t</sub> , gWSP <sub>t</sub> , gWFR <sub>t</sub> , gWIT <sub>t</sub> , gWNE <sub>t</sub> , gWAT <sub>t</sub>	Rate of growth of wages
gPDE <sub>t</sub> , gPSP <sub>t</sub> , gPFR <sub>t</sub> , gPIT <sub>t</sub> , gPNE <sub>t</sub> , gPAT <sub>t</sub>	Rate of growth of prices
gQDE <sub>t</sub> , gQSP <sub>t</sub> , gQFR <sub>t</sub> , gQIT <sub>t</sub> , gQNE <sub>t</sub> , gQAT <sub>t</sub>	Rate of growth of productivity
im00q1	im = impulse dummy, 00 – year 2000, q1 - first quarter

Note: DE, SP, FR, IT, NE, and AT denote Germany, Spain, France, Italy, Netherlands and Austria.

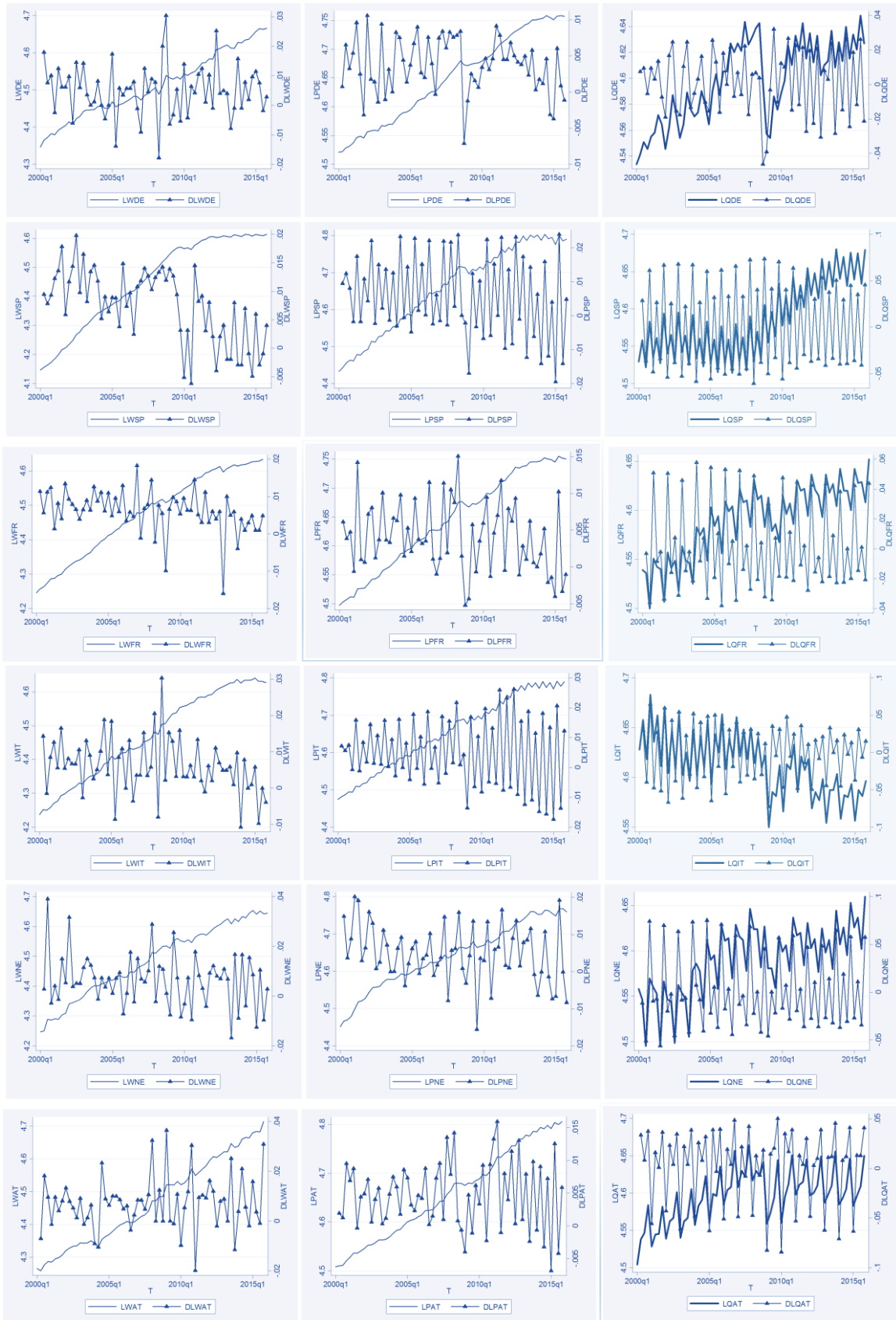


Figure 3 - Plots of log-levels and first differences of log-levels

Table 5 - ADF test for Germany

VARIABLE	LD	LWDE	LPDE	LQDE	DLWDE	DLPDE	DLQDE
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\mu_0$	1	-0.30	-1.41	-2.15	***-7.54	***-5.23	***-6.14
	0	-0.68	-1.27	** -2.87	***-10.00	***-7.01	***-11.48
$\mu_0+s_i$	1	-0.27	-1.43	-1.80	***-7.24	***-4.40	***-4.50
	0	-0.71	-1.24	-2.06	***-9.86	***-6.37	***-8.88
$\mu_0+\mu_1$	1	-2.52	-1.08	-2.91	***-7.48	***-5.37	***-6.10
	0	*-3.32	-0.86	***-4.06	***-9.92	***-7.16	***-11.41
$\mu_0+\mu_1+s_i$	1	-2.39	-1.10	-2.40	***-7.18	***-4.54	***-4.50
	0	*-3.25	-0.64	-2.77	***-9.77	***-6.54	***-8.83

Note 1: Critical values for test with  $\mu_0$ , and  $\mu_0+s_i$ : \*\*\* - 1% = -3.43; \*\* - 5% = -2.86; \* - 10% = -2.57; and for test with  $\mu_0+\mu_1$  and  $\mu_0+\mu_1+s_i$ : \*\*\* - 1% = -3.96; \*\* - 5% = -3.41; \* - 10% = -3.13. Critical values for the subsequent tables are identical.

Table 6 - ADF test for Spain

VARIABLE	LD	LWSP	LPSP	LQSP	DLWSP	DLPSP	DLQSP
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\mu_0$	1	***-3.80	***-3.76	-0.23	-2.52	***-3.79	***-7.29
	0	***-5.62	-1.99	***-4.08	***-4.51	***-16.32	***-40.86
$\mu_0+s_i$	1	***-3.71	***-3.51	0.34	-2.46	** -3.09	***-5.30
	0	***-5.49	** -3.17	-0.14	***-4.39	***-6.25	***-10.24
$\mu_0+\mu_1$	1	0.77	1.01	-1.93	***-4.34	***-4.62	***-7.26
	0	1.26	-1.38	***-9.07	***-6.68	***-18.76	***-40.70
$\mu_0+\mu_1+s_i$	1	0.75	0.59	-1.36	***-4.22	** -3.85	***-5.36
	0	1.23	0.94	-1.67	***-6.51	***-7.83	***-10.29

Table 7 - ADF test for France

VARIABLE	LD	LWFR	LPFR	LQFR	DLWFR	DLPFR	DLQFR
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\mu_0$	1	***-3.48	-2.02	-1.72	***-4.95	***-5.37	***-8.26
	0	** -3.10	-2.02	** -3.40	***-8.68	***-7.91	***-16.86
$\mu_0+s_i$	1	** -3.40	-2.25	-1.31	***-4.77	***-3.98	***-5.99
	0	** -3.07	-2.41	-1.04	***-8.47	***-5.55	***-7.24
$\mu_0+\mu_1$	1	0.30	-0.27	** -3.93	***-6.41	***-5.90	***-8.24
	0	-0.36	-0.52	***-7.83	***-10.15	***-8.35	***-16.71
$\mu_0+\mu_1+s_i$	1	0.33	-0.33	-2.06	***-6.19	***-4.47	***-6.06
	0	-0.35	0.46	-1.88	***-9.91	***-6.13	***-7.21

Table 8 - ADF test for Italy

VARIABLE	LD	LWIT	LPIT	LQIT	DLWIT	DLPIT	DLQIT
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\mu_0$	1	** -3.03	** -2.93	-1.85	***-4.47	***-3.95	***-6.54
	0	-2.34	-1.26	***-6.00	***-11.03	***-24.43	***-27.01
$\mu_0+s_i$	1	** -2.94	** -3.25	-1.46	***-4.35	-2.22	***-5.80
	0	-2.29	-1.76	-2.10	***-10.75	***-11.11	***-11.23
$\mu_0+\mu_1$	1	2.03	0.79	*-3.31	***-5.55	***-4.44	***-6.49
	0	0.10	** -3.59	***-10.92	***-12.37	***-26.23	***-26.79
$\mu_0+\mu_1+s_i$	1	1.98	1.06	-2.89	***-5.40	-2.77	***-5.74
	0	0.09	-0.41	***-4.13	***-12.04	***-12.56	***-11.13

Table 9 - ADF test for Netherlands

VARIABLE	LD	LWNE	LPNE	LQNE	DLWNE	DLPNE	DLQNE
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\mu_0$	1	*-2.84	-2.53	-2.31	***-6.59	***-6.69	***-8.56
	0	-2.09	*-2.75	***-4.58	***-10.41	***-7.78	***-15.83
$\mu_0+S_i$	1	*-2.78	** -3.26	-1.42	***-6.32	***-3.72	***-8.47
	0	-2.03	***-3.70	-1.09	***-10.17	***-5.80	***-7.28
$\mu_0+\mu_1$	1	-2.01	-2.88	***-4.35	***-7.07	***-7.57	***-8.50
	0	-2.37	-3.11	***-7.93	***-11.18	***-8.26	***-15.69
$\mu_0+\mu_1+S_i$	1	-1.89	*-3.31	-2.52	***-6.79	***-4.40	***-8.40
	0	-2.26	-2.88	-2.36	***-10.93	***-6.68	***-7.20

Table 10 - ADF test for Austria

VARIABLE	LD	LWAT	LPAT	LQAT	DLWAT	DLPAT	DLQAT
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\mu_0$	1	0.53	-0.43	***-3.50	***-7.55	***-4.47	***-8.15
	0	0.56	-0.32	***-5.38	***-10.29	***-10.60	***-13.66
$\mu_0+S_i$	1	0.53	-0.61	-2.07	***-7.35	***-3.91	***-6.75
	0	0.52	-0.26	-2.48	***-10.00	***-7.49	***-7.57
$\mu_0+\mu_1$	1	-2.12	-1.96	***-4.52	***-7.62	***-4.45	***-8.08
	0	-2.98	-2.78	***-6.91	***-10.28	***-10.53	***-13.55
$\mu_0+\mu_1+S_i$	1	-2.07	-1.98	-2.13	***-7.42	** -3.89	***-6.85
	0	-2.87	-2.06	-2.37	***-9.99	***-7.44	***-7.58

Table 11 - Schmidt-Phillips test

VARIABLE	LD	LW	LP	LQ	DLW	DLP	DLQ
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DE	1	-2.37	-1.73	***-3.78	***-7.78	***-7.30	***-9.74
	0	-2.56	-1.63	***-4.05	***-7.80	***-7.27	***-9.55
SP	1	-0.72	-1.37	***-9.89	***-5.47	***-21.09	***-41.08
	0	-0.59	-2.01	***-9.38	***-5.73	***-18.75	***-38.04
FR	1	-0.96	-1.57	***-7.89	***-10.41	***-8.28	***-12.18
	0	-1.00	-1.57	***-7.90	***-10.48	***-8.32	***-11.37
IT	1	-1.04	-2.71	***-8.86	***-10.28	***-24.84	***-28.11
	0	-1.23	***-3.79	***-8.65	***-10.11	***-20.59	***-25.67
NE	1	-2.61	-1.75	***-8.13	***-11.49	***-6.17	***-11.26
	0	*-2.78	-1.72	***-8.09	***-11.53	***-6.23	***-10.66
AT	1	-2.70	-2.15	***-4.26	***-5.38	***-10.45	***-13.11
	0	*-2.90	-2.42	***-4.68	***-5.79	***-10.02	***-13.93

Note: Critical values: \*\*\* - 1% = -3.56; \*\* - 5% = -3.02; \* - 10% = -2.75.

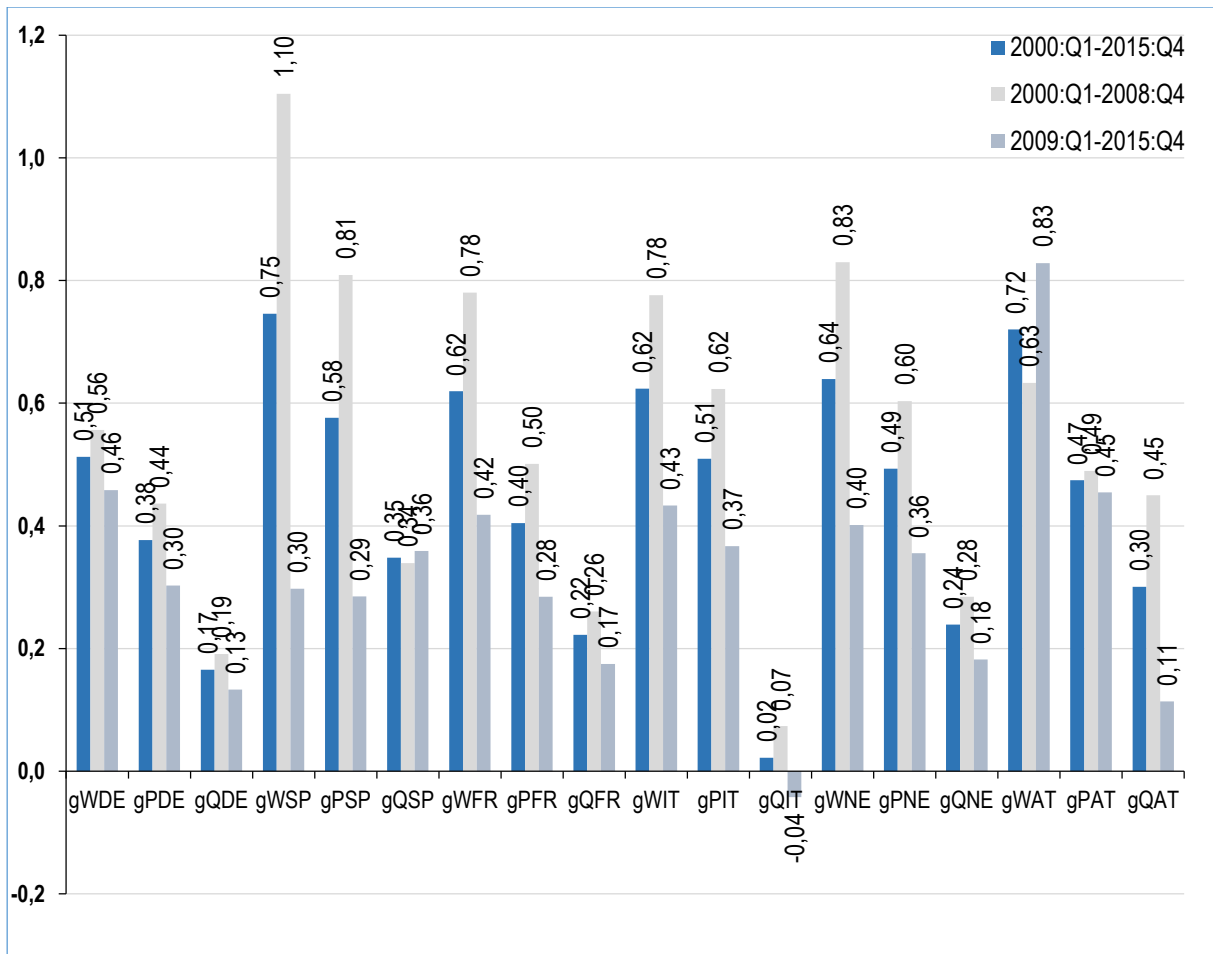
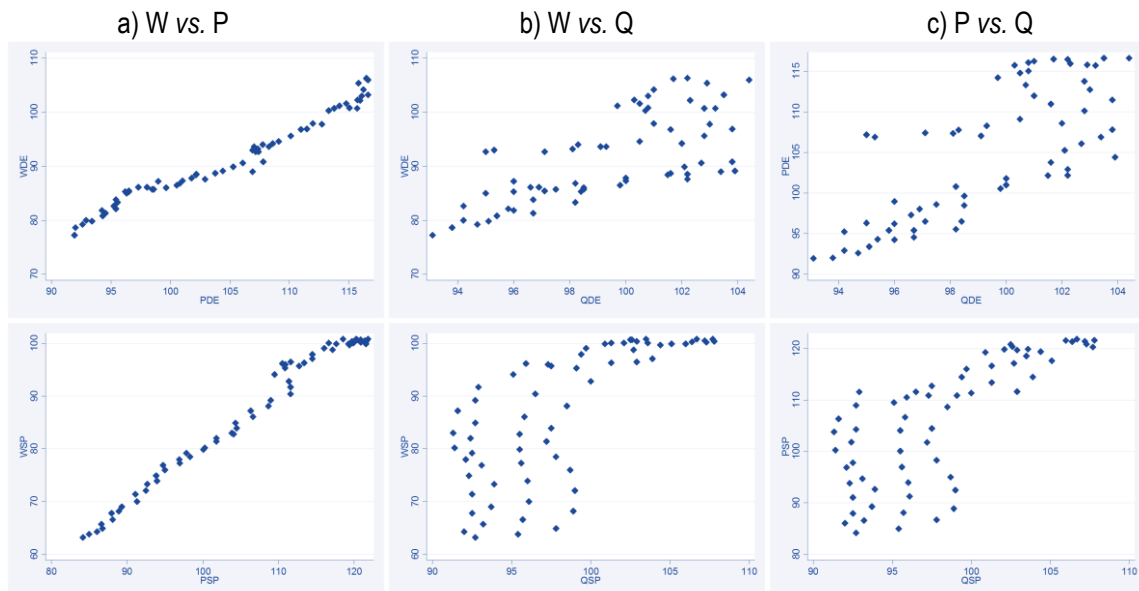


Figure 4 - The quarterly rates of growth of wages, prices and productivity series





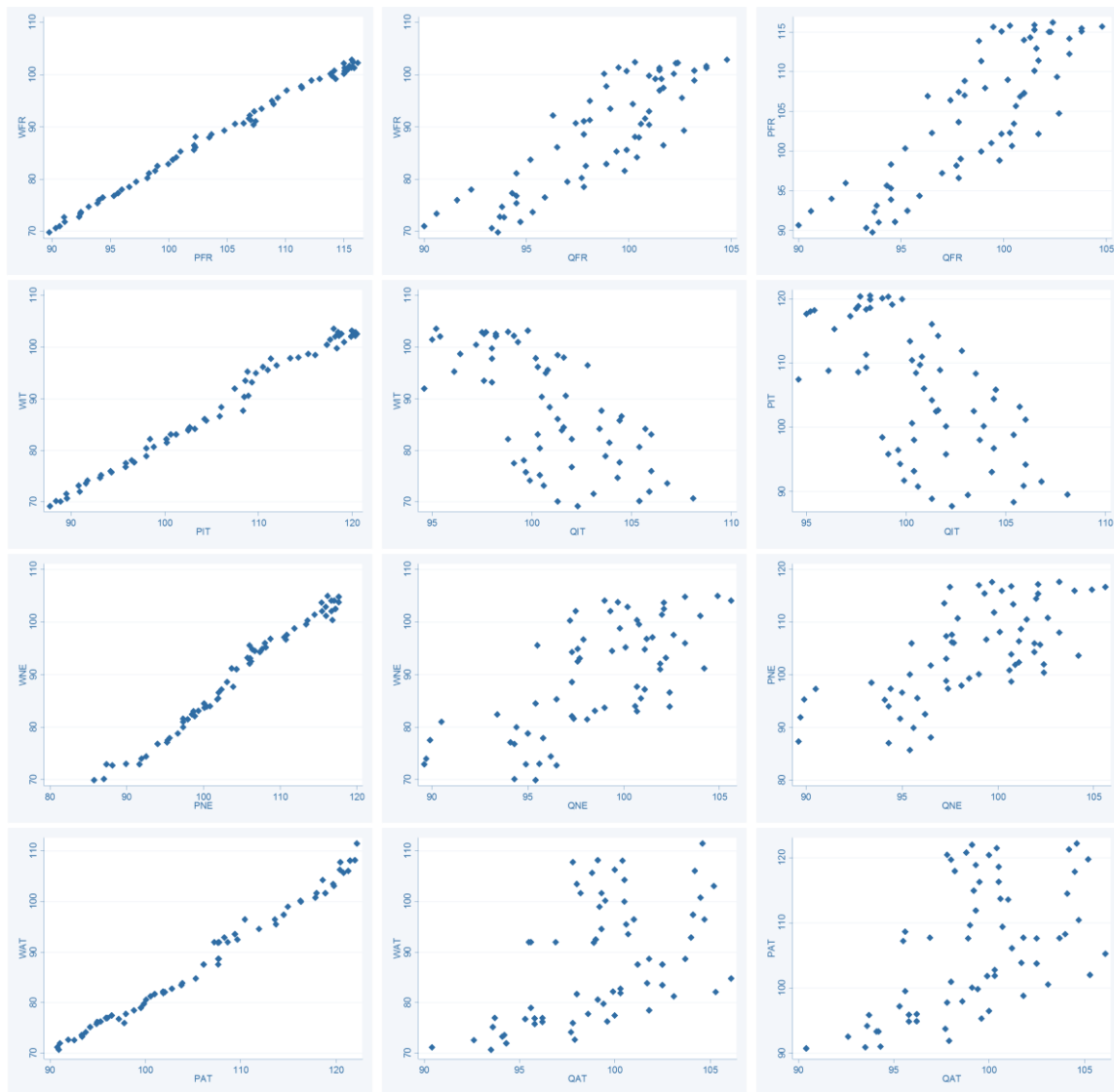


Figure 5 - Cross-plots of wage, price and productivity series

Table 12 - Johansen Trace Tests for the rank of cointegration

TEST	LD	Intercept ( $\mu_0 \neq 0, \mu_1 = 0$ )		Intercept + trend ( $\mu_0 \neq 0, \mu_1 \neq 0$ )		Orthogonal Trend
		rk ( $\Pi$ ) = 0	rk ( $\Pi$ ) = 1	rk ( $\Pi$ ) = 0	rk ( $\Pi$ ) = 1	rk ( $\Pi$ ) = 0
(1)	(2)	(3)	(4)	(5)	(6)	(7)
LWDE & LPDE	2	***42.73	3.13	14.19	3.19	9.17
	2 <sup>im</sup>	***41.76	0.78	13.51	0.85	8.89
	1	***76.48	3.97	21.25	2.32	*13.80
	1 <sup>im</sup>	***77.67	2.77	22.18	0.48	**15.44
LWSP & LPSP	3	**23.31	**9.80	**27.79	*10.99	***20.47
	3 <sup>im</sup>	***25.03	*8.94	**29.08	8.95	***20.60
	1	***99.31	4.24	***48.34	4.67	***35.68
	1 <sup>im</sup>	***109.39	4.01	***54.02	3.99	***39.57
LWFR & LPFR	2	***45.33	7.46	**27.14	5.49	***26.09
	2 <sup>im</sup>	***84.88	**11.31	***31.84	8.07	***28.36
	1	***108.65	***12.66	***35.12	8.06	***35.09
	1 <sup>im</sup>	***156.85	***20.19	***40.57	*11.55	***36.64
LWIT	8	***30.09	2.66	**29.29	2.47	***25.39

& LPIT	8 <sup>im</sup>	***33.85	7.03	**28.94	1.41	***26.21
	3	***25.66	*8.17	**30.51	**13.89	***20.33
	3 <sup>im</sup>	***27.18	6.02	***32.94	*11.07	***23.17
LWNE & LPNE	2	***47.00	*7.74	**29.25	7.23	***23.58
	2 <sup>im</sup>	***45.23	**9.27	***32.25	9.20	***25.38
	1	***68.87	*7.83	**27.55	7.79	***21.81
	1 <sup>im</sup>	***70.35	**10.20	***32.51	10.28	***25.11
LWAT & LPAT	3	***27.76	6.39	*23.77	5.77	12.24
	3 <sup>im</sup>	***32.37	7.38	***36.80	5.14	**18.63
	1	***84.52	**10.06	16.67	4.49	11.81
	1 <sup>im</sup>	***91.76	***16.60	*24.75	3.86	***20.43

Note: Level of significance: \*\*\* - 1 %, \*\* - 5 %, \* - 10 %; (p values). rk( $\Pi$ ) – rank of cointegration matrix  $\Pi = \alpha\beta$ . Superscript *im* in column 2 shows that impulse dummies have been included in the respective cointegration tests.

Table 13 - Saikkonen and Lütkepohl Tests for the rank of cointegration

TEST	LD	Intercept ( $\mu_0 \neq 0, \mu_1 = 0$ )		Intercept + trend ( $\mu_0 \neq 0, \mu_1 \neq 0$ )		Orthogonal Trend
		rk ( $\Pi$ ) = 0	rk ( $\Pi$ ) = 1	rk ( $\Pi$ ) = 0	rk ( $\Pi$ ) = 1	rk ( $\Pi$ ) = 0
(1)	(2)	(3)	(4)	(5)	(6)	(7)
LWDE & LPDE	2	***16.68	0.02	4.60	2.95	3.88
	2 <sup>im</sup>	***43.84	0.95	14.00	1.10	9.84
	1	***37.61	0.27	7.64	2.63	5.66
	1 <sup>im</sup>	***40.71	0.12	4.94	2.20	3.65
LWSP & LPSP	3	9.07	0.01	7.53	2.19	**9.91
	3 <sup>im</sup>	7.42	0.02	6.57	2.18	*8.32
	1	***37.49	0.05	8.30	1.56	***16.09
	1 <sup>im</sup>	***38.86	0.06	8.78	1.35	***17.73
LWFR & LPFR	2	***23.71	0.06	***22.46	0.76	***21.49
	2 <sup>im</sup>	***24.79	0.01	***24.46	1.80	***23.80
	1	***81.46	0.10	***24.99	0.39	***26.69
	1 <sup>im</sup>	***91.24	0.01	***27.51	1.03	***30.71
LWIT & LPIT	8	***18.08	2.51	***30.55	0.23	***26.90
	8 <sup>im</sup>	*11.78	1.33	***25.18	4.40	***20.73
	3	*11.51	0.03	11.86	0.89	**12.92
	3 <sup>im</sup>	*11.62	0.05	11.55	***14.43	**12.74
LWNE & LPNE	2	***16.49	1.85	8.06	0.08	*9.41
	2 <sup>im</sup>	***16.27	0.05	8.53	0.68	*9.67
	1	***33.41	***7.79	9.08	1.15	**9.88
	1 <sup>im</sup>	***36.07	1.89	8.62	0.27	*9.73
LWAT & LPAT	3	***18.23	0.03	11.08	2.69	6.55
	3 <sup>im</sup>	***23.57	0.00	**16.43	2.14	*8.61
	1	***58.77	0.02	6.75	2.47	*9.01
	1 <sup>im</sup>	***59.71	0.30	11.10	2.38	**10.29

Note 1: Level of significance: \*\*\* - 1 %, \*\* - 5 %, \* - 10 %; (p values). rk( $\Pi$ ) – rank of cointegration matrix  $\Pi = \alpha\beta$ . Superscript *im* in column 2 shows that impulse dummies have been included in the respective cointegration tests.

Table 14 - Coefficients of lagged variables and deterministic terms

PANEL A	VECM <sub>0</sub> <sup>DE</sup>		VECM <sub>0</sub> <sup>SP</sup>		VECM <sub>0</sub> <sup>FR</sup>	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	DLW <sub>t</sub>	DLP <sub>t</sub>	DLW <sub>t</sub>	DLP <sub>t</sub>	DLW <sub>t</sub>	DLP <sub>t</sub>
DLW <sub>t-1</sub>	n/a	n/a	n/a	n/a	n/a	n/a
DLP <sub>t-1</sub>	n/a	n/a	n/a	n/a	n/a	n/a
LQ <sub>t</sub>	**0.00	-	-	-	***0.00	***-0.00
im1	***-0.03	-	-	***-0.02	***-0.02	***-0.01
im2	***0.02	***-0.01	-	***-0.01	***-0.03	-
im3	***0.02	-	***-0.01	-	***-0.01	-
im4	n/a	n/a	***-0.01	-	n/a	n/a
S <sub>1</sub>	-	***0.00	-	***-0.02	***0.01	-
S <sub>2</sub>	-	***0.00	-	***0.01	-	***0.01
S <sub>3</sub>	-	***0.00	-	***-0.02	-	-
trend ( $\mu_1$ )	-	-	***0.00	***0.00	-	***0.00
PANEL B	VECM <sub>2</sub> <sup>IT</sup>		VECM <sub>0</sub> <sup>NE</sup>		VECM <sub>0</sub> <sup>AT</sup>	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	DLW <sub>t</sub>	DLP <sub>t</sub>	DLW <sub>t</sub>	DLP <sub>t</sub>	DLW <sub>t</sub>	DLP <sub>t</sub>
DLW <sub>t-1</sub>	***-0.37	***-0.15	n/a	n/a	n/a	n/a
DLP <sub>t-1</sub>	-	-	n/a	n/a	n/a	n/a
DLW <sub>t-2</sub>	-	-	n/a	n/a	n/a	n/a
DLP <sub>t-2</sub>	-	***0.64	n/a	n/a	n/a	n/a
LQ <sub>t</sub>	0.00	-	-	**0.00	***-0.00	***0.00
im1	**0.01	***0.01	***0.03	-	***0.03	**0.01
im2	***0.02	-	***0.02	-	***0.03	-
im3	-	-0.01	***0.02	-	***0.03	-
im4	**0.01	-	n/a	n/a	n/a	n/a
S <sub>1</sub>	-	***-0.00	-	***0.01	-	**0.00
S <sub>2</sub>	-	***0.01	-	***0.01	-	-
S <sub>3</sub>	-	-	-	***-0.00	-	***-0.01
trend ( $\mu_1$ )	-	***0.00	***0.00	-	***0.00	-

Note: Level of significance: \*\*\*- 1%; \*\*- 5%; \*- 10%. n/a - not applicable. The following impulse dummies have been included for Germany: im1 = im08q2, im2 = im08q4, and im3 = im12q2; Spain: im1 = im08q4, im2 = im09q1, im3 = im10q1, and im4 = im10q3; France: im1 = im09q1, im2 = im13q1, and im3 = im14q1; Italy: im1 = im08q1, im2 = im08q3, im3 = im09q1, and im4 = im09q2; Netherlands: im1 = im00q3, im2 = im07q4, and im3 = im09q2; and, Austria: im1 = im09q1, im2 = im10q4, and im3 = im15q4.



Figure 6 - Plots of residuals of the estimated VECM models

Table 15 - VECM models diagnostic tests

MODEL	VECM <sub>0</sub> <sup>DE</sup>	VECM <sub>0</sub> <sup>SP</sup>	VECM <sub>0</sub> <sup>FR</sup>	VECM <sub>2</sub> <sup>IT</sup>	VECM <sub>0</sub> <sup>NE</sup>	VECM <sub>0</sub> <sup>AT</sup>
(1)	(2)	(3)	(4)	(5)	(6)	(7)
VECM Model statistics	4.00 (0.86)	7.11 (0.63)	9.32 (0.23)	15.21 (0.36)	4.02 (0.86)	1.93 (0.98)
LM- Test for auto-correlation with 5 lags	13.23 (0.87)	25.16 (0.20)	21.04 (0.39)	21.47 (0.37)	21.16 (0.39)	26.76 (0.14)
TESTS FOR NONNORMALITY						
Doornik & Hansen	3.31 (0.51)	3.15 (0.53)	0.76 (0.94)	0.32 (0.99)	2.57 (0.63)	4.08 (0.40)
Skewness	3.00 (0.22)	0.21 (0.90)	0.69 (0.71)	0.10 (0.95)	2.31 (0.32)	1.49 (0.48)
Kurtosis	0.30 (0.86)	2.94 (0.23)	0.08 (0.96)	0.23 (0.89)	0.26 (0.88)	2.59 (0.27)
Lütkepohl	3.52 (0.47)	3.88 (0.42)	1.24 (0.87)	0.33 (0.99)	2.90 (0.57)	4.07 (0.40)
Skewness	3.23 (0.20)	0.32 (0.85)	1.05 (0.59)	0.07 (0.97)	2.38 (0.30)	1.49 (0.47)
Kurtosis	0.29 (0.87)	3.56 (0.17)	0.19 (0.91)	0.26 (0.88)	0.53 (0.77)	2.58 (0.28)
Jarque-Berra						
u <sub>1</sub>	1.42 (0.49)	2.53 (0.28)	1.20 (0.55)	0.22 (0.90)	0.73 (0.70)	0.21 (0.90)
u <sub>2</sub>	1.67 (0.43)	0.49 (0.78)	0.03 (0.99)	0.18 (0.91)	0.95 (0.62)	3.88 (0.14)
ARCH-LM TEST with 16 lags						
u <sub>1</sub>	14.93 (0.53)	15.44 (0.49)	10.16 (0.86)	13.11 (0.66)	15.64 (0.48)	20.26 (0.21)
u <sub>2</sub>	13.52 (0.63)	12.77 (0.69)	10.67 (0.83)	12.44 (0.71)	11.83 (0.76)	13.64 (0.63)
MULTIVARIATE ARCH-LM TEST with 5 lags						
VARLM test statistic	40.39 (0.67)	44.49 (0.49)	45.22 (0.46)	36.84 (0.80)	52.37 (0.21)	48.89 (0.32)

Note: Level of significance: \*\*\* - significant at 1 %; \*\* - 5 %; \* - 10 %. (p values).

## Financial Mechanisms of Nanotechnology Development in Developing Countries

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### Abstract:

*Starting point of the research is the idea that nanotechnologies can become a new vector of development of economy of developing countries which will allow them to leave the path of overcoming development and conquer leading positions in the sphere of nanotechnologies. The article is devoted to determination and comparative analysis of various financial mechanisms of nanotechnology development in developing countries with the help of instrumentarium of the game theory as to criterion of effectiveness by the example of Russia's economy. The authors determine, analyze, and schematically present tax, investment, loan, amortization, and cluster mechanisms.*

**Keywords:** nanotechnology development, developing countries, financial mechanisms, global economy.

**JEL Classification:** G31, F63.

### 1. Introduction

In the 21<sup>st</sup> century, the moving force of the global economy is new technologies. Therefore, provision of competitiveness of the country in the system of the global economy needs something more than large stocks of natural resources or cheap work force – it is necessary to develop technologies.

One of the most perspective directions of development of new technologies is nanotechnologies. Invented in the second half of the XX century, nanotechnologies entered the science and are viewed in developed countries as one of the top-priority directions of economy's development. Developing countries are also interested in nanotechnologies development, as it will allow them improving their positions in the global economy and reduce the gap in the level of economic development as compared to developed countries. (Popkova and Tinyakova 2013a)

In view of innovational nature of nanotechnologies, their development is not oriented at following one or several global leaders in this sphere, which is peculiar for many spheres of technologies development, but supposes own innovational research and development allowing even developing countries to take leading positions in the sphere of nanotechnology development in case of their success. (Popkova *et al.* 2013b)

One of the most serious problems of nanotechnology development in developing countries is absence or lack of financial resources. As a rule, developing countries possess far lesser investment attractiveness, which complicated the process of attraction of foreign investments, and weak development of institutional environment, which complicated the redistribution of internal financial resources. (Popkova and Tinyakova 2013b)

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Therefore, developing countries require development and creation of own financial mechanisms of nanotechnology development which are different than mechanism that successfully function in developed countries, in view of their peculiarities and existing possibilities, which predetermines high topicality of this research.

The purpose of this research is development of financial mechanisms of nanotechnology development in developing countries.

**2. Materials and methods of research**

A lot of modern scientific works are devoted to study of the issues of nanotechnology development, among which are the following: (Youtie and Kay 2014, Jiang *et al.* 2013, Lorusso 2013, Sahin and Ekli 2013, Foley and Wiek 2013, Jordan *et al.* 2012).

Peculiarities of nanotechnology development in developing countries are determined and analyzed in works of such modern researchers as (Karaca and Öner 2015, Frolov *et al.* 2015, Jemala 2015, Fronseca and Pereira 2014, Ali and Sinha 2015, Palash and Mozumder 2013, Lau 2011, Foladori *et al.* 2012).

Financial aspects of nanotechnology development are studies in the works of such modern scientists as (Munari and Toschi 2014, Lakshmanakumar *et al.* 2014, Hoser 2013, Drexler 2013, McComas 2012, Beaudry and Allaoui 2012).

An important aspect during determination of the most perspective financial mechanisms of nanotechnology development in developing countries is consideration of criterion of effectiveness of these mechanisms. In order to determine the effectiveness of action of financial mechanisms of nanotechnology development in developing countries, this research offers to use the game theory instrumentarium which allows evaluating not only the ratio of expenses and profits from the use of various financial mechanisms but determining probability of their successful implementation in developing countries in view of their peculiarities (Table 1).

Table 1 - Methodology of evaluation of effectiveness of financial mechanisms of nanotechnology development in developing countries with the help of the game theory instrumentarium.

Financial mechanism	Expenses (volume of investments, USD billion)	Result (growth of GDP, USD billion)	Probability	Economic effect (USD billion)
-	a	b	p	$b \cdot p - a$

As is seen from Table 1, methodology of evaluation of effectiveness of financial mechanisms of nanotechnology development in developing countries with the help of the game theory instrumentarium supposes determination of expenses – volume of investments necessary for launch of the mechanism, the result expressed in the GDP growth, probability of achievement of this result and calculation of general economic effect from mechanism’s actions (Popkova *et al.*, 2013a). Apart from the game theory instrumentarium, the methodological base of the research is comprised of the general scientific methods of research – induction, deduction, synthesis, formalization, and comparative, problem, and systemic analysis.

**4. Results of the research and their discussion**

One of the financial mechanisms of nanotechnology development in developing countries is tax mechanism. This mechanism supposes provision of tax subsidies to nanotechnology companies. Simplified scheme of tax mechanism of nanotechnology development in developing countries is shown in Figure 1.

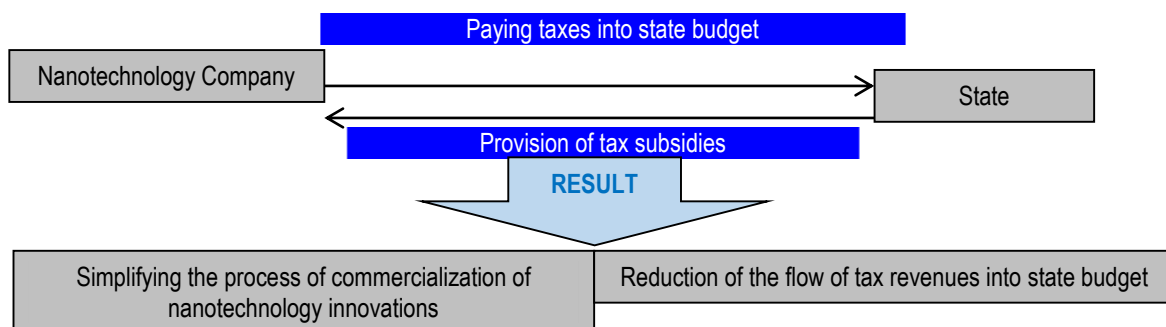


Figure 1 - Simplified scheme of action of tax mechanism of nanotechnology development in developing countries

As is seen from Figure 1, the state, within tax mechanism, provides tax subsidies for nanotechnology companies, which, on the one hand, leads to simplification of the process of commercialization of nanotechnology innovations, and, on the other hand, to reduction of the flow of tax revenues into state budget. Therefore, tax mechanism is more profitable for nanotechnology companies than for the state.

Another financial mechanism of nanotechnology development in developing countries is investment mechanism. This mechanism supposes creation of favorable investment climate in economy. This mechanism is actively used in developed countries.

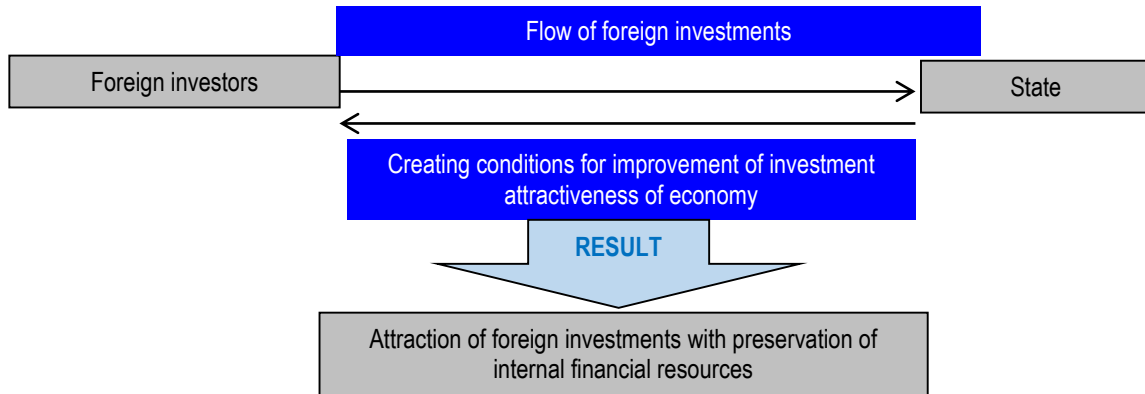


Figure 2 - Simplified scheme of work of investment mechanism of nanotechnology development in developing countries

As is seen from Figure 2, the state creates within investment mechanism favorable conditions for foreign investors, which ensures attraction of foreign investments with preservation of internal resources. However, it should be noted that creation of favorable investment climate requires a complex aggregate of measures, and the effect has a long-term nature.

Another financial mechanism of nanotechnology development in developing countries is loan mechanism. This mechanism supposes provision of preferential loans to nanotechnology enterprises by means of assets of state budget with involvement of banks. Simplified scheme of action of loan mechanism of nanotechnology development in developing countries is shown in Figure 3.

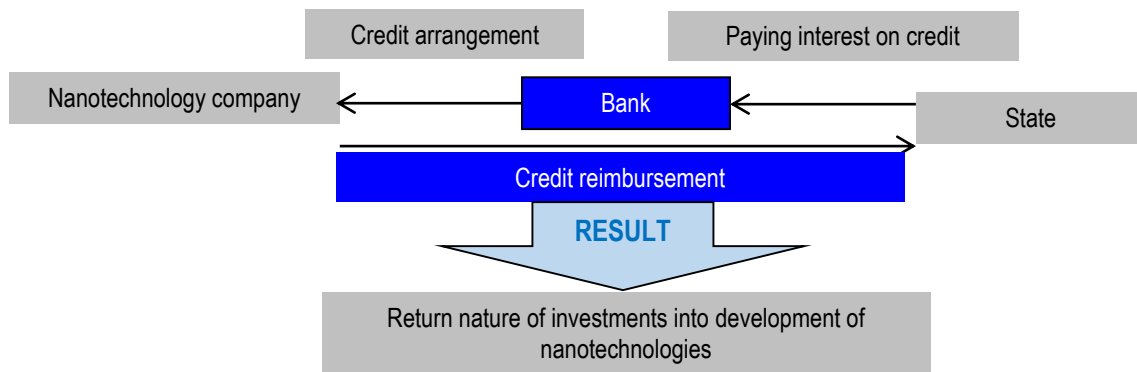


Figure 3 - Simplified scheme of loan mechanism of nanotechnology development in developing countries

As is seen from Figure 3, bank – within loan mechanism – performs intermediary function between the state and nanotechnology companies. Return nature of investments into development of nanotechnology is profitable for the state, but complicated the work of nanotechnology companies.

Financial mechanisms of nanotechnology development in developing countries also include amortization mechanism. This mechanism supposes provision of possibility of accelerated amortization to nanotechnology companies. The simplified scheme of work of amortization mechanism of nanotechnology development in developing countries is shown in Figure 4.



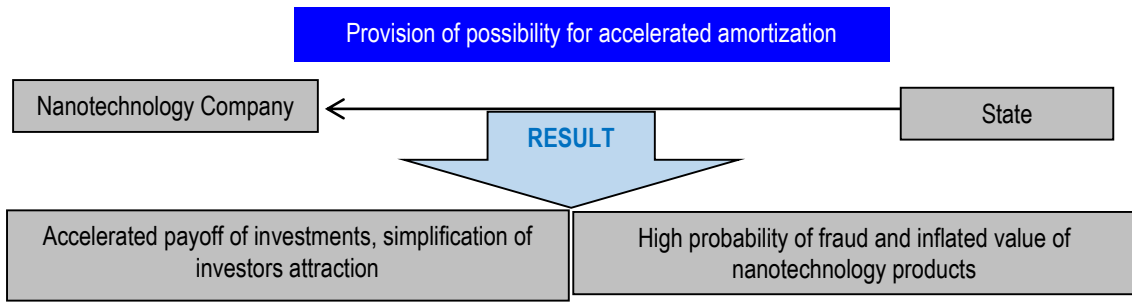


Figure 4 - Simplified scheme of work of amortization mechanism of nanotechnology development in developing countries

As is seen from Figure 4, the work of amortization mechanism ensures the accelerated payoff of investments into nanotechnology companies, but at the same time there arises a problem of fraud and inflated value of nanotechnology products, which can eventually lead to reduction of its competitiveness and decrease of general effect from nanotechnology development.

Another financial mechanism of nanotechnology development in developing countries is cluster mechanism. This mechanism supposes uniting nanotechnology companies into common cluster. The simplified scheme of work of cluster mechanism of nanotechnology development in developing countries is shown in Figure 5.

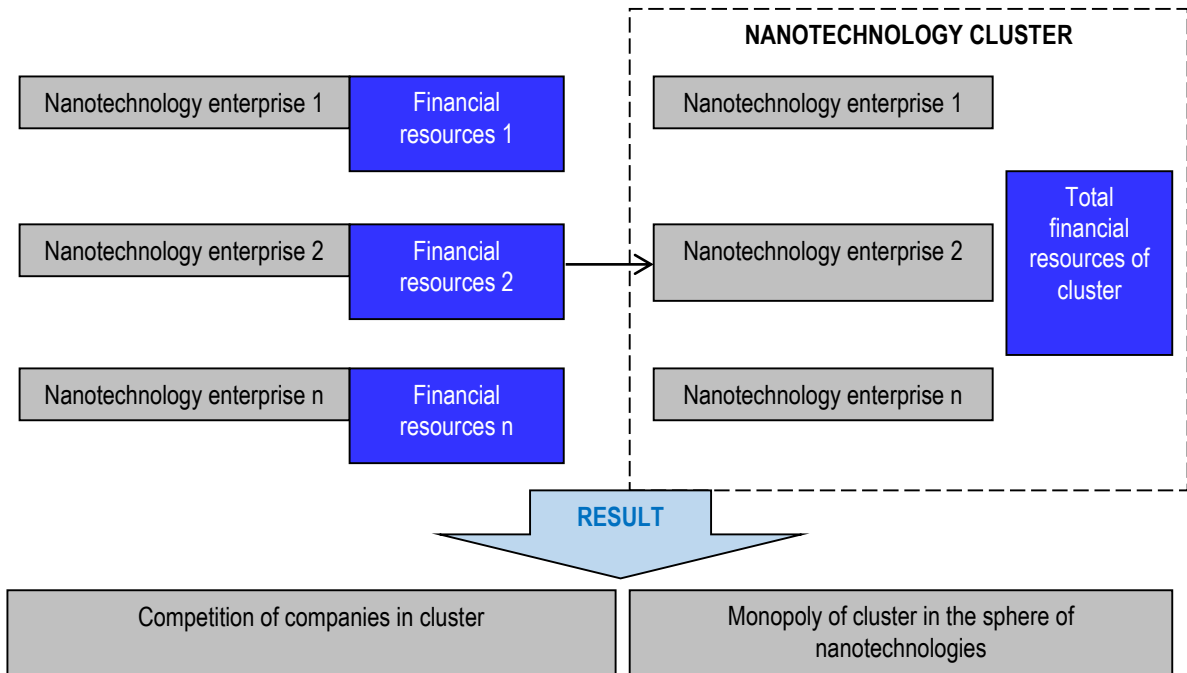


Figure 5 - Simplified scheme of work of cluster mechanism of nanotechnology development in developing countries

As is seen from Figure 5, emergence of nanotechnology cluster results in financial resources of separate nanotechnology companies unite in common budget of cluster which expands its possibilities. Results of comparative analysis of various financial mechanisms of nanotechnology development in developed countries are shown in Figure 2.

Table 2 - Comparative analysis of various financial mechanisms of nanotechnology development in developing countries

Financial mechanism	Nature of mechanism	Advantages of mechanism	Disadvantages of mechanism
Tax mechanism	Provision of tax subsidies to nanotechnology companies	Simplification of the process of commercialization of nanotechnology innovations	Reduction of the flow of tax revenues into state budget
Investment mechanism	Creation of conditions for the increase of investment attractiveness of economy	Attraction of foreign investments with preservation of internal financial resources	Complexity of realization of mechanism, long-term character of its implementation
Loan mechanism	Provision of preferential loans to nanotechnology companies	Return nature of investments into development of nanotechnologies	Necessity for involvement of banks, spending assets of state budget
Amortization mechanism	Provision of possibility of accelerated amortization for nanotechnology companies	Accelerated return on investments, simplified attraction of investors	High probability of fraud and inflated value of nanotechnology products
Cluster mechanism	Unification of nanotechnology companies into cluster	Self-regulation of cluster, work of market powers in cluster	Probability of monopolization of market by cluster

As is seen from Table 2, all stated financial mechanisms of nanotechnology development in developing countries have advantages and disadvantages. Therefore, determination of the most perspective financial mechanisms of nanotechnology development in developing countries requires their comparison with the help of effectiveness criterion. For the sake of precision of evaluation, let us perform it by the example of Russia with the help of the game theory instrumentarium (Table 3).

Table 3 - Comparison of various financial mechanisms of nanotechnology development in developing countries by the example of Russia with the help of the game theory instrumentarium

Financial mechanism	Expenses (volume of investments, USD billion)	Result (growth of GDP, USD billion)	Probability	Economic effect (USD billion)																									
Tax mechanism	18	35	0.7	$(35 \cdot 0.7 + 62 \cdot 0.3) - 18 = 25.1$																									
		62	0.3		Investment mechanism	25	46	0.4	$(46 \cdot 0.4 + 22 \cdot 0.6) - 25 = 66.0$	22	0.6	Loan mechanism	12	20	0.7	$(20 \cdot 0.7 + 23 \cdot 0.3) - 12 = 89.0$	23	0.3	Amortization mechanism	13	31	0.7	$(31 \cdot 0.7 + 45 \cdot 0.3) - 13 = 22.2$	45	0.3	Cluster mechanism	15	75	0.5
Investment mechanism	25	46	0.4	$(46 \cdot 0.4 + 22 \cdot 0.6) - 25 = 66.0$																									
		22	0.6		Loan mechanism	12	20	0.7	$(20 \cdot 0.7 + 23 \cdot 0.3) - 12 = 89.0$	23	0.3	Amortization mechanism	13	31	0.7	$(31 \cdot 0.7 + 45 \cdot 0.3) - 13 = 22.2$	45	0.3	Cluster mechanism	15	75	0.5	$(75 \cdot 0.5 + 90 \cdot 0.5) - 15 = 67.5$	90	0.5				
Loan mechanism	12	20	0.7	$(20 \cdot 0.7 + 23 \cdot 0.3) - 12 = 89.0$																									
		23	0.3		Amortization mechanism	13	31	0.7	$(31 \cdot 0.7 + 45 \cdot 0.3) - 13 = 22.2$	45	0.3	Cluster mechanism	15	75	0.5	$(75 \cdot 0.5 + 90 \cdot 0.5) - 15 = 67.5$	90	0.5											
Amortization mechanism	13	31	0.7	$(31 \cdot 0.7 + 45 \cdot 0.3) - 13 = 22.2$																									
		45	0.3		Cluster mechanism	15	75	0.5	$(75 \cdot 0.5 + 90 \cdot 0.5) - 15 = 67.5$	90	0.5																		
Cluster mechanism	15	75	0.5	$(75 \cdot 0.5 + 90 \cdot 0.5) - 15 = 67.5$																									
		90	0.5																										

As is seen from Table 3, expenses for realization of tax mechanism of nanotechnology development in Russia constitute USD 18 billion. As a result of influence of this mechanism, there is a high probability (70%) of GDP growing by 1.5% (USD 35 billion) and probability of 30% – of GDP growing by 3% (USD 62 billion), which depends on the possibility of creation of necessary institutional environment for determining nanotechnology companies. Economic effect from the tax mechanism constitutes USD 25 billion – 2<sup>nd</sup> position.

Expenses for implementation of investment mechanism of nanotechnology development are the highest ones and constitute USD 25 billion, which is caused by its high complexity. As a result of influence of this mechanism, there is a high (40%) probability of GDP growing by 2% (USD 46 billion) and probability of 60% - of GDP growing by 1% (USD 22 billion). Economic effect from investment mechanism constitutes USD 66 billion – the smallest effect, last position.

Expenses for realization of loan mechanism of nanotechnology development are low and constitute USD 12 billion. However, it provides slight growth of GDP – USD 200 billion with probability of 70% and USD 23 billion with probability of 30%. This is caused by return nature of investments. Economic effect from investment mechanism constitutes USD 89 billion – slight effect, last but one position.

Expenses for realization of amortization mechanism of nanotechnology development are also low and constitute USD 13 billion. However, the GDP growth is higher – USD 31 billion with probability of 70% and USD 45 billion with probability of 30%. Economic effect from influence of investment mechanism constitutes USD 22.2 billion – good effect, 3<sup>rd</sup> position.

Expenses for realization of cluster mechanism of nanotechnology development are among the lowest ones and constitute USD 15 billion. Together with substantial growth of GDP – USD 75 billion with probability of 50% and USD 90 billion with probability of 50% - the maximal economic effect of USD 67.5 billion is ensured – 1<sup>st</sup> position.

## Conclusions

Thus, it can be concluded that the most effective and, therefore, the most perspective financial mechanisms of nanotechnology development in developing countries are cluster and tax mechanisms, as they ensure achievement of the most positive effect expressed in the growth of GDP by means of nanotechnology development, with high probability and low expenses, which allows maximizing the common general positive effect.

It should be noted that implementation of tax, loan, and amortization mechanisms supposes creation of preferential conditions for nanotechnology companies, which increases the possibility for companies that are not involved with nanotechnology research to pose as ones. This causes the problem of companies' belonging to the list of nanotechnology enterprises and requires formation of corresponding institutional basis and additional expenses from state.

Comparative analysis of effectiveness of various financial mechanisms of nanotechnology development in developing countries with the help of the game theory instrumentarium was conducted by the example of Russia, which somewhat limits the results of the research. However, this does not mean that results of this analysis are true only for the Russian economy. In view of common peculiarities of developing countries, the received results could be applied also to other developing countries.

At the same time, a perspective direction of further research in this sphere is determination of effectiveness of various financial mechanisms of nanotechnology development by the example of other developing countries for determining common regularities and individual peculiarities.

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## Pricing Bounded Value Based Salam

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### Abstract :

*Salam is a contract in which advance payment is made for goods to be delivered at a future date. The main disadvantage of this contract is the variation of good's price at maturity. To resolve this issue, we use classically the Value-based Salam where the value of the good is defined as quantity time unit price. This solution permits the hedge the buyer and the seller against fluctuations in price's good but the quantity to be received at maturity can undergo unlimited changes.*

*In this work we propose a new approach to model Value-based Salam where the quantity to be received is Bounded and known.*

**Keywords:** Islamic finance, derivatives, risks, hedging, Salam, value-based Salamke.

**JEL Classification:** G12, C5, C6, C87.

### 1. Introduction

Risk in finance is associated with financing, including financial transactions that include company loans in risk of default. Risk is a term often used to imply downside risk, meaning the uncertainty of a return and the potential for financial loss. It is not desirable as such. In Islamic finance the risk is more undesirable since it can be considered as "Gharar" meaning uncertainty which is banned by the Shariah<sup>1</sup>.

To resolve this issue, we have to consider the main principle of Islamic in order to model new or existing financial contracts for hedging (Aboulaich and Dchieche 2015) and (Aboulaich and Dchieche 2016), or to use engineering in order to improve Islamic existing contracts (Dchieche and Aboulaich 2016).

In this work we propose to improve Salam contract especially the Value-based case to obtain a bounded Value-based Salam where the quantity to be received at maturity is bordered and the loss of the buyer and the seller is limited and known.

According to Figure 1 (Al-Suwailem 2011) an Islamic contract to be acceptable must respect the principles of Consistency. Substance means the outcome of the product, for example the outcome of tawarruq<sup>2</sup> is money for money, and this is not acceptable. For Mourabaha<sup>3</sup> the outcome is money for a good. This is an acceptable substance or outcome. Therefore, we move to the next step: is the form acceptable? We need to be sure that the buyer owns the good and is liable for it. Salam is a contract in which advance payment is made for goods to be delivered at a future date. The problem with Salam is that the price value of the good at maturity can be different from the expected price.

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<sup>1</sup> Islamic law

<sup>2</sup> Tawarruq is a financial instrument in which a buyer purchases a commodity from a seller on a deferred payment basis, and the buyer sells the same commodity to a third party on a spot payment basis meaning that payment is made on the spot.

<sup>3</sup> Sale on profit. Technically a contract of sale in which the seller declares his cost and profit

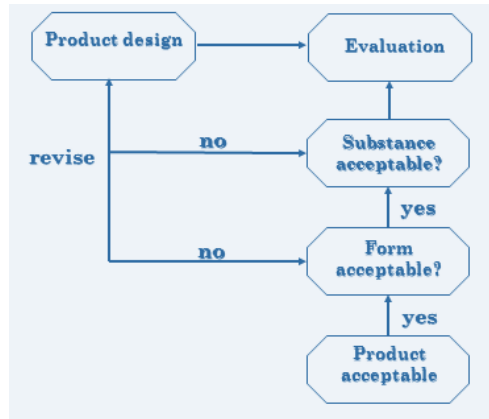


Figure 1 – Process of product evaluation

According to Khan and Ahmed (2001) there are two important counterparty risks in Salam. The counterparty risks can range from failure to supply on time or even at all, and failure to supply the same quality of good as contractually agreed.

According to Mrad (2010) the buyer and the seller of Salam contract suffers from fluctuation prices and the author suggest that the solution can be the value-based Salam.

According to Al-Suwailem (2011) Value based Salam can be a good solution to address price fluctuations because the value is defined as quantity times unit price, the buyer is able to hedge against price fluctuations of the future good and if the price raises the quantity to be delivered declines.

The quantity of good delivered using the value-based Salam has unlimited changes, the buyer and the seller have unlimited profits and unknown loss.

In this work we propose to use the idea behind the extended modified Salam (Dchieche and Aboulaich 2016) to Model a Bounded Value-based Salam. The remainder of this paper is as follows: the next section introduces the classical Salam contract; Section three includes the Value-based Salam; Section four presents the Bounded Value-based Salam; Section five explains an analysis and section six summarizes the finding and concludes.

In the following we will introduce the data used in the paper.  $S_0$  is the price of one unit of good at  $t=0$  and  $S_t$  is the price of one unit of good at maturity where  $t$  is the maturity. The price of a quantity of the good is denoted  $P$  and  $P_0$  denotes the price of the quantity  $Q_0$  of the good, where  $Q_0$  is the quantity of the good at  $t=0$ .  $P_t$  is the price of the quantity  $Q_t$  of the good where  $Q_t$  denotes the quantity time's unit of the good and  $P_F$  is the future price of good calculated using the formula of actualization.  $P_r$  is the reduced price of good where  $r$  the rate of reduction and  $R$  is the rate of return of good.

## 2. Classical Salam

### 2.1. Definition

Salam is a contract for deferred delivery that was originally sanctioned during the time of the Prophet, peace be upon him, to facilitate the trading activities of farmers who were awaiting the harvest of crops. In more modern times it has also been applied to the production of raw materials and fungible goods in general.

According to (Ahmad, Hassan 2009) Islamic jurists have permitted a difference between a commodity's cash and credit price in Salam, they could not legitimize a predetermined time value for money. The jurists could have allowed the difference in the cash and credit price because they recognized that supply and demand forces could be different at different times. The same demand and supply considerations led the jurists to allow the future price in Salam transactions to be higher, lower, or equal to the present price. Allowing for any difference in the price of a commodity to be delivered in the future is likely to be simply recognition of the forces of supply and demand that may cause prices to be different at different points in time.

### 2.2. Classical Salam modelling

Salam is a contract in which advance cash payment is made for goods to be delivered later on. The quantity of the good  $Q_0$  is decided by the buyer at  $t=0$ . The future price of this quantity  $P_F$  is calculated using the classical formula of actualization:

$$P_F = (1+R)^t * P_0 \quad (2.1)$$

Where  $P_0$  is the price of the quantity  $Q_0$  of the good at  $t=0$ , expressed by:

$$P_0 = Q_0 * S_0 \quad (2.2)$$

The price of the Salam includes a reduction since the whole amount is paid spot at the beginning (Ahmad and Hassan 2009). To apply this condition, we use the rate of reduction  $r$  to give the formula of the reduced price of the good:

$$P_r = P_F * (1 - r) \quad (2.3)$$

$P_r$  is the price paid by the buyer to receive the quantity  $Q_0$  of the good at maturity.

The fluctuation of price's good at maturity doesn't impact the execution of the contract, the buyer receives the agreed quantity  $Q_0$ . If prices fluctuate much the seller receives the same agreed quantity  $Q_0$  which can produce important loss for both parts of the contract.

### 3. Value-based Salam

#### 3.1. Definition

According to Al-Suwailem (2011) the Value-based Salam is a form of Salam where the price is defined as quantity time's unit price. The commodity is determined by the value and not by the quantity. However, Commodity has to be specified in terms of Quantity in addition to nature, properties and so on. This form of Salam has been approved by Ibn Taymiah<sup>4</sup>. According to Al-Masri (2003) the Companion Abu-Saeed Al-Khudari<sup>5</sup> narrated that the prophet, peace be upon him, says "Salam at the market price is a form of riba<sup>6</sup>".

One cannot grasp the riba involved in such transaction unless one assumes that the price meant here is that of the market price at the time of delivery, after it has been discounted by a specific sum or a specific percentage. But since Salam cannot be transacted except under this assumption, the narration of Al-Khudari is based on ellipsis. This assumption has requirements that are implicitly understood by the listener without any need to make them explicit.

Based on the above, if what is meant by the market price of Salam is the future market price on the date of delivery, it is not valid. The author concurs with Ibn Taymiyya's view that the market price of Salam, if it is meant to be the market price on the date of the contract, is valid.

#### 3.2. Value-based Salam modeling

To model Value-based Salam we need to define the quantity time's unit price.

At  $t=0$  the buyer decides of  $Q_0$  the expected quantity of the good to be received, and pays the future reduced price of the good  $P_r$  defined by Eq. (2.3). At maturity the buyer will receive  $Q_{\text{Value-based}}$  the quantity which depending on unit price. The quantity time's unit  $Q_t$  is calculated using the equation:

$$Q_t = \text{Price of all the quantity of good paid at } t=0 / \text{Price of one unit of good at maturity} \quad (3.1)$$

In this case the price paid by the buyer is  $P_r$ , the quantity which will be delivered is expressed by:

$$Q_{\text{Value-based}} = P_r / S_t \quad (3.2)$$

The quantity  $Q_{\text{Value-based}}$  received by the buyer can be higher, lower or equal to the expected quantity  $Q_0$ , it's depending on the market's price of the good at maturity.

### 4. Bounded Value-based Salam

#### 4.1. Definition

We proposed in another work (Dchieche and Aboulaich 2016) the model of extended modified Salam contract defined by:

<sup>4</sup> One of Islam's most forceful theologians, who, as a member of the Pietist school founded by Ibn Hanbal, sought the return of the Islamic religion to its sources: the Quran and the sunnah, revealed writing and the prophetic tradition

<sup>5</sup> Was an Ansari from the original inhabitants of Medina and one of the younger companions of the Islamic prophet Muhammad.

<sup>6</sup> Interest, usury

$$P_{ms} = \beta_{[IEC]} * [ P_r + P_{[IEC]} ] + \beta_{[Up]} * [ P_r + P'_{Pr*(1+p)} ] + \beta_{[Down]} * [ P_r + P'_{Pr*(1-p)} ] \tag{4.1}$$

The formulation supposes that the price of the good at maturity is separated into three intervals: [IEC] the interval of the execution of the contract using the modified Salam contract, [Up] includes the values strictly superior to the values in [IEC], and [Down] includes the values strictly inferior to the values in [IEC].

The bounded value-based Salam will contain also three intervals; the quantity to be received in each one is defined in the next section.

#### 4.2. Bounded value-based Salam modelling

In this work we use the idea introduced before to model Bounded value-based Salam.

At the beginning of the contract the buyer and the seller agreed on the tolerance rate  $p$ , meaning that the quantity to be received, regardless changes in good's price at maturity, is included in the interval  $[(1 - p) * Q_0 ; (1 + p) * Q_0]$ . According to Eq. (2.2), the interval agreed by the buyer and the seller using the tolerance rate  $p$  and executed using the Value-based Salam is defined by:

$$[Value-based] = [ P_r * (1 + p) * Q_0 ; P_r * (1 - p) * Q_0 ] \tag{4.2}$$

Values outside the interval are defined by:

$$[Up] = [ - \infty ; P_r / (Q_0 * (1+p)) ] \tag{4.3}$$

$$[Down] = [ P_r / (Q_0 * (1-p)) ; +\infty ] \tag{4.4}$$

According to Eq. (4.1), Eq. (4.2) Eq. (4.3) and Eq. (4.4) we give the expression of the quantity received using Bounded Value-based Salam:

$$Q_{Value-Based-Bounded} = \beta_{[Down]} * Q_{max} + \beta_{[Value-Based]} * Q_{Value-based} + \beta_{[Up]} * Q_{min} \tag{4.5}$$

$\beta$  is a function that takes the value 0 or the value 1.

If the price of the good at maturity is higher than the values in the interval [Value-based], the quantity to be received is lower than the expected quantity, this quantity is  $Q_{min} = Q_0 * (1 - p)$ .  $\beta_{[Down]}$  takes 0,  $\beta_{[Value-Based]}$  takes 0 and  $\beta_{[Up]}$  takes 1. If the price of the good at maturity is in the interval [Value-based], the quantity to be received is calculated using the Value-based Salam according to Eq (3.2).  $\beta_{[Down]}$  takes 0,  $\beta_{[Value-Based]}$  takes 1 and  $\beta_{[Up]}$  takes 0. If the price of the good at maturity is lower than the values in the interval [Value-based], the quantity to be received is higher than the expected quantity, this quantity is  $Q_{max} = Q_0 * (1 + p)$ .  $\beta_{[Down]}$  takes 1,  $\beta_{[Value-Based]}$  takes 0 and  $\beta_{[Up]}$  takes 0.

#### 4.3. Tables of profit and loss

In the following, according to Eq. (2.2) we consider the quantity of reduced Salam price defined by:

$$Q_r = P_r / S_0 \tag{4.6}$$

Table 1 - Profit and loss of the buyer

CASES	$S_t$	Salam	Value Based Salam	Bounded Value Based Salam
Case1	$S_t \leq P_r / Q_0 * (1+p)$	$Q_0 * S_t - P_r$	$(Q_{Value-Based} - Q_r) * S_0$	$(Q_{max} - Q_r) * S_0$
Case2	$P_r / Q_0 * (1+p) < S_t < P_r / Q_0$	$Q_0 * S_t - P_r$	$(Q_{Value-Based} - Q_r) * S_0$	$(Q_{Value-Based} - Q_r) * S_0$
Case3	$P_r / Q_0 < S_t < P_r / Q_0 * (1-p)$	$Q_0 * S_t - P_r$	$(Q_{Value-Based} - Q_r) * S_0$	$(Q_{Value-Based} - Q_r) * S_0$
Case4	$S_t \geq P_r / Q_0 * (1-p)$	$Q_0 * S_t - P_r$	$(Q_{Value-Based} - Q_r) * S_0$	$(Q_{min} - Q_r) * S_0$

Table 2 - Profit and loss of the seller

CASES	$S_t$	Salam	Value Based Salam	Bounded Value Based Salam
Case1	$S_t \leq P_r / Q_0 * (1+p)$	$P_r - Q_0 * S_t$	$(Q_r - Q_{Value-Based}) * S_0$	$(Q_r - Q_{max}) * S_0$
Case2	$P_r / Q_0 * (1+p) < S_t < P_r / Q_0$	$P_r - Q_0 * S_t$	$(Q_r - Q_{Value-Based}) * S_0$	$(Q_r - Q_{Value-Based}) * S_0$
Case3	$P_r / Q_0 < S_t < P_r / Q_0 * (1-p)$	$P_r - Q_0 * S_t$	$(Q_r - Q_{Value-Based}) * S_0$	$(Q_r - Q_{Value-Based}) * S_0$
Case4	$S_t \geq P_r / Q_0 * (1-p)$	$P_r - Q_0 * S_t$	$(Q_r - Q_{Value-Based}) * S_0$	$(Q_r - Q_{min}) * S_0$





4.4. Results

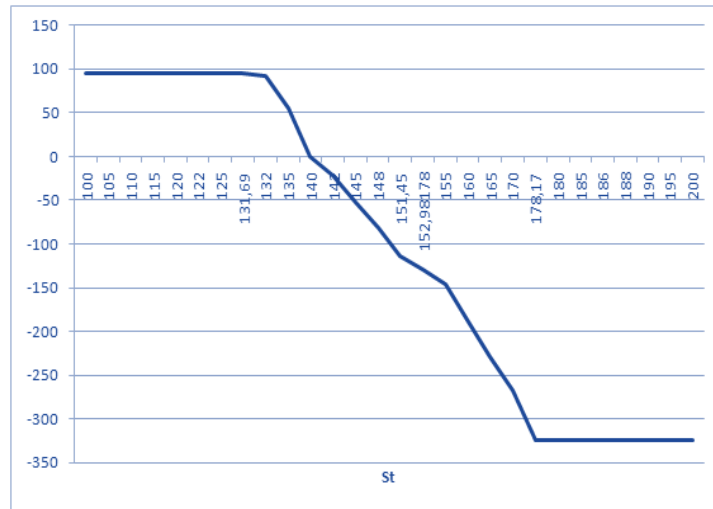


Figure 2 - Buyer's profit in Bounded Value-based Salam

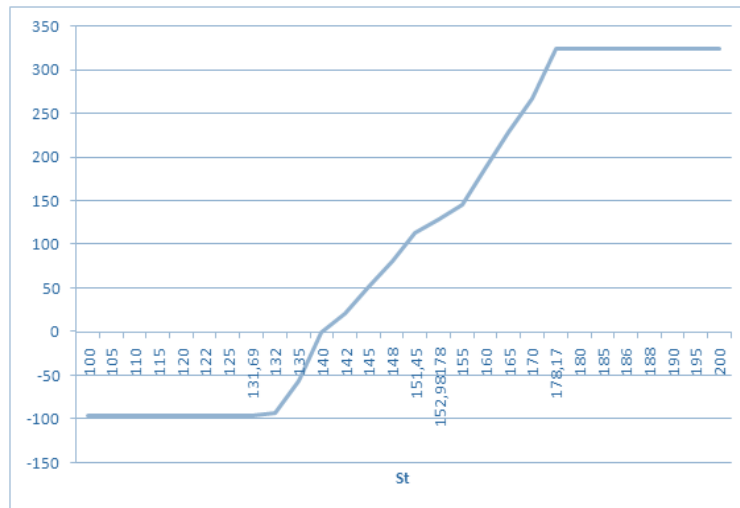


Figure 3 - Seller's profit in Bounded Value-based Salam

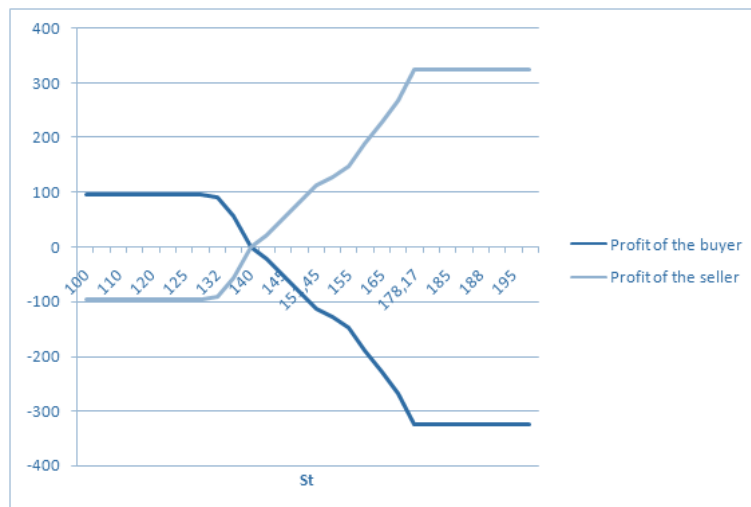


Figure 4 - Intersection of buyer's and seller's profit in Bounded Value-based Salam

Figure 4 presents the intersection between buyer's and seller's profit. The parallel lines in the left present the borders of profit and loss if the price of the good at maturity falls below the value  $P_r / Q_0 * (1+p)$ . The parallel lines in the right present the borders of profit and loss if the price of the good at maturity raises above the value  $P_r / Q_0 * (1-p)$ . The curve in the middle presents the different possibilities of profit and loss according to Value-based Salam.

5. Analysis

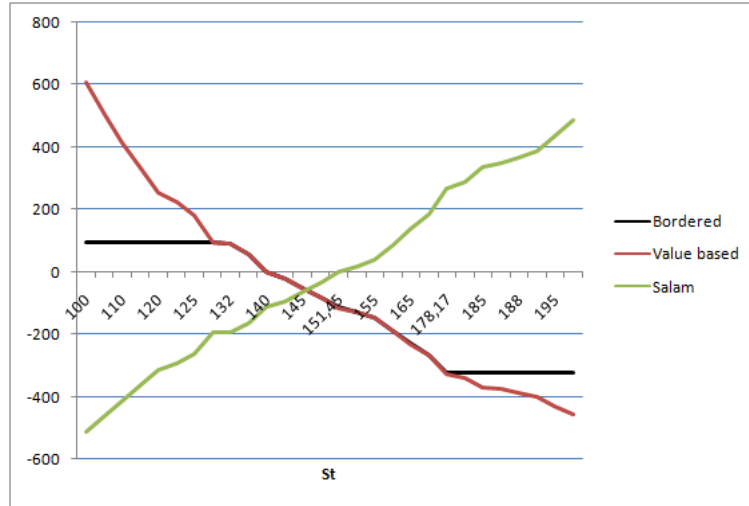


Figure 5 - Intersection of buyer's profit in three cases of Salam

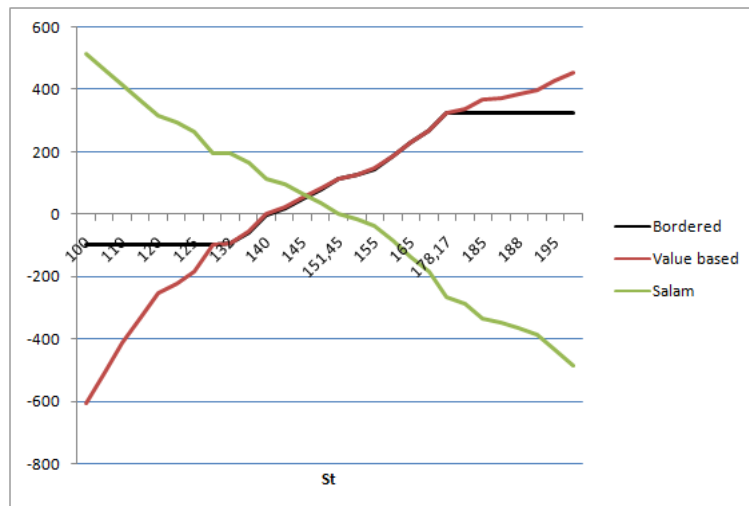


Figure 6 - Intersection of seller's profit in three cases of Salam

In Figure 5 and in Figure 6 the curve of Value-based and Bounded Salam are close point of view shape, both have upward trend or downtrend. The difference is that the Value-based can increase or decrease indefinitely instead of the Bounded which is limited in both sides. In terms of Classical Salam contract the shape is different from previous curves, because the quantity of good to be received is not changing regardless the variation of good's price at maturity.

According to Figure 7 the quantity to be received according to the classical Salam contract is fixed. In Value-based Salam this quantity is infinitely variable. In Bounded Value-based the quantity to be received is the same as in Value-based until a threshold determined by agreement between the buyer and the seller, beyond this threshold the quantity becomes fixed.

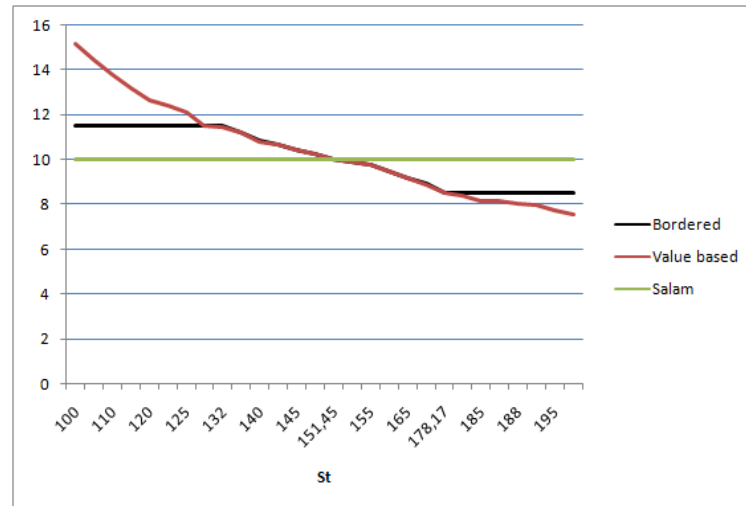


Figure 7 - Intersection of quantity received in three cases of Salam

## Conclusion

Salam is a contract in which advance payment is made for goods to be delivered at a future date. The main problem of this contract is that the quantity of good to be delivered at maturity is fixed despite the changes of good's price at maturity. To resolve this, issue many authors (Al-Suwailem 2011) and (Mrad 2010) propose to use Value-based Salam which is a contract where the value of the good is defined as quantity time unit price. This approach permits to vary the quantity of good to be received according to the price of the good at maturity, but doesn't allow limiting the loss in case of important price's fluctuations.

In this work we propose a Bounded value based Salam where the buyer and the seller agreed on a common interval of execution of the contract based on percentage of tolerance's loss. Inside the interval we use the value-based Salam; outside this interval the quantity to be delivered is fixed. Value-based Salam protects the buyer and the seller against price's variation but can deprive them of better income in case of favourable variation. To avoid this problem, we are working on defining and modelling Hybrid Salam contract which will consist of two parts: value-based and quantity-based, this contract can hedge capital risk, return risk and liquidity risk.

## Acknowledgment

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## Companies' Financial Outcomes in Nigeria: Does Chief Executive Officer Nationality Matter?

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### Abstract:

*The purpose of the study is to expand the understanding of corporate governance mechanisms and company performance in Nigeria. In particular, it focuses on the upper echelon and resource dependence theories, which relate to the foreign CEO. The fixed and random effect estimators are employed to identify the variables that influence the performance of public listed companies on the Nigerian Stock Exchange. The empirical analysis shows that CEO nationality, percentage of non-executive directors, board size and board meetings statistically influence company performance. This indicates that these are the relevant corporate governance variables which benefit shareholders. More importantly, the study indicates CEO's nationality provides a better alignment of interests of shareholders and managers, which increases a company's competitive advantage.*

*Thus, the results serve as a guide to regulators to design and implement key corporate governance mechanisms in Nigeria to encourage diversification of boards. In addition, the study is one of the few studies that considers this aspect, especially in the Nigerian context and adds to the extant literature on the vital role of foreign CEOs in company performance in Nigeria.*

**Keywords:** CEO nationality, corporate governance, performance, asset turnover, board meeting.

**JEL Classification:** G30, G34, G32.

### 1. Introduction

Given the spate of the collapse of corporate giants (e.g., Adelphia, Enron, Parmalat, Global Crossing, HIH and WorldCom) in the developed markets such as in the United States (US), United Kingdom (UK) and Australia, and in the developing markets, like in Malaysia and India (Transmile and Megan Media), corporate governance has become a topical issue in the business world. Similarly, the collapse of 70% of Nigerian companies (African Petroleum PLC, Concord Group, HITV, Kaduna Textile Mills, Nigeria Airways, Mtel, Intercontinental Banks, Oceanic Bank) has raised the important question on the characteristics of those responsible for managing a company's affairs (Ogbozobe 2009, Oteh 2013, Ujunwa 2012, [www.myfinancialintelligence.com](http://www.myfinancialintelligence.com)). In other words, it begs the question of the role of corporate board members. As a result, the impact of corporate boards has been a subject of policy debate and a focus of considerable academic research in accounting and finance fields. (Adewuyi and Olowookere 2013, Ehikoya 2009, Ujunwa 2012)

The case for high standard of corporate governance rests on five main criteria: it improves the economic performance of companies through enhancement of shareholders' value; it leads to long term stability of the companies (Shleifer and Vishny 1997); it provides easy accessibility to finance and stock market valuation (Claessens and Yurtoglu 2013, Klapper and Love 2004, Kyereboah-Coleman and Biekpe 2006a, Kyereboah-Coleman and Biekpe 2006b); it instils investors' confidence in the market (Adewuyi and Olowookere 2013, Ehikoya 2009, Haniffa and Hudaib 2006, Kumar and Singh 2013); and it serves as a shock absorber to enhance the quality of earnings reported by managers (Marra *et al.* 2011). In contrast, poor corporate governance could lead to poor performance regardless of the company's age and risks faced. (Claessens and Yurtoglu 2012)

Owing to the great importance of corporate governance as well as the claim by Ogbechie *et al.* (2009) that the importance of corporate governance remains unclear in Nigeria, the present study examines the impact of corporate governance on company performance. In particular, it examines the influence of Board size, Non-executive directors, Executive directors, Board independence, CEO duality, Foreign CEOs and Board meetings,

along with a few control variables, such as Company size, Company age, Leverage and Fixed assets ratio on company performance measures (Return on assets, Return on equity and Assets turnover). The examination of the factors influencing company performance is of great important to practitioners, academicians and those involved in designing and implementing corporate governance policies. In addition, the financial performance of companies is also crucial to shareholders and stakeholders. Notably, it is one of the key sources of finance and a yardstick for distribution of dividends. Therefore, with the inclusion of new variables that have not been explored by previous studies in the Nigerian context, the present study serves to augment examples found in the literature. More so, it contributes to the literature from the aspect of corporate governance mechanisms and their impact on the performance of the Nigerian public listed companies, given that corporate boards play a central role in the governance of public listed companies.

Also, the Nigerian case is likely to present a different picture owing to the influx of foreign CEOs in the Nigerian companies. Foreign CEOs' engagement can generate greater benefits to the companies' operations such as internationalization of various companies and opening of the country for investment. This is also likely to enhance the reputation of companies and enable them to diversify internationally. The rest of the paper is structured as follows: Section 2 discusses the corporate governance issues in Nigeria, while section 3 presents the theoretical background and review of literature. The research design and econometric method are explained in sections 4 and 5. In section 6, we discuss the results and section 7 presents the conclusion.

## 2. Corporate governance issues in Nigeria

In recent times, a joint annual report on the stress test of banks conducted by the Central Bank of Nigeria (CBN) and Nigerian Deposit Insurance Commission (NDIC) indicated that ten banks failed the capital adequacy, liquidity, and corporate governance tests. This implies that weak corporate governance can have devastating effect on the economy of a country. For instance, weak corporate governance is one of the reasons for the collapse of many sectors, such as the telecom and banking industry in some West African countries, particularly Nigeria (Dozie 2013, Oladokun and Aluko 2012).

In addition, the Transparency International Report in 2012 indicated that with regards to company's ethical behaviour, Nigeria was placed in the 125<sup>th</sup> position, which is far below the positions of some of its African counterpart countries, such as Ghana and South Africa in 66<sup>th</sup> and 50<sup>th</sup> positions, respectively (Aginam 2011). This lack of ethics in companies may indeed not be unconnected with weak governance, inefficiency of corporate boards, weak auditing and accounting standards report, corruption, poorly protected property rights and government inefficiency. Therefore, a high standard of corporate governance is needed in Nigeria in the advent of the country experiencing several fluctuations in the economic system, lack of policy support, weak legal and judicial systems, poor institutional framework and major upheavals in the social system (Adegbite *et al.* 2013).

Unfortunately, unlike other market settings, such as in the US, UK, Malaysia and South Africa, there is no uniform corporate governance code guiding public listed companies in Nigeria. The various corporate governance codes are the Company and Allied Matters Act 1990 (as amended in 2004), Securities and Exchange Commission (SEC) Code 2003 (as amended in 2009 and made effective in 2011) and industry specific codes, for example, the CBN Code 2006, Code of Corporate Governance for Pension Companies (PENCOM 2011), Code of Corporate Governance for Insurance Companies (NAICOM CODES 2008) and the SEC Code for Shareholders' Associations. In general terms, the objective of the SEC Code 2003 is to ensure that the board of directors acts independently and is concerned with maximization of shareholders' value. However, the persistent agency problem indicates that the code is weak and its enforcement is less effective. In the light of this shortcoming, the SEC inaugurated a National Committee in September 2008 to review the 2003 Code of Corporate Governance for public companies in Nigeria. The aim was to reclaim the loss of investors' confidence that had crippled the Nigerian Stock Market and to improve the companies' value. This is because high standard of corporate governance can enhance investors' trust and ensure that investors' wealth is managed efficiently (Oteh 2013). Among the salient changes in the SEC Code 2003 (as amended in 2009 and made effective in 2011) are board size, board independence, and the issue of separation of position of the CEO and the company chairman. All these changes are crucial corporate governance mechanisms and are expected to yield meaningful results. The corporate governance code recommends that the board members should have business and industrial experience; it emphasizes on high percentage of non-executive directors on the board and the board size should be of a reasonable size, depending on the size of the company and frequency of board meetings.

### 3. Theoretical background and review of literature

It is generally recognized that corporate governance is a key policy agenda in every economy, especially in developing economies; its mechanisms are key determinants of corporate performance (Claessens and Yurtoglu 2012, Kyereboah-Coleman 2007, Kyereboah-Coleman and Biekpe 2006b). One such mechanism is the board of directors (Fama 1980, Jensen and Meckling 1976). The board of directors plays fundamental roles, ranging from its fiduciary functions and strategic decision making, to the monitoring function (Ogbechie *et al.* 2009). The company's board is an internal control mechanism that deters management of the company from opportunistic behaviour (Hermalin and Weisbach 2007, Lefort and Urzua 2008). Board members are elected by the shareholders of the company and represent the interests of both shareholders and stakeholders (Kumar and Singh 2013).

Corporate governance is a system by which companies are managed and controlled effectively and efficiently in a well-defined manner to attain corporate performance and contractual obligations, in the interest of shareholders and other stakeholders of the company, such as creditors, regulators and employees (Kyereboah-Coleman 2007). The corporate governance structure involves board of directors, chairman, managing directors and sub-committees of the company. Corporate governance provides the framework through which corporate objectives are set and achieved. The framework is also expected to provide the strategic direction for the company. It aims at promoting corporate transparency and accountability (Adekoya 2011). As pointed out by Adekoya (2011) and Mellahi (2005), corporate performance cannot be measured if the system is weak and corporate failures are mostly caused by the atrocious behaviour of the top management in the company.

Several theories, such as the agency theory, stewardship theory and resource dependence theory are linked to corporate governance research. Of these theories, the major one is the agency theory. The agency theory is deeply rooted in various fields of corporate governance research, particularly in finance and economics (Zahra and Pearce 1989). The theory emerged in the 1970s following the conflicts of interest that arose between the principals, who are the shareholders, and the managers, who are the agents of the company (Fama 1980). Jensen and Meckling (1976) define agency relationship as a contractual relationship where one or more parties (principals) engage the other parties (agents) to carry out some duties that involve decision-making on their behalf. The agency theory assumes that both agents (managers) and principals (shareholders) are likely to have different conflicting goals, whereby agents try to satisfy their own interests rather than that of the principals. In a situation where a conflict of interest arises, managers may likely perpetuate certain myopic behaviour at the expense of shareholders, which in turn, undermines the maximization of shareholders' returns in the long-run (Hossain, Prevost and Rao 2001, Jensen and Meckling 1976). This myopic behaviour raises important question as to whether managers can be trusted when shareholders entrust the management of the company in their hands. In addition, both principals and agents have different attitude towards risks (Jensen and Meckling 1976). While agents are risk-averse because of their inability to diversify their job, principals have the prerogative to diversify their portfolio resulting in a more liquid position unlike agents. Based on these two differences, i.e., differences in attitude towards risk and the self-interest goal, there is a need to align managers' self-interest objectives with that of shareholders.

Hence, corporate governance mechanisms play a key role in reducing agency cost (agency problem) in a company (Fama 1980, Jensen and Meckling 1976). Jensen and Meckling (1976) view that appropriate corporate governance structure should be implemented in order to safeguard the interest of shareholders. One of the primary functions under the corporate governance system is the monitoring function of the board of directors to mitigate agency problems. This can be achieved through the board of directors' enormous power, which includes power to recruit, fire, and reward the top-level managers and to ratify and monitor important decisions (Fama 1980, Fama and Jensen 1983). Other responsibilities of the board of directors include the approval of investment and operating decisions, promoting the culture and value of the company, ameliorating profitability and ensuring that the management acts in the interest of the shareholders.

The board of directors also ensures that the management maximizes shareholders' wealth through performance, and strong competitive advantage and that the company's engagement in corporate governance follows best practices. Jensen and Meckling (1976) and O'Connell and Cramer (2010) are of the view that the board of directors plays a monitoring role in the activities of the management, such as implementing and designing strategy. Therefore, the ability of the board to discharge its monitoring, strategic and service roles could signify its effectiveness (Abdullah 2004, Kamardin and Haron 2011). In fact, board contribution to company performance can be achieved by reducing agency costs arising from conflict of interest and strictly ensuring that attention of agents is focused on improving the company's performance. For instance, Jensen (1993) notes that the board of directors plays an important role in sustaining an effective governance system with the monitoring of management by the independent directors. Companies with stronger board composition that is, having higher number of independent



directors on the board are likely to provide greater returns to shareholders because independence of board is a prerequisite for improving corporate governance (Jensen 1993). Similarly, corporate governance also stresses on separation of the role of the chairman and CEO of a company in order to avoid CEO duality that may likely influence the company's performance. (Fama and Jensen 1983)

In contrast to the agency theory, the stewardship theory explains that managers act as "stewards rather than as agents", hence they maximize their satisfaction in order to achieve the company's goals rather than self-interest goals. The information advantage possessed by insider directors assists directors in making effective decisions that are likely to enhance company performance (Donaldson and Davis 1991; Muth and Donaldson 1998). The assumption is that the insider directors have privilege to certain specific information that ordinarily is not available to the outsiders. Therefore, insiders would be more knowledgeable about the company's current dynamics and operations and have the technical expertise and commitment to the company. All these provide them the opportunity to make more effective decisions than the independent directors (Fama and Jensen 1983). The theory also suggests that managers act as stewards rather than economic agents in order to achieve non-financial motives, such as recognition and intrinsic benefits as a result of successful performance and work ethics (Muth and Donaldson 1998). Managers are essentially good stewards of corporate assets and they extend their loyalty and trust to the company (Donaldson and Davis 1991, Davis, Schoorman and Donaldson 1997, Muth and Donaldson 1998). These types of managers are collectivists; they support the company and are trustworthy.

In addition to the stewardship theory, there is upper echelons theory. The upper echelons theory suggests that organisational outcomes and performance are reflection of the company's top management team's (TMT) characteristics (Carpenter, Geletkanycz and Sanders 2004; Hambrick and Mason 1984). Hambrick (2007) suggests that the characteristics of executives themselves, particularly the CEO of the company, determine various corporate strategic decisions. The stream of arguments indicates that TMT and executive's characteristics, such as age, education, experience, personal value and cognitive reasoning of the company do matter when it comes to company's strategic decisions that could influence company performance. More recently, the internationalization of TMT and executives have featured in the upper echelons theory. This is expected to have a positive impact on company performance and be beneficial to shareholders (Carpenter, Geletkanycz and Sanders 2004; Carpenter, Sanders and Gregersen 2000; Heijltjes, Olie and Glunk 2003). For example, Aleman (2012) documents those foreign born CEOs may likely have a positive influence on company's reputation and the degree to which a company can engage in international diversification. In fact, boards prefer to have some international members in the upper echelons so as to increase the knowledgebase of the board and internationalization of the company (Carpenter and Fredrickson 2001, van Vee, Sahid and Aangeenbrug 2014, Kaczmarek and Ruigrok 2013).

Similar to the view expressed in the upper echelons theory, the resource dependence theory further elaborates on the specific functions such as career experience, attitude and value of top managers within a company and how they can add value to the company (Pfeffer and Salancik 1978). These specific functions influence the way top managers interact with the environment. Following this assertion, studies have suggested that the foreign CEOs can play a crucial role in linking the company to its environment (Dalton *et al.* 1998, Nielsen 2010). These CEOs are expected to have higher level of external networking than domestic CEOs, and this higher level of networking is likely to results in successful co-optation of needed resources for the company, which in turn may lead to higher company performance. Indeed, directors use the external connection to further the interest of the company that employs them. More so, executives with international experience are believed to understand the logic and dynamics of foreign markets which are expected to boost the financial performance of the company. In addition, the presence of international directors on the boards of public listed companies can enhance the reputation and market value of listed companies in the financial market. This is because it portrays a company's commitment to apply either advanced corporate governance standards, such as shareholders' rights or foreign expertise, particularly in emerging markets (Mi Choi, Sul and Kee Min 2012, van Vee, Sahid and Aangeenbrug 2014, Oxelheim and Randoy 2003). On this premise, one can argue that both the upper echelons theory and the resource dependence theory elaborate on the influence of top management decisions and actions on companies' strategic decisions, its environment and performance (Hambrick and Mason 1984, Pfeffer and Salancik 1978). Therefore, the present study includes the upper echelons and the resource dependence theories in addition to the agency theory to look at the impact of corporate governance structure, particularly the board of directors on company performance.

#### 4. Corporate governance and company performance

Corporate governance involves those mechanisms that prompt the board to act in the best interest of the shareholders, and protect their return on investment (ROI) (Shleifer and Vishny 1997). The existing empirical

literature has shown that there is a link between corporate governance and company performance (Bhagat and Bolton 2008, Klapper and Love 2004). However, the results of these links have been conflicting. For example, Gompers, Ishii, and Metrick (2003) find that strong shareholders' rights of companies lead to increase in company's value, profit, growth, lower acquisition and lower capital structure. Using the data from Malaysia, Ponnu (2008) finds no evidence on the relationship between corporate governance mechanisms: board structures and CEO duality on company performance. Klapper and Love (2004) use data from 14 developing countries and find that good corporate governance translates to better company performance. In another study, Kyereboah-Coleman and Biekpe (2006) use Ghanaian data and find that corporate governance mechanisms improve companies' performance. On the contrary, Bhagat and Bolton (2008) find that none of the corporate governance mechanisms relates to the future stock market returns.

#### 4.1 Board meetings and company performance

One of the fundamental means of examining the effectiveness of board from the monitoring point of view is the number of meetings held in a financial year (Jensen 1993, Vafeas 1999). Boards that meet frequently tend to perform their duties diligently and effectively, thereby enhancing their level of oversight (Christensen, Kent and Stewart 2010, Lipton and Lorsch 1992, Vafeas 1999). In a study by Vafeas (1999), the frequency of board meetings is found to be negatively related to the company's value measured by Tobin's Q during the normal period. This implies that an increase in the number of board meetings decreases the company's share price. On the other hand, the operating performance of the company tends to improve following an abnormal year. This is because during the abnormal period, board monitoring is more intense and its importance is reflected in company performance. Another related study by Fich and Schivdasani (2006) uses 508 US listed companies from 1989 to 1995 and provides evidence that higher frequency of board meetings attracts lower market value. The study of Christensen *et al.* (2010) also reports that board meeting has no significant association with company performance, but is negatively related to the market value of the Australian companies. This is an indication that markets view the high frequency of board meetings as inefficiency of the board in discharging its duties or that there are a number of negative issues that seriously need board attention.

In the African context, Ntim and Oseit (2011) examine the impact of board meetings on company performance. The results show that high frequency of board meetings statistically and positively influences the South African listed companies' performance. The results further show that either small or large number of board meetings influences company performance. From the foregoing, it seems the relationship between the frequency of board meetings and company performance may differ based on different institutional contexts. Therefore, this study posits that there is a relationship between the frequency of board meetings and company performance.

#### 4.2 Board size and company performance

Board size numerically indicates the number of members sitting on the corporate boards. The number could play an important role in board efficacy. It is expected that the number of members should be realistic, combined with skills, experience and resources to achieve the company's stated goals. However, what the number should realistically be has generated a lot of argument among researchers, leading some of them to favour a smaller board while others favour a larger board. Researchers have argued that larger board size strengthens information management and improves information sources. However, larger boards could lead to potential agency problem, where they may likely be controlled by the CEO, and thus, become less effective (Haniffa and Hudaib 2006). Rahman and Ali (2006) are of the view that smaller boards are more efficient than larger boards. According to Jensen (1993) and Lipton and Lorsch (1992), the average board size that could be effective may range from seven to eight members.

Empirical studies by Yermack (1996), Eisenberg, Sundgren, and Wells (1998), Mak and Kusnadi (2005) and Christensen *et al.* (2010), using data extracted from US, Finland, Malaysia, Singapore and Australia, find that larger board size is inversely related to company performance. On the other hand, Dalton *et al.* (1999) conduct a meta-analysis on prior US studies and find that board size is positively related to company performance. A study by Jackling and Johl (2009) on the relationship between board size and company performance shows that board size has a significant positive association with company performance. In Ghana, Kyereboah-Coleman and Biekpe (2006) find that on average, board size is positively related to company performance. In addition, it has been found that a larger board manages assets inefficiently, which invariably affects returns negatively. In the context of Nigeria, Ogbachie *et al.* (2009) find no evidence of correlation between board size and corporate strategic decisions, whereas Ujunwa (2012) finds a negative relationship between board size and company performance. Based on the

above contradictory results, this study proposes that the size of board could have an impact on company performance.

#### 4.3. Board independence and company performance

Board independence plays a critical role in reducing agency problems that arise due to conflict of interest between manager and shareholders, and protects the shareholders from the managers' opportunistic behaviour (Fama and Jensen 1983, Lipton and Lorsh 1992). This consequently can enhance the performance of the company. However, studies examining the influence of board independence on company performance have found mixed results. For example, the results of Haniffa and Hudaib (2006) suggest that a board dominated by a substantial number of independent and non-executive directors discharges its responsibilities effectively, and thus, improves company performance. Knyazeva, Knyazeva, and Masulis (2013) find that board independence is positively related to the company's operating performance and value. Other studies (Choi, Park and Yoo 2007, Jackling and Johl 2009, Lefort and Urzua 2008) have also reported similar results. However, a study by Abdullah (2004) finds no relationship between board independence and accounting performance. Similarly, Ogbachie *et al.* (2009) find no evidence of the association of board independence with corporate strategic decisions. Ehikioya (2009) finds that having limited number of independent directors on the board has negative influence on company performance. Similarly, Christensen *et al.* (2010) document that the proportion of independent outside directors on the board of Australian companies negatively influences company performance. These suggest that board independence and company performance are related.

#### 4.4 Chief Executive Officer (CEO) duality and company performance

Nowadays, in the corporate world, companies are under pressure to separate the position of the CEO and Chairman (Krause and Semadeni 2013) in order to eliminate confusion and duplication of efforts, and to avoid CEO duality which may cause an entrenchment effect in a company. This CEO duality may be prevalent in a country with a weak corporate governance system. Separating the position of Chairman and the CEO of a company has generated argument among the corporate governance scholars, policy makers and investors. In fact, there is an unanswered question on whether separation of the position of CEO and Chairman improves performance and ensures stability of the company or it results in power struggles. Haniffa and Hudaib (2006) argue that companies in which the position of the CEO is separated from that of chairman outperform those with CEO duality. Jensen (1993) is of the view that separation of the CEO and chairman positions reduces the CEO entrenchment effect and increases the board's effectiveness. While some scholars favour a single individual managing the same position with the opinion that such leads to better performance (Kyereboah-Coleman and Biekpe 2006, Yermack 1996), others argue that having a single individual sitting on both positions is detrimental to company performance. In a study, Obradovich and Gill (2013) find that CEO duality has a positive effect on American companies' performance. On the other hand, Ehikioya (2009) finds that CEO duality is inversely related to company performance in Nigeria. On the contrary, another study in Nigeria by Ogbachie *et al.* (2009) finds no relationship between CEO duality and corporate strategic decisions. Similarly, Daily and Dalton (1992) also find no relationship between CEO duality and company performance. In view of these previous results, this study proposes that there is a relationship between CEO duality and company performance.

#### 4.5 Foreign Chief Executive Officer (CEO) and company performance

The process of globalization<sup>1</sup> of an economy has led to an increase in the number of foreign directors on the boards of public listed companies in different markets of the world (Mi Choi, Sul and Kee Min 2012, van Vee, Sahid and Aangeenbrug 2014). For instance, Aleman (2012) claims that social and economic pressure has forced US companies to embrace the need for globally diversified executives. This situation witnesses top corporate organisations of the world increasingly accumulating more foreign directors on the boards of companies (Staples 2007). The advantage of this increase is that it tends to enrich the supply of ideas, introduces unique approaches and provides expertise and knowledge available within a group, which subsequently enhances creativity, quality of decision making, performance, and equity value of the company (Mi Choi *et al.* 2012, Nielsen and Nielsen 2013, Oxelheim and Randoy 2003, van Vee *et al.* 2014). Hence, internationalization of the board has a positive effect on company performance. Masulis, Wang and Xie (2012) argue that foreign directors have a wealth of international experiences that could be employed by them to boost the company performance. These individuals have greater

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<sup>1</sup> Globalization removes barriers to trade and capital flow. It also reduces company level barriers to cross-border information flows and corporate governance (Oxelheim and Randoy 2003).

management techniques and skills that can improve their advisory roles and enrich the shareholder's wealth. Indeed, any company (irrespective of the company's country of origin) with more international directors and a foreign chairman sitting on its board indicates that it has what it takes to compete in the international market. This international orientation helps to improve company performance (Collin *et al.* 2012).

It has been considerably documented in the literature that companies with national diversity in the upper echelons have greater chance of entering a foreign market and perform well (Masulis *et al.* 2012, Nielsen and Nielsen 2013, van Vee *et al.* 2014, Kaczmarek and Ruigrok 2010). The interpretation of this is that companies with a TMT and national diversity benefit from cross-cultural awareness and knowledge (Kaczmarek and Ruigrok 2010). An important and influential member of the TMT is the CEO. Studies (Carpenter, Sanders, and Gregersen 2001, Daily, Certo and Dalton 2000) have found that companies helmed by a CEO with international experience have better financial performance than companies headed by CEOs with limited or no international experience in a sample of fortune 500 companies in the US. Similarly, Hsu, Chen and Cheng (2013) find that the CEO's international experience plays important role in internationalizing the Small and Medium Enterprises (SMEs) and has significant moderating effects on the relationship between company internationalization and performance. Furthermore, a study conducted by Sanda *et al.* (2005) documents that foreign CEOs are positively significant in influencing company performance compared to the indigenous CEOs. This suggests that the foreign CEOs have better and wider range of managerial and administrative skills that could improve company performance. Therefore, this study posits that there is a positive relationship between the CEO's nationality and company performance

## 5. Research design

### Sample

This study aims to examine the link between company performance and corporate governance mechanisms. Specifically, we investigate the influence of the CEO's nationality on performance of public listed companies on the Nigerian Stock Exchange. As indicated by Echikioya (2009), companies listed on the Nigerian Stock Exchange are required to publish their annual report in compliance with the accounting standards and the state law governing their business activities. The sample size covers all the companies that have actually complied with the new code of corporate governance, as reported in the SEC annual report in 2011. Based on the SEC annual report in 2011, a total of 164 companies submitted their annual reports and 138 companies complied with the code. However, the final selection is based on the data availability. In particular, we select those companies having their annual reports available online from 2011 to 2012. Being consistent with other international studies (Ntim and Osei 2011, Mak and Kusnadi 2005, O'Connell and Cramer 2010), companies which data are not available are excluded in the study. Besides, in line with the prior studies (Ehikioya 2009, Kyereboah-Coleman 2007, Abdullahi 2004), the present study considers only non-financial companies because financial institutions have a different way of reporting profit and business activities. More so, the Nigerian financial institutions have different corporate governance code which they comply with. Therefore, the study uses a sample of 32 companies over the period of 2011-2012.

### Dependent variables

As suggested by Tijjani *et al.* (2009), one of the items of interest to investors in Nigeria is the company's profitability. Thus, the dependent variable of this study is company performance. Prior studies have suggested that company performance can be measured by accounting and stock market (Abdullah 2004, Haniffa and Hudaib 2006). The present study relies on an accounting-based measure of performance because stock market-based measures are susceptible to investors' anxiety (Bhagat and Bolton 2008). Yermack (1996) uses return on assets (ROA) and return on sales (ROS) as their performance measurements while Erhardt, Werbel, and Shrader (2003) use return on equity (ROE) and return on investment (ROI). A study by Leng (2004) uses only the ROE as a measure of company performance. In the Nigerian context, Oba and Fodio (2012) only consider return on capital employed (ROCE) while Ujunwa (2012) considers ROA as a measure of company performance. Other studies, such as Adewuyi and Olowookere (2013); and Ehikioya (2009), consider Tobin's Q, ROA, ROE and Price-earnings ratio as measures of company performance. Since Tijjani *et al.* (2009) indicate that Nigerian investors are mostly interested in the company's profitability, this paper employs Mak and Kusnadi's (2005) measurement of a company's profitability: ROA, ROE and Assets-Turnover (AST).

The explanatory variables considered in this study are corporate governance mechanisms, such as board size, independence and executive directors, board meetings, CEO duality, CEO' nationality and CEO expertise. These variables were hand-picked from the company's annual report, and this makes it different from the study done by Ogbechie *et al.* (2009) that uses survey. In the annual report, companies are expected to indicate the level

of compliance with various corporate governance variables. To be consistent with the previous Nigerian studies by Ehikioya (2009) and Ujunwa (2012), other variables likely to influence company performance in this study are leverage, age and size. However, the present study augments these variables by adding the total fixed assets ratio. This follows the argument of Mak and Kusnadi (2005) that the total fixed assets ratio and company age have the tendency to influence company performance. In addition, the present study differs from those conducted in Nigeria by also adding three new explanatory variables: board meeting, CEO nationality and CEO expertise. These variables are critically important because the role of the corporate board influences company performance. For instance, board meeting serves as the monitoring power and signifies the effectiveness of the board. Furthermore, the frequency of board meetings in relation to performance is becoming a subject of debate in the corporate governance literature.

Leng (2004) shows that the size of company and the company's financial leverage has significant influence on company performance. Nevertheless, the performance decreases as the company size increases. Leverage is a measure of the company's strength to cope in times of crisis, as this could lead the company to under invest when there is cash shortage. Thus, a company that is highly geared may have its value affected adversely, thereby affecting performance because such a company may not be able to discharge its obligations. Myers (1984) argues that debt is inversely related to the company's profitability. Therefore, a negative relationship is expected between leverage and company performance. On the other hand, a large company finds it easy to source for funds and this could positively influence its performance. In contrast, Fama and French (2002) note that large companies are highly diversified and prone to high agency cost. Therefore, either a positive or negative relationship is expected between company size and company performance. Given these relationships, this study considers company size, leverage and the total fixed assets ratio as additional variables that are likely to influence company performance.

## 6. Method

In order to examine the link between corporate governance variables and company performance, we use panel data regression based on fixed and random effect estimators. Ujunwa (2012) argues that the fixed and random effects enable researchers to examine the variations among cross-sectional units simultaneously with variations within individual units over time. The benefit of using panel data regression is that it takes into consideration the individual frailty of companies in relation to possible explanatory variables (Baltagi and Levin, 1992; Ehikioya, 2009; Ntim and Oseit, 2011). It also allows for larger sample size due to the pooling of individual and time dimensions; it gives room for more variability and less collinearity where the variation between the units (cross-sectional) is higher than the variation within units as in time series (Wooldridge, 2009). Table 1 provides the summary of the variables' measurements.

Table 1 - Summary of the variables' measurements

NAME	MEASUREMENT
DV (company performance)	
Return on assets (ROA)	Percentage of Net income by total assets (Adewuyi and Olowookere 2013, Ehikioya 2009)
Return on equity (ROE)	Percentage of Net income by common stockholder equity (Adewuyi and Olowookere 2013, Ehikioya 2009)
Assets Turnover (AST)	Total sales by total assets (Mak and Kusnadi 2005)
Explanatory variables	
Board size (BDZ)	The total number of executive and non-executive directors sitting on the board
Non-Executive directors (BODIND)	Percentage of non-executive directors on the board
Executive directors (EXE)	Percentage of executive directors on the board
CEO duality (CEODUA)	A dummy variable of 1 if a single individual is both the CEO and chairman, 0 if otherwise
CEO nationality (CEOFOR)	A dummy variable of 1 if the CEO is from foreign countries, 0 if otherwise
CEO expertise (CEOFIN)	A dummy variable of 1 if the CEO has a financial background, 0 if otherwise
Board meeting (BODMET)	The total number of meetings held in a fiscal year
CONTROL VARIABLES	

NAME	MEASUREMENT
Company age (AGE)	The number of years a company has been incorporated
Company size (SIZE)	The natural logarithm of the total assets of the company
Leverage (LEV)	The ratio of total debt to total assets
Fixed assets ratio (TFA)	The ratio of total fixed assets to total assets

In this study, the dependent variable is company performance, measured by ROA, ROE, and AST. Company performance is represented by the following functions. Company performance = f (non-executive directors, executive directors, board size, CEO duality, CEO nationality, CEO expertise, company size, company age, leverage, board meeting, total fixed assets ratio).

The model is as follows:

$$Y = a_0 + \beta_1 LBDZ_{it} + \beta_2 BODIND_{it} + \beta_3 EXE_{it} + \beta_4 BODMET_{it} + \beta_5 CEODUA_{it} + \beta_6 COEFIN_{it} + \beta_7 CEOFOR_{it} + \beta_8 LEV_{it} + \beta_9 AGE_{it} + \beta_{10} LSIZE_{it} + \epsilon_{it}$$

where: Y = ROA, ROE and AST.

## 5. Estimated results

Table 2 presents the summary statistics of the selected variables that could influence company performance. Based on the year of observation of the sample, the average (maximum) age of the companies in the sample is estimated to be 21.06 (47.00), while the average and maximum values of board size (BDZ) are 8.50 and 14.00, respectively for the whole sample. The average values estimated appear to be similar to the results obtained by Ujunwa (2012) and Adewuyi and Olowookere (2013). The two previous studies report average values of 8.80 and 10.01 over the period of 1991-2008 and 2000-2008, respectively. According to Section 4.2 of the 2011 SEC Codes, it is expected that the number of directors sitting on the board should not be less than five. In line with this, the summary statistics results reveal a minimum of five members for board size, which is different from the minimum value of three presented by Ujunwa (2012). As suggested by Lipton and Lorsh (1992), an ideal board from the monitoring perspective is a board composed of eight to nine members. The differences in the minimum value indicate that most of the sampled companies comply with the new corporate governance code.

Table 2 - Results of descriptive statistics

VARIABLES	Minimum	Maximum	Mean	Std. Deviation
TFA	0.39	0.95	0.57	0.45
LEV	0.00	0.90	0.39	0.30
AGE	2.00	47.00	21.06	14.30
COEFIN	0.00	1.00	0.48	0.50
CEODUA	0.00	1.00	0.16	0.13
BDZ	5.00	14.00	8.50	1.94
BODIND	0.36	0.90	0.71	0.13
EXE	0.08	0.90	0.51	0.35
BODMET	0.00	9.00	4.47	1.94
CEOFOR	0.00	1.00	0.41	0.50
SIZE	1.00	9.39E5	5.9906E4	1.83336E5

The results of the summary statistics also show a slight difference between the percentage of executive and non-executive directors on the boards of these companies. On average, 71% and 51% of the directors on the board are non-executive directors and executive directors, respectively. This percentage also differs from the percentage of non-executive directors (41.80%) presented by Adewuyi and Olowookere (2013). This appears to be an indication that the new corporate governance Code is in operation. By comparison, the percentage of non-executive directors recorded in the present study is somewhat higher than the 53.62% reported for Irish companies (O'Connell and Cramer 2010). However, due to data unavailability, the present study considers the non-executive directors as independent directors. This decision is in line with prior studies such as Adewuyi and Olowookere (2013), which

use the word “outsider on the board” and other international studies such as O’Connel and Cramer (2010). From the results in Table 2, the average percentage of CEODUA is 16%. This indicates that few companies (0.16%) still have a single individual holding the position of the CEO and chairman of the board. The Table also shows that 48% of the CEOs are financially literate while 41% are foreigners.

Having identified several changes in the corporate governance mechanisms resulting from the new corporate governance code as shown in the summary statistics, it would be more meaningful to examine the impact of this new code on company performance. Considering this, the company performance is a complementary of three accounting measurements: ROA, ROE, and AST. As a result, the study presents the panel regression results of each dependent variable in a separate column represented by model 1, 2, and 3 in Table 3. This Table shows the summary of the main results of the influence of corporate governance on company performance (ROA, ROE, and AST). In general, board meeting, board size, percentage of non-executive directors, and foreign CEOs are better explanatory variables for company performance in Nigeria.

Prior to the estimation of the models, an attempt is made to conduct variance inflation factor (VIF) to identify the possible presence of multicollinearity among the variables. This is because potential multicollinearity of the variables may generate instability in the results. Therefore, this test is conducted and the results, on average, indicate the VIF value for these variables is less than 5. With the value of VIF less than 10, we conclude that multicollinearity is not an issue among the variables. Next, we proceed to the model estimation.

In model 1, we use the fixed and random effect estimators. These are followed by the Hausman test. The result of the Hausman test indicates that random effects. GLS is the appropriate estimator and the result is reported in column 2 of Table 3 for company performance (ROA). From the result, CEO nationality has a significant positive relationship with ROA at the 5% level. Besides, leverage and total fixed assets ratio are found to be significantly related to ROA at the 1% level each. As such, the two control variables indicate a very strong relationship with ROA.

Table 3 - Empirical Results

	MODEL 1	MODEL 2	MODEL 3
DEPENDENT VARIABLES	ROA	ROE	AST
Constant	0.553(0.89)	-11.861 (0.013)	-13.37(0.92)
INDEPENDENT VARIABLES			
lsize	-0.163 (0.39)	.376 (0.06)*	22.431 (0.00)***
lev	-0.034 (0.00)***	-0.028 (0.00)***	-0.375 (0.08)*
bodind	-0.873 (0.69)	0.40 (0.87)	134.260 (0.05)**
exec	-0.182 (0.91)	1.133 (0.36)	17.56(0.63)
ceofin	0.943 (0.12)	0.119 (0.86)	8.19 (0.67)
ceodua	-1.242 (0.60)	-1.074 (0.68)	-115.98 (0.12)
ceofor	1.230 (0.04)**	1.335 (0.06)*	-14.46 (0.47)
lbdz	1.210 (0.34)	2.321 (0.09)*	-153.946 (0.00)***
age	-0.032 (0.13)	-0.038 (0.09)*	-1.643 (0.01)***
bodmet	0.04 (0.80)	0.029 (0.87)	-18.755 (0.00)***
tfa	0.165 (0.00)***	0.112 (0.00)***	1.302 (0.08)*
Observation			
VIF(multicollinearity)	3.25		

Notes: the figures in parenthesis are the p-values. The \*\*\*, \*\* and \* indicate 1%, 5% and 10% level of significance. Note also, that lsize and lbdz are in natural logarithm.

In model 2, we also employ the fixed and random effect estimators. The post-estimation test, Hausman test, is performed to identify the best estimator. The results of the test indicate that the random effects GLS estimator is the best. Thus, the results of the random effects are presented in column 3 of Table 3 for company performance (ROE). From the results, company size, leverage, foreign CEOs, board size, company age, and total fixed assets ratio are found to be significant determinants of the ROE, although some of the independent variables appear to have weak significant influence. Following the same procedure, the Hausman test results, after the estimation of model 3 using fixed and random effect estimators, show that the random effects GLS is a better estimator compared to fixed effects. Therefore, the results of the random effects for model 3 are reported in column 4 of Table 3. From

the results, board size, board meeting, the proportion of non-executive director, age, company size, and total fixed assets ratio are found to be significant in influencing company performance (AST).

Generally, most of the independent variables influence company performance at varying levels of significance. The impact of CEO nationality on company performance is statistically and positively related to ROA and ROE at the 5% and 10% levels, respectively. This result further confirms the importance of having a foreign CEO in the companies in Nigeria. This is because their managerial competence and experience can be employed to add value to shareholders' investment and improve company performance. This result is similar to earlier results reported by Unjunwa (2012), that board nationality has positive impact on company performance. In line with the agency theory, the quality of monitoring by board improves because the presence of well diversified experts from different backgrounds reduces managerial entrenchment and agency cost. The positive relationship of the foreign CEO to company performance further shows the importance of managerial skills and business experience of the foreign CEOs compared to the indigenous CEOs in improving company performance (Laing and Weir 1999). Another justification of the importance of CEOs to company performance is further highlighted in the recently released report on how CEOs impact positively on the Nigerian capital market, a situation whereby the market was rated as the best performing market in 2013. (Sule 2014)

The results also show that board meeting negatively influences company performance. This result is in line with that obtained by Vafeas (1999) but contrary to a positive relationship reported in a South African study by Ntim and Osei, (2011). The implication of this result, as argued by Vefeas (1999), and Lipton and Lorsch (1992), is that most of the time spent by board members is not really utilized to satisfy the interest of the shareholders and for exchange of ideas among board members, but for presentation of reports by management. Unfortunately, most of these reports are just formalities, without substantially adding anything to shareholder value. Another possible implication of this result could be attributed to the sample period which is not a crisis period, where the board frequently meets to improve its performance. Conclusively, the results do not concur with the agency theory that suggests that an increase in board meetings leads the board to effectively advise and monitor management to act in a way that would maximize shareholders' wealth.

The relationship between board size and company performance produces mixed results. The result shows that board size and ROE are positively related while on the other hand, when considering AST as a dependent variable, it shows that they are negatively related. This implies that board size can affect company performance negatively or positively. The positive relationship obtained between board size and company performance is similar to the findings of Ujunwa (2012). However, we find a positive relationship but not significant to influence company performance. Thus, a company with larger board size is associated with less efficient use of assets and hence, lower profitability. This result is consistent with the result obtained in a study by Mak and Kusnadi (2005) for Malaysian companies and Yermack (1996) for US companies.

In addition, the relationship between the proportion of independent directors and company performance (measured by AST) is statistically and positively significant at the 10% level. This further emphasizes the importance of having a higher percentage of independent directors on the board of the company. These directors give independent judgement when it comes to company matters and act in a way that will increase the company's value. More importantly, they work in the best interest of shareholders. The result is consistent with the agency theory arguments that a higher percentage of independent directors on the board improve company performance since they act independently in the best interest of the shareholders. The significance level is also similar to that reported by O'Connell and Bramer (2010).

In general, a negative relationship is found between CEO duality and company performance. However, this relationship is statistically insignificant. For the control variables, the lsize (log of size) is positively related to company performance at the 1% significance level. These results are parallel to the previous results obtained by Ehikioya (2009).

## **Conclusion**

This study examines the impact of corporate governance mechanisms on company performance within the jurisdiction of the Nigerian Stock Exchange. With the employment of three performance measurements (ROA, ROE and AST), the results show that CEO nationality, percentage of non-independent directors, board size and number of board meetings of corporate boards statistically influence company performance. This suggests that apart from the initial excitement of establishing a company, corporate governance, which is main foundation that guides a company in the conduct of its day-to-day activities, remains the key to long-term survival of any company. In particular, a positive relationship is found between the CEO's nationality with all the three measurements of performance, while board meeting shows a statistically negative relationship with only one out of the three



measurements of performance. As such, regulators should further focus their attention on the key corporate governance mechanisms in Nigeria and allow flexibility in determining the number of meetings to be held in a financial year.

This study also establishes the important role of foreign CEOs in company performance in Nigeria. The significant influence of the foreign CEOs on company performance in Nigeria indicates that these CEOs act in the best interest of shareholders and have a well-diversified business experience compared to the indigenous CEOs. Therefore, this development could be a drive towards attracting foreign direct investment in order to promote long-term growth of the country.

In addition, the study contributes to prior literature on corporate governance where it has been suggested that internationalizing the top level management of a company can improve the monitoring function as well as the transparency standards (Oxelheim and Randoy 2003). Further, the composition of a company's TMT is among the crucial corporate governance issues (Schmid and Dauth 2014). Hence, the finding that foreign CEOs have a significant impact on company performance provides a clue on how companies operating in Nigeria could make a good strategic choice towards improving company performance. All these can attract more foreign investors and increase the company's value.

Furthermore, the results of this study could be useful to the regulatory authorities and policy-makers to engage more in training and retraining of indigenous CEOs and encourage diversity on corporate boards so as to improve the performance of the company. More importantly, this has been the clamour of regulatory authorities around the globe, such as the SEC of Germany, the US and the UK, whereby the Corporate Governance Code recommends that board appointment should be made with regards to the benefit of diversity (Schmid and Dauth 2014). In line with the recommendation of the regulatory authorities from different countries and as suggested by the empirical results from this study, it is high time the SEC of Nigeria concentrated on the diversity of the board of companies to improve performance. Doing this could stimulate the achievement of Vision 2020 to become one of the developed countries in the world. An internationally-oriented board could enable Nigerian companies to compete at the international level because diverse business practices are expected to positively influence company performance that could be more beneficial to shareholders. For future studies, consideration should be given to the other measurements of company performance, e.g., market measurement, earnings management and financial decisions made by the company, and possibly, an extended sample period.

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## Methodological Ways of Formation of Corporate Entities in Food Industry

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### Abstract

*Formation of corporate entities is an objective process, caused by globalization of economy and economic subjects' striving for creation of economically and socially effective structure, capable of providing balance of interests of groups which are interested in its functioning. In the food industry, formation of corporate entities takes place according to traditions in national economy and in view of production peculiarities, which is a basis for study of the sense and content of this process and for development of recommendations aimed at its improvement. The purpose of the research is to develop theoretical and methodological process of corporate perfection and practical recommendations, aimed at formation of effective corporate entities in the food industry. The authors offer developments which open theoretical and methodological aspects of the problem of formation of corporate entities in the food industry. The mechanism of formation of corporate entities in the food industry is developed, which is peculiar for its structure and order of elements which determine factors influencing formation of corporate entities; the authors determine the goal, tasks, and principles of formation of business structures in food industry which perform production, administrative, and social functions in the process of manufacture of food products in view of influence of conditions of internal and external environment, responsibility produced by its element, resource provision, interests of interested groups, and market requirements. The authors offer a scenario approach to management of food industry enterprises which differ as to the level of realization of processes of corporate perfection which is peculiar for combination and succession of application in managerial practice of the methods of formation of corporate entities, differentiated depending on the phase (stage) of corporate transformation. The procedure of formation of corporate entities in food industry is offered, which is peculiar for a set and succession of realization of stages which lead to transformation of processing enterprises and provision of their economically and socially effective functioning in the food market under the conditions of execution of liabilities before consumers, state, management, owners, public institutions, and employees.*

**Keywords:** formation, corporate entities, food industry, model.

**JEL Classification:** E23.

### 1. Introduction

Actuality of the topic of the research is predetermined by totality of associated factors which cause the necessity for development and improvement of theoretical and methodological approaches and practical measures aimed at formation in the industrial sector of economy, which specializes on manufacture of food products, of effective and sustainable – in long-term – corporate entities.

Firstly, sectorial enterprises have unbalance of scales of production and taken managerial decisions, which negatively influences economic results. Despite wide use of technical and technological innovations, processing enterprises preserve orthodox approaches to current intra-company and strategic planning and, consequently, have to function under the conditions which do not allow fully realizing their potential and effectively organizing mass production (Serebryakova *et al.* 2014). It is possible to solve this problem through formation of corporate entities of a new type which are peculiar for systemic realization if managerial practice of instrumentarium of development and realization of scientifically reasoned managerial decisions which allow coordinating resource possibilities of enterprise with effective demand for the issued products and satisfying the consumers' needs for high-quality food products more fully, as compared to rivals.

Secondly, a comparatively low level of labor payment at most enterprises for manufacture of food products and other socio-economic factors depreciate the existing system of corporate values which is a basis for formation of effective production relations, which does not allow enterprises which process raw materials of agricultural origin having internal integrity and violates their sustainability. This circumstance is a basis for organization of functioning of sectorial enterprises according to requirements set to modern corporate entities which are socio-economic systems, the subjects of management of which have many-aspect responsibility before their employees, consumers, state, institutes of civil society, and other members of market relations (Serebryakova *et al.* 2014).

Thirdly, formation of corporate entities is a natural evolutionary process which corresponds to tendencies of globalization which are peculiar for modern world economy – these tendencies are expressed in establishment of integration connections between separate economic entities. Being a projection of the global phenomena, formation of corporate entities needs development of theoretical and methodological provision which is adequate to conditions of modern innovational environment.

Thus, actuality of the topic of the research is supported by endogenous (low speed of diffusion at enterprises of food industry of means and methods of effective management) and exogenous (insufficient elaboration of conceptual provisions of formation of corporate entities in food industry) factors which hinder formation of corporate entities and their effective functioning.

Corporate entities of food industry are industrial enterprises or their associations, created for the purpose of receipt of profit; they conduct production and economic activities, aimed at industrial processing of agricultural raw materials and production of food and bear responsibility for results of their functioning before consumers, state, owners, managers, employees, and other interested groups (Serebryakova 2014).

The main identifying features of existing corporate entities in production of food products are: mass character of production, which shows potential possibility for realization of advantages of large-scale production; matrix or divisional type of organizational construction, which characterizes structural integrity of entity and determines the character of its behavior in internal and external environment; long-term partnership connections with suppliers of raw materials which provide closeness of production cycle and sustainability of corporate entity; correspondence of business processes to requirements of the concept of general quality management, which positions enterprise's capability to function under the conditions of globalization of the world economy; presence of the system of corporate responsibility which determines conditions and character of execution of responsibilities of the entity before various interested groups (Semenenko 2014).

According to the authors' position, corporate entities of food industry include integrated economic entities of mainly holding type, as well as autonomous and independently functioning industrial enterprises which possess the above peculiarities (Sirotkina and Grishchenko 2013).

Formation of corporate entities in food industry, unlike other spheres of industrial sector of economy, is a relatively new process which requires development of corresponding methodological provision (Serebryakova *et al.* 2014). The most important category that determines the process of formation of corporate entities is corporate responsibility, which is treated by the authors as responsibility produced by owners, managers, and employees of corporate entity and other elements of its internal and external environment (Khorev, Salikov and Serebryakova 2015). Elements that show similar interest unite into interest groups – i.e., groups of participants of organizational and economic relations which are interested in effective functioning of corporate entity and achievement of its other (socio-economic) goals and which contribution into development of corporate entity is a basis of its successful functioning. Formation of corporate entities is an objective evolutionary process, as it is in corporations and thanks to their dual (financial and social) nature that the most favorable conditions for maximization of profit and socialization of production and economic activities are created (Salikov *et al.* 2015). The mechanism of formation of corporate entities in food industry is understood as totality of interconnected elements, order of interaction of which determines content of processes which lead to emergence in the industrial sector of national economy, which specializes in manufacture of food products, of large creative business structures which perform production, administrative, and social functions as could see in Figure 1. (Grishchenko and Kulikova 2014)

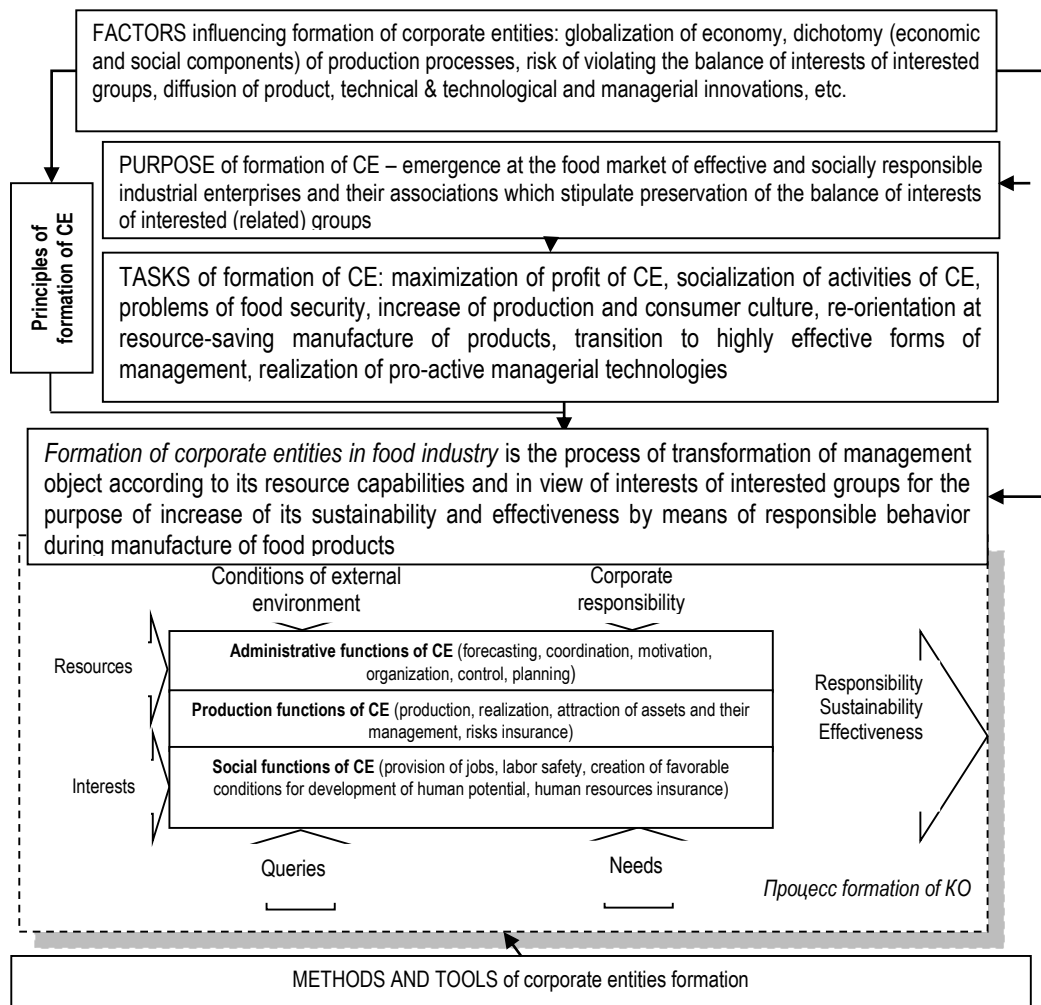


Figure 1 – Mechanism of corporate entities (CE) formation in food industry

The main principles of formation of corporate entities are:

- conscious (responsible) selection of goals and strategies of development of corporate entity;
- constant search for new forms and types of activities which stipulate maximization of income and increase of socialization of corporate entity;
- positioning of corporate entity as a responsible member of food market;
- coordination of interests of interested groups with development of corporate strategy.

The process of corporate entities formation is determined by its functional content. Administrative functions of formation of corporate entities include: development of the strategy of behavior of corporate entity in the market, coordination of goals and interests of interest groups which allows determining strategic landmarks of formation of corporate entity and developing indicators which show their achievement, motivation for maximization of profit and simultaneous socialization of corporate entity, and control over achievement of aims of corporate entity formation. (Zhuravlev *et al.* 2011)

Productive functions of formation of corporate entity consist in current and operative planning of the character and content of productive and economic activities, organization of intra-company interconnection of structural departments of corporate entity according to strategic landmarks which take into account interests of various interest groups. (Serebryakova 2014)

Social functions of formation of corporate entities in food industry include development of the strategy of corporate responsibility, motivation of human resources for socially and economically responsible behavior, realization of socially significant projects, creation of favorable (including safe) conditions for human resources, nature-oriented, and resource-saving activities, activation of activities aimed at development of human potential, and insurance.



## 2. Research methods

Conservatism of food industry complicates implementation at processing enterprises of modern managerial concepts and technologies, so methods and means of corporate transformations, addressed to subjects of the stated sector of economy, need perfection.

At present, as to the state of corporate transformations, enterprises of food industry could be divided – through empirical generalization into the following groups:

- Group A – processing enterprises which possess all or several attributes of corporate entities (Kalacheevskiy and Molvest factories);
- Group B – processing enterprises which initiate corporate transformations (Ostrogzhmoloko, Kamenkamoloko, Kantemirovkamoloko, Rossoshmoloko, and Novovoronezhskiy factories);
- Group C – processing enterprises which do not have corporate initiative (Liskinskiy, Verkhne-Mamonskiy factories).

According to the research tasks, for each group – in view of the phase (stage) of corporate improvement, application of various methods of formation of corporate entities was offered (Figure 2), where: I – phase of generation of idea (appearance of initiative) on formation of CE; II – idea verification; III – design of CE; IV – restructuring of CE; V – motivation of human resources, management, and owners of CE for responsible behavior; VI – standardization and regulation of activities of CE; VII – formation of strategic portfolio of CE; VIII – positioning of CE; IX – functioning of CE; M1 – expert evaluations method, M2 - method of structuring of goals, M3 - method of evaluation, M4 – model testing, M5 – internal benchmarking, M6 – general benchmarking, M7 – functional benchmarking, M8 – method of analogies, M9 – indicator planning, M10 – method of strong and weak signals, M11 – Delphi method, M12 – modified matrix method of strategic planning, M13 – method of extrapolation, M14 – economic and mathematical modeling, M15 – program-oriented method, M16 – scenario method.

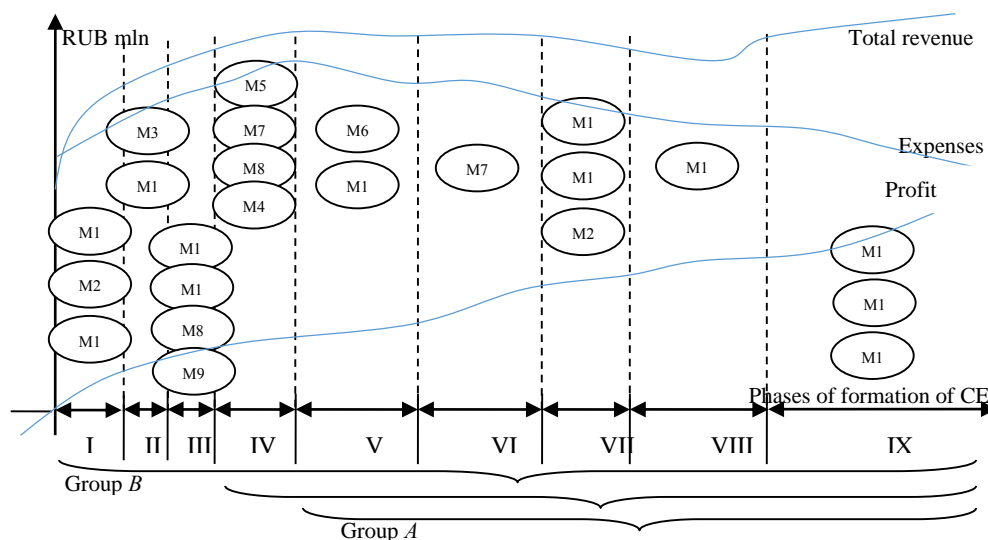


Figure 2 – Realization of methods of formation of corporate entities in food industry depending on the phase of corporate improvement

Curves shown in Figure 2 imitate functions of total revenue, total expenses, and profit of corporate entity, described by the following dependencies:

- function of total revenue (TR) of corporate entity:

$$TR(t) = R_1t_1 + R_2t_2 + R_3t_3 + R_4t_4 + R_5t_5, \quad (2.1)$$

where:  $t$  – period of time, during which enterprise received additional revenue from corporate transformations;  $R_1$  – revenue from realization of additional volume of products, growth of which is possible due to increase of production scale:

$$R_1 = P(Q_2 - Q_1) \quad (2.2)$$

where:  $P$  – price of realization of a product item, RUB;  $Q_1$  – volume of realization before corporate transformations, thousand tons;  $Q_2$  – volume of realization achieved as a result of corporate transformations, thousand

tons;  $R_2$  – revenue (saving) from improvement of organizational structure received as a result of reduction of expenses for labor payment due to reduction of staff, increase of labor efficiency, elimination of responsibilities overlap, and increase of management speed;  $R_3$  – revenue from increase of load of production capacities due to optimization of resource provision, calculated as economy of fixed costs:

$$R_3 = \left(1 - \frac{100}{100 - \Delta A}\right) \frac{C_1 S}{100}, \quad (2.3)$$

where:  $\Delta A$ - growth of volume of issued products as a result of conduct of corporate transformations, %;  $C_1$  – production costs in basic year, RUB;  $S$  – share of fixed costs, %.  $R_4$  – revenue related to increase of trademark prestige;  $R_5$  – revenue from increase of popularity of corporate entity and its products.

It should be noted that receipt of additional revenue is possible only with the use of a set of methods – shown in Figure 2 – in a differentiated manner, depending on the phase (stage) of formation of corporate entity.

- function of total cost (TC) for formation of corporate entity:

$$TC(t) = C_1 t_1 + C_2 t_2 + C_3 t_3, \quad (2.4)$$

where:  $C_1$  – costs related to modernization of existing and start-up of new production capacities;  $C_2$  – costs related to development, implementation, and receipt of certificate of correspondence of the system of quality management of the enterprise to requirements of ISO;  $C_3$  – costs related to development and implementation of standards of corporate social responsibility.

- functions of profit (P) of corporate entity:

$$P(t) = TR(t) - TC(t) \quad (2.5)$$

With factual data of processing enterprises of groups: A, B, and C, the following prediction estimates were received (Table 1):

Table 1 – Scenarios of formation of corporate entities in food industry

Accounting parameters	On average for Group A	On average for Group B	On average for Group B
Phases of formation of corporate entity		Restructuring of CE	Idea generation, idea verification, design, restructuring of CE
	Motivation of interest groups for responsible behavior, standardization and regulation of activities of CE, formation of strategic portfolio, positioning of CE, functioning of CE		
Methods of formation of CE	General and functional benchmarking, method of strong and weak signals, method of extrapolation, matrix method of strategic planning, method of structuring of goals, scenario method, program-targeted method		
		Indicator planning, method of economic and mathematical modeling and analogies	Evaluation method, Delphi method, expert evaluations, economic and mathematical modeling
$R_1$ , RUB thousand	27,375	10,503	7,875
$R_2$ , RUB thousand	987	1,029	700
$R_3$ , RUB thousand	3,023	1,077	707
$R_4$ , RUB thousand	777	688	505
$R_5$ , RUB thousand	245	153	285
$C_1$ , RUB thousand	15,523	8,538	5,989
$C_2$ , RUB thousand	1,300	1,300	1,300
$C_3$ , RUB thousand	300	300	300
Increment in profit, RUB thousand	15,284	3,312	2,483

Thus, the use of methods of formation of corporate entities in managerial practice, if a differentiated manner, depending on the state of corporate transformations and stage of corporate improvement, is capable of providing receipt of additional revenue, increasing economic effectiveness of productive and economic activities, and leading to appearance of corporate structures in the food market which show responsible behavior before interested groups.

### 3. Analysis results

According to the authors, the procedure of formation of corporate entities in food industry should include the following components:

- Conduct of marketing research aimed at determination of need for products, determination of market volume, and comparison of resource provision of enterprise with possibility for satisfaction of effective demand for products within local, national, and global markets. The main tasks of initial stage of formation of corporate entity are: formation and assignment of positive image with corporate entity and issued products: branding of corporate entity; popularization of products issued by corporate entity through advertising and PR-actions.
- Restructuring of enterprise which creates possibilities for advantages of corporation as an organizational and legal form. Realization of this stage is peculiar for organizational perfection of enterprises of food industry which consists in divisional structuring as to functional attribute. Taking into account seasonality of production and consumption of most of food products, organizational structure should have temporary departments which mobilize production potential of corporate entities in most tense period of its functioning (Semenenko 2012). Temporary departments' capability for concentration on solving a problem and determining new leaders, as well as for quick execution of production tasks and, therefore, achievement of goals – which makes employees satisfied with work – and other advantages show that temporary structural departments are an effective managerial tool which can be used in case of force majeure or conflict situations related to transformational processes that always accompany formation of corporate entities (Sirotkina and Grishchenko 2013).
- Establishment of integration connections with suppliers of resources – primarily, raw materials. The main results of effective realization of this stage should be attraction of raw materials suppliers under the conditions that are economically expedient for them; coordination of all key and financial operations, performed by participants of corporate entity; intra-company control over economic effectiveness; technological perfection of production; budget control over targeted spending of resources.
- Management of conflicts between interested groups of corporate entity (Table 2). The most widespread conflict is the one set by the nature of formation of corporate entity, related to non-fulfillment of obligations (Serebryakova and Faradzheva 2013). In practice, corporate entities take up responsibility for fulfillment of the following obligations:
  - before consumers for provision of required qualitative and quantitative diversity of goods and services;
  - before state for payment of taxes, allocations, and other payments and achievement of indicative budget effectiveness;
  - before institutes of civil society through sponsor support for socially significant projects, participation in charity events, investment support for projects with indicative commercial effectiveness, etc.;
  - before owners in achieving strategic goals and normative level of economic effectiveness;
  - before management through achievement of normative level of economic effectiveness;
  - before employees in provision of satisfaction with labor conditions and payment, professional growth, and development of employees' potential.

Table 2. Matrix of conflicts between interested (related) groups of corporate entities

Interested groups of CE	Consumers	State	ICS	Owners	Management bodies of CE	Employees
Consumers	CC, CCE, CNO	CCE, CNO	CNO	CNO	CL, CS	CCE
State	CMC, CL, CS, CNO	CCEP, CNO, CS	CCE, CNO	CCEP, CNO, CS	CCEP, CNO, CS	CNO
Institutes of civil society (ICS)	CL	CCEP, CNO	CNO	CCEP, CNO	CCEP, CNO	CNO, CS
Owners	CMC, CL, CS	CNO, CMC, CL	CNO, CS	CER, CDS, CCEP, CNO, CS	CER, CDS, CRE, CCEP, CNO, CS	CER, CRE, CRS, CNO, CS
Management bodies of CE	CMC, CL, CS, CNO	CCEP, CNO	CNO	CNO	CC, CSO, CNO	CNO
Employees	CS	CNO, CL, CS	CNO, CS	CNO, CL	CCEP, CNO	CC, CNO

Note: CER – conflict of expectations in receipt and distribution of profit, CDS – conflict of determination of strategy, CER – conflict of expectation of receipt of reward, CC – competitive conflict, CRE – conflict of necessity for reduction of expenses and receipt of guaranteed revenue, CSO – conflict between strategic and operative tasks, CCEP – conflict of control over expenses and distribution of profit, CCE – conflict of consumer expectations, CNO – conflict caused by non-fulfillment of obligations, CMC – conflicts caused by necessity for material compensation for violated obligations, CL – conflict caused by loss-making, CS – situational conflict.

- Minimization of risks of corporate entity. Identifying features of food industry – stochastic character of supply of agricultural raw materials for industrial processing, necessity for provision of economically expedient level of use of production capacities under the condition of provision of offer of goods with inelastic demand, presence of large number of manufacturers, etc. – have a good chance of leading to consequences which are unfavorable for corporate entities. This circumstance requires a complex of preventive actions which minimize production, financial, and other risks (Serebryakova 2014).
- Optimization of business processes, bringing them in accordance to requirement of international standards ISO 9001. Implementation of international standards ISO at domestic enterprises of food industry has a range of positive consequences. Firstly, development and implementation of a system of quality management, certified according to standards of ISO 9001 allows ordering business processes and conduct their economically expedient improvement. Secondly, enterprises acquire competitive advantages, as manufacturers of high-quality products which have a possibility to set lower selling price due to economy achieved as a result of optimization of business processes (Voronin *et al.* 2012).
- Development and implementation of regulations of corporate social responsibility. Regulations of corporate social responsibility are universal managerial documents, so it is necessary to take into account not the specifics of production but corporate peculiarities during their development (Serebryakova, Ulchenko and Pankova 2015). Similarly, to development of the systems of quality management, development of regulations of corporate social responsibility should not be conducted under the conditions of outsourcing, as effective realization of the stated documents is possible only as a result of their independent development.
- Development and implementation of pro-active managerial instrumentarium in management practice. Pro-active managerial instrumentarium in the research includes road maps, factor analysis, imitational, and economic & mathematical modeling and other tools which allow making pre-emptive managerial decisions.
- Selecting and implementing in practice the methods of management of corporate entities in food industry. The studied management methods include general scientific (complex approach, experimenting, specific historical approach), specific (methods of solving problems, methods of execution of general management functions, methods of functional departments management), and elementary (organizational and regulatory, economic, social & psychological) methods.
- Development of basic strategy of management of food industry enterprises.

Complex and consistent realization of the above stages will lead to emergence in the food market of sustainable and effective – from economic and social positions – corporate entities which manufacture food products.

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## Estimating Determinants of Unemployment Duration in Korea: Evidence from the Korean Labor and Income Panel Study

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### Abstract:

*This paper examines the determinants of unemployment duration in Korea by using the Korean Labor and Income Panel Study (KLIPS) survey dataset. Empirical analyses find that unemployment duration increases when the subjects are female, older, have less than college education, have more family members, and have been unemployed for over 2 years. Specifically, the education effect is prominent during periods of economic crisis, (e.g. 1997-1998 and 2008-2009), implying that people with no college education have more difficulty finding employment during severe recessions rather than those with college degrees. In addition, we find that the duration of unemployment increases as the level of perception of life satisfaction is increases, which highlights the importance of personal psychological factors in explaining the average duration of Korean unemployment.*

**Keywords:** Korean Labor and Income Panel Study (KLIPS), unemployment, survival model, education, recession, perception, life satisfaction

**JEL Classifications:** C23, C41, J64.

### 1. Introduction

Unemployment, defined as losing a job, is generally related to macroeconomic fundamentals. Weak demand from the labor market can lead to job losses. Unemployment duration as a result of this can be longer than average, as the labor market is sclerotic. From the supply side of the labor market, unemployment could be related to individual characteristics, such as, age, gender, education, marital status, etc. A lot of literature suggests empirical evidence that individual characteristics are significant factors to explain unemployment.<sup>2</sup>

Using a time-to-event (survival) function of the Kaplan-Meier (hereafter K-M), we attempt to find determinants of unemployment duration in Korea. Our analyses are distinguished from the existing literature in several aspects. First, we provide empirical evidence about the duration and demographic structure of the general unemployment duration in the Korean labor market as a first case study among leading emerging economies. Second, we use individual-level data from the first wave of the longitudinal surveys therefore our results refer to Korea as a whole. Also the analysis is carried out for wage workers and self-employed workers as well as males and females separately, in order to identify the differences in the labor market experiences by job type and gender. Consequently, our results of unemployment duration analysis will contribute to the deep understanding of the Korean unemployment duration factors from an individual and household perspective.

### 2. Empirical model

This paper employs the survival analysis to measure individual unemployment duration and obtain an individual level survey dataset to estimate the conditional probability of exiting (leaving) unemployment.<sup>3</sup> The survival analysis is used to model the time elapsed  $T$ , between unemployment and employment. The possible

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<sup>2</sup> For example, please see Goldsmith *et al.* (1997), Kettunen (1997), Valletta (1998), Machin and Manning (1999), Clark (2006), Uysal and Pohlmeier (2011) and Choi (2013). Also, there exists an argument for extra factors, such as, discouragement and loss of motivation, depreciation of human capital, and stigma effects, for instance, see Heckman and Borjas (1980), Jones and Manning (1992), Machin and Manning (1999), Knights *et al.* (2002), and Stewart (2007).

<sup>3</sup> Kiefer (1988) and Lancaster (1990), among others, have comprehensively discussed survival time from an economic perspective; and in a recent study, Freedman (2008) has provided an introduction to survival analysis.

values of  $T$  have a probability density function  $f(t)$ , and a cumulative distribution function,  $F(t)$ . The distribution function of the random variable  $T$  is less than some particular value  $t$ , and is given by  $F(t) = Pr(T \leq t)$ . For all points at which  $F(t)$  are differentiable, we define the associated probability function,  $f(t) = dF(t)/dt$ .

Another important concept is the survival function,  $S(t)$ . It gives the probability that the random variable  $T$  exceeds the specified  $t$ ,  $S(t) = 1 - F(t) = Pr(T > t)$ . The  $S(t)$  can also be thought of as the proportion of units surviving beyond  $t$ . The survival function shows the proportions of people who survive unemployment as time proceeds. Here, we want to find the probability of ending up in an unemployment spell in the next period of time, say  $dt$ , when it has lasted until time  $t$ .

The relationship between failure times and the survival function is captured through the hazard rate,  $h(t) = f(t)/S(t)/(1-F(t))$ . The hazard rate indicates the conditional failure rate, that is, the conditional probability that the spell will terminate at time  $T = t$ , given that it has survived until  $t$ . If the hazard rate is treated as time and as a covariate dependent, then we can re-express the hazard rate, as in the following equation (2.1), where  $X$  represents the covariates.

$$h(t, X) = \lim_{\Delta t \rightarrow \infty} Pr(t \leq T < t + \frac{\Delta t}{T} \geq t, X) / \Delta t \tag{2.1}$$

Using the Cox model, the hazard at  $t$  is the product of the baseline hazard function  $h_0(t)$  and the exponential expression  $e$  of the linear sum of  $\beta_i X_i$ . The hazard rate for the  $i^{th}$  individual is demonstrated in the following equation (2.2).

$$h_i(t, X) = h_0(t) e^{\beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_n X_{ni}} \tag{2.2}$$

where:  $X = X_1, X_2, \dots, X_n$ ,  $\beta$  is a vector of the regression coefficients, the baseline hazard function  $h_0(t)$  is the hazard function when  $X = 0$ , and  $\beta X$  represents the covariates and regression parameters. The regression coefficients  $\beta$  are estimated by the maximum likelihood (ML) method, and  $exp(\beta)$  could be interpreted as the hazard ratio. If one re-expresses the model in terms of the log of the hazard ratios, one obtains the following equation (2.3).

$$\log \left[ \frac{h_i(t)}{h_0(t)} \right] = \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_n X_{ni} \tag{2.3}$$

Suppose  $n$  independent subjects are recruited into a longitudinal study after experiencing an initial event and the recurrences of the same event are recorded during the study period. Let us consider what happens when we have repeatable events.<sup>4</sup> The conditional risk set model, specifically assumes that an observation is not at risk of a later event, until all prior events have already occurred. Thus, the risk set at  $t$  for the  $K^{th}$  occurrence of an event is limited to those observations under study at time  $t$  that have already experienced  $k-1$  events of that type. The estimates are stratified by event rank so that one can get different baseline hazards across event ranks. In this paper, the focus is on one particular model, namely, the "conditional gap time model." The "gap" in the conditional gap time model refers to the time interval between successive repeated events. In this model, after the occurrence of an event, the survival time is assumed to be reset. Thus, after the first event is experienced, the observation becomes at risk for a second event, at which time the survival time starts anew.

If the hazard rate is allowed to vary by the  $k^{th}$  failure in a repeated-events model by the use of stratification, then the data are stratified according to the  $k^{th}$  event. In a Cox model, the hazard or risk of a particular event  $K$  occurring for a specific individual is  $i(h_{ik})$ . So, the data was generated by drawing the time to an individual  $i$ 's,  $K^{th}$  event,  $t_{ik}$ , from an exponential distribution with rate  $h_{ik}$ :

$$h_{ik}(t) = h_{ok}(t - t_{k-1}) e^{\beta' X_{ik}} \tag{2.4}$$

where  $K$  refers to the event number;  $h_{ok}$ , which varies by event number, is the baseline hazard rate;  $t - t_{k-1}$  incorporates a gap time data structure so that the hazard gives the risk for event as  $k$  since the previous event occurred,  $X$  is a vector of independent variables, and  $\beta$  gives the effect parameters. The model is formulated in gap time so that the parameter estimates can be interpreted as a risk estimate for the  $K^{th}$  event since the previous event.

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<sup>4</sup> Repeated events can be handled in a variety of ways (Cleves 1999, Box-Steffensmeier and Zorn 2002, Box-Steffensmeier and Jones 2004).

### 3. Data and summary statistics

As mentioned before, the main dataset in this paper is taken from the Korean Labor and Income Panel Study (KLIPS) survey data for waves 1 to 15 (1998-2012) and the Work History data for 15 waves, a wide ranging representative survey that contains a large set of personal and labor market characteristics of household members.<sup>5</sup> The panel also includes some questions aimed at capturing the household structure, background of individuals in their teens, and current satisfaction with the individual's living environment.

The sample used for estimation includes men and women aged between 19 and 60 years who are potential labor market participants, except for the individuals that are students and those who temporarily stayed out of school in each survey year. We also excluded samples that had no response in job types, timing of job entry or exit, and retired people. We merged the KLIPS data and the Work History data, for our survival analysis. In this way we chose 24,401 relevant samples.

Table 1 shows the definitions of the variables and notations. The key analysis variables are: the individuals' duration of unemployment and the hazard factors (explanatory variables) for the probability of being employed, along with identifiers for selected individual and household characteristics. The duration of unemployment is measured in days or time elapsed between a final date in the previous job and the start date of the next employment opportunity. Any remaining unemployed people are treated as right censored.

Table 1- Definition of variables

VARIABLE NAME	NOTATION	DEFINITION
Duration of unemployment	UND	Period to escape unemployment (days)
<i>Individual and household characteristics</i>		
Gender	FMD	Female=1, Male=0
Age group	AGE_1	Age 19-29=1, Otherwise=0
	AGE_2	Age 30-39=1, Otherwise=0
	AGE_3	Age 40-49=1, Otherwise=0
	AGE_4	Age 50-60=1, Otherwise=0
Education level	EDU_1	Middle school or under=1, Otherwise=0
	EDU_2	High school=1, Otherwise=0
	EDU_3	Bachelor degree=1, Otherwise=0
	EDU_4	Over graduate degree=1, Otherwise=0
Marital status	MSD	Married=1, Otherwise=0
Household size	FAM	Number of family members
<i>Household background</i>		
Growth Region	GRD	Metropolis in their teens=1, Otherwise=0
Family wealth in their teens	HWD	Family circumstances over scale 4=1
Unemployment history	UNH	Previously unemployed over 2 years=1
<i>Propensity for current living</i>		
Family income	SFI	Feeling with family income
Leisure	SLE	Feeling with leisure
Residential environment	SRE	Feeling with residential environment
Family relations	SFR	Feeling with family relations
Near relatives	SNR	Feeling with near relatives
Social familiarity	SSF	Feeling with social familiarity

Of the basic demographic trait variables, gender, age, and education level are measured using dummy variables. Of the household characteristics, including growth background variables (marital status, family size, growth region, and household wealth), marital status, growth region and family wealth in their teens, are measured using dummy variables. The unemployment history variable is measured using a dummy variable set on the basis of the unemployment duration over two years. Current satisfaction status variables are measured by scores ranging from 1 to 5. The questions indicating current satisfaction with their living environment are family income, leisure, residential environment, family relations, near relatives, and social familiarity.

<sup>5</sup> The KLIPS data have been constructed by the Korea Labor Institute in the manner of longitudinal surveys from 1998 about randomly selected sample of approximately 5,000 households and individual constituents residing in urban areas. The Work History data, which is based on jobs, contains information about all of the individual jobs.



Four dummy variables house data for the corresponding age groups: from 19 to 29, from 30 to 39, from 40 to 49, and from 50 to 60; reference age group is 19-29. Four dummy variables house date for the corresponding level of education: less than a middle school diploma; high school diploma; college and university degree; graduate and higher. The reference education group is those with less than a middle school diploma. Marital status dummy variable is 1 if married and living with their mate, 0 otherwise (never married, divorced, and widowed). The household background measures growth region and household wealth of individuals during there teen years.<sup>6</sup> An unemployment history dummy was set to 1, if previously unemployed over 2 years, 0 otherwise.

Table 2 shows the distribution of unemployment duration for this sample and explanatory variables of the panel data measurements during all the sample periods by job type. The mean duration of unemployment of total sample is 953.5 days. In the sample, the types of unemployment by destination state are included as exit to employment (94.78%) and right censored (5.22%), then the mean duration of completed spells is 882.29 days and the mean duration of censored spells is 2,246.12 days, respectively. The distribution of duration is positively skewed with about 40% of the sample having unemployment duration of less than six months (183 days), and about 16 per cent having duration in excess of five years (1,826 days). It is shown that job type is important for self-employed workers since they appear to be at greater risk of long-term unemployment. The proportion of wage workers who are long-term unemployed (> 1year) is a little under 65%. This contrasts with 68% of self-employed workers.

Of the individual and household characteristic variables, females are 46.38%, those married and living with their mate are 68.72% of the sample. The age group of from 30 to 39 is the largest taking 33.43% of the total sample. In the education level, those with high school diplomas were 44.62% of the sample, college and university degree made up 31.08% of the sample. The percentage of individuals previously unemployed over two years is 61.12% of the sample. In connection with satisfaction status, the mean values of current satisfaction with their living environment are respectively 2.64% (family income), 2.84% (leisure), 3.15% (residential environment), 3.63% (family relations), 3.42% (near relatives), and 3.42% (social familiarity).

Table 2- Summary Statistics

Factors	Total	Wage worker	Self-employed worker
<i>Mean duration (day)</i>			
Total sample	953.50	1079.00	1370.45
Completed spells	882.29	962.99	1249.68
Censored spells	2246.12	2430.51	1870.31
<i>Type of unemployment spell by destination state</i>			
% Exit to employment	94.78	92.09	80.54
% Right censored	5.22	7.91	19.46
<i>Duration group</i>			
% < 183 days	39.99	35.55	31.98
% 184-365 days	12.75	12.86	10.86
% 366-730 days	14.39	14.97	13.32
% 732-1,826 days	17.00	18.34	19.60
% > 1,826 days	15.87	18.29	24.25
%Female	46.38	48.02	39.68
% Married	68.72	65.66	82.62
<i>Age group</i>			
% 19-29	20.11	23.92	3.33
% 30-39	33.43	35.17	24.14
% 40-49	26.73	24.52	37.77
% 50-60	19.73	16.39	34.76
<i>Education level</i>			
% EDU_1	20.63	19.38	29.31
% EDU_2	44.62	44.74	45.44
% EDU_3	31.08	32.00	23.24
% EDU_4	3.67	3.88	2.01
Sources of subsistence			
% Unemployment benefits	28.74	36.00	0.03

<sup>6</sup> Metropolis refers to the current seven metropolitan cities in Korea.

Factors	Total	Wage worker	Self-employed worker
<i>Growth background</i>			
%Growth region in their teens (Metropolis)	32.71	33.78	29.83
%Family wealth in their teens	42.49	42.39	45.65
<i>Propensity for current living</i>			
Sati1(mean)	2.64	2.65	2.54
Sati2(mean)	2.84	2.85	2.77
Sati3(mean)	3.15	3.14	3.17
Sati4(mean)	3.63	3.63	3.60
Sati5(mean)	3.42	3.41	3.41
Sati6(mean)	3.42	3.41	3.40
Number of spells (observations)	24,401	19,265	2,847

Figure 1 shows the trends of mean duration of unemployment for this sample by educational attainment. This suggests that, based on the sample, there are no considerable differences in the duration of unemployment spells. We can see that during the financial crisis of Korea in 1998 and the global crisis in 2008, all of the mean durations of unemployment grouped by educational level were lengthened dramatically. Interestingly, the wide gaps in the durations among the groups of disparate education levels imply that during the two crises, the less educated workers are unemployed more often and longer than highly educated workers.

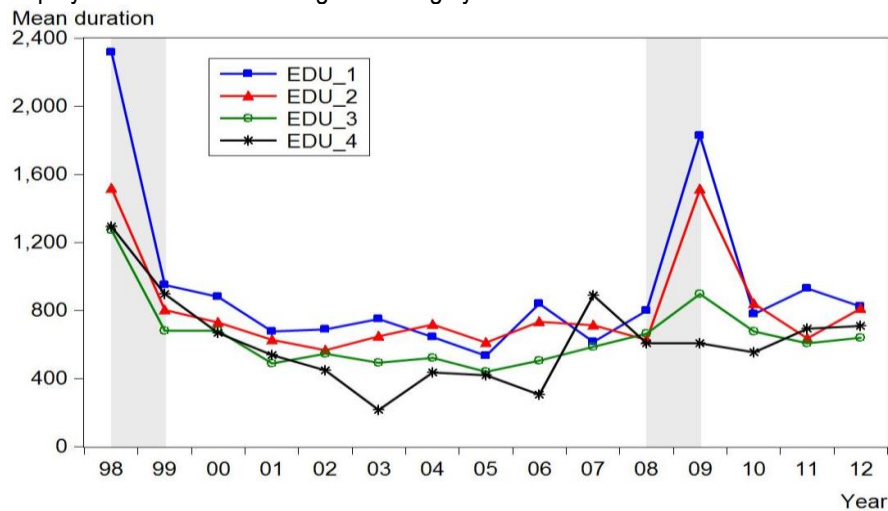


Figure 1 - Unemployment duration by educational attainment

Note: EDU\_1 shows middle school or under, EDU\_2 shows high school, EDU\_3 shows bachelor degree, EDU\_4 shows over graduate degree, respectively.

## 4. Estimation results

### 4.1. Results from the Kaplan-Meier estimation

We start with a non-parametric duration analysis of the dataset for analyze the duration of unemployment and the probability of employment. In the non-parametric approach to the duration analysis we provide the estimates of the Kaplan-Meier survivor method, which is the most common technique and typically includes an initial estimation of the unconditional hazard function.

Table 3 displays the distribution of unemployment duration. The mean duration of unemployment in the total sample is 953.5 days. Twenty-five percent of workers escaped unemployment within 365 days, but 75% of workers appeared to maintain a longer unemployed period of over 2,163 days. The mean duration of self-employed workers is 1,370.45 days, and this contrasts with 1,079 days of wage workers. Specifically, unemployment duration in 25% of self-employed workers was relatively short at 246 days, but 75% of self-employed workers of unemployment duration were 2,703 days.

Table 3 - Distribution of unemployment duration

		Mean duration (days)	Accumulated duration(days)		
			25%	50%	75%
TOTAL		953.50	365	1,035	2,163
Job Type	Wage worker	1,079.00	366	1,005	2,017
	Self-employed worker	1,370.45	246	1,137	2,703

Table 4 presents the non-parametric estimation results. The results of survival analysis are identified by three functions: The Kaplan-Meier survival function (hereafter unemployment probability function;  $S(t)$ ), the Kaplan-Meier failure function ( $1-S(t)$ ), and the Nelson-Aalen estimate of the cumulative hazard function. Through these functions we can characterize the distribution of the unemployment duration. The Kaplan-Meier survival functions show the proportion of individuals who leave unemployment as time proceeds. Depending on the duration of unemployment, the cumulative probability of unemployment is dramatically reduced because of the increasing number of escape to employment event incidents through re-employment. For the total sample, the probability of unemployment persisting for more than one year (365+ days) is 52.6%, while the probabilities that it persists for more than three years (1,095+ days) and five years (1,826+ days) are 31.7% and 20.0% respectively. This phenomenon is shown in the results of the survival function estimation shown in Figure 2.

Table 4 - The Kaplan-Meier survival functions

	Unemployment probability $S(t)$	Exit to employment event				
	DAYS	Beg. TOTAL	N	SF	95% Conf. Int.	
TOTAL	182	15,031	4,695	0.6873	0.6798	0.6946
	365	10,301	1,875	0.5616	0.5536	0.5695
	730	8,332	2,314	0.4052	0.3973	0.4131
	1,095	5,969	1,300	0.3169	0.3094	0.3244
	1,826	4,664	1,720	0.2000	0.1936	0.2065
	3,652	2,941	1,695	0.0847	0.0803	0.0893
Wage worker	182	11,973	3,237	0.7292	0.7212	0.7371
	365	8,700	1,502	0.6025	0.5937	0.6113
	730	7,089	1,893	0.4409	0.4319	0.4498
	1,095	5,131	1,059	0.3498	0.3412	0.3585
	1,826	4,064	1,446	0.2253	0.2178	0.2329
	3,652	2,613	1,464	0.0991	0.0937	0.1046
Self-employed worker	182	1,925	457	0.7616	0.7419	0.7800
	365	1,452	162	0.6751	0.6535	0.6956
	730	1,238	214	0.5565	0.5336	0.5788
	1,095	985	173	0.4587	0.4358	0.4814
	1,826	811	241	0.3222	0.3008	0.3439
	3,652	568	311	0.1458	0.1298	0.1626

Note: N and SF indicate the number of events and survival function, respectively.

Figure 2 plots the estimates of the survival function (panel (a)) and the hazard function (panel (b)) of unemployment duration for the total sample. As is evident from the figure, the estimation results of the probability of exit to employment show the turnover in unemployment to employment at each point in time. As seen in the graphs for all data, the survivor function (unemployment probability function) declines steeply. This implies that unemployed workers likely to find jobs in a relatively short time, the hazard rate also starts to decrease sharply until about 3 years. Estimated probabilities of exit to employment are reduced significantly over time for duration of less than 3 years, but thereafter there is a relatively slow decrease in the hazard rate. The graphs imply that the longer period of unemployment due to failure to escape quickly from unemployed status is lower than the probability of escaping unemployment.

Figure 3 demonstrates the estimates of the Kaplan-Meier failure function (panel (a)) and cumulative hazard function (panel (b)) for the probability of exit to employment by educational attainment. As expressed by the figure, there is clear evidence of longer unemployment duration of less educated workers in comparison to highly educated workers. The figure shows that the probability of exit to employment for highly educated workers is higher than less educated workers.

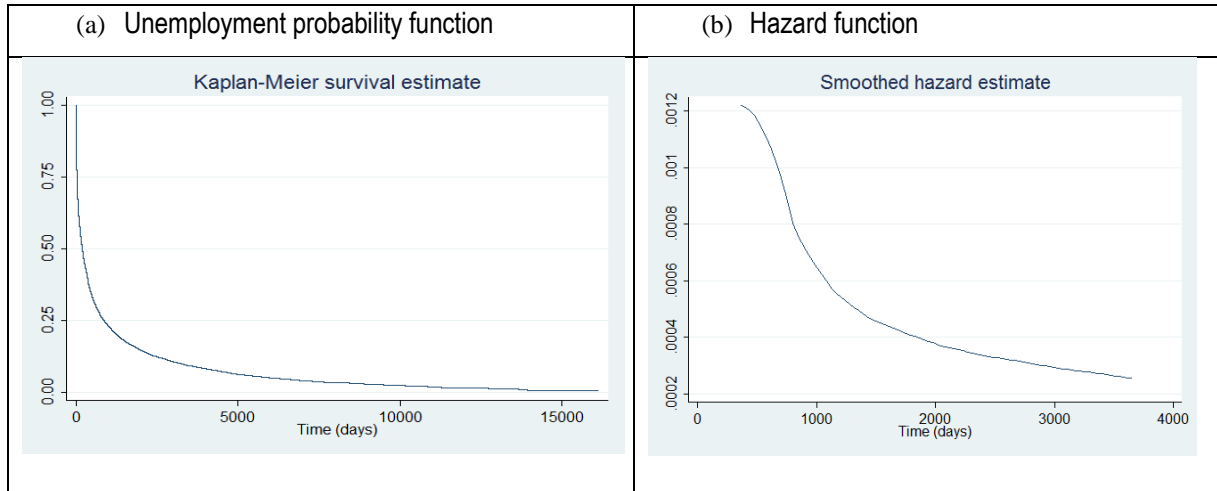


Figure 2 - The Kaplan-Meier survival and hazard functions

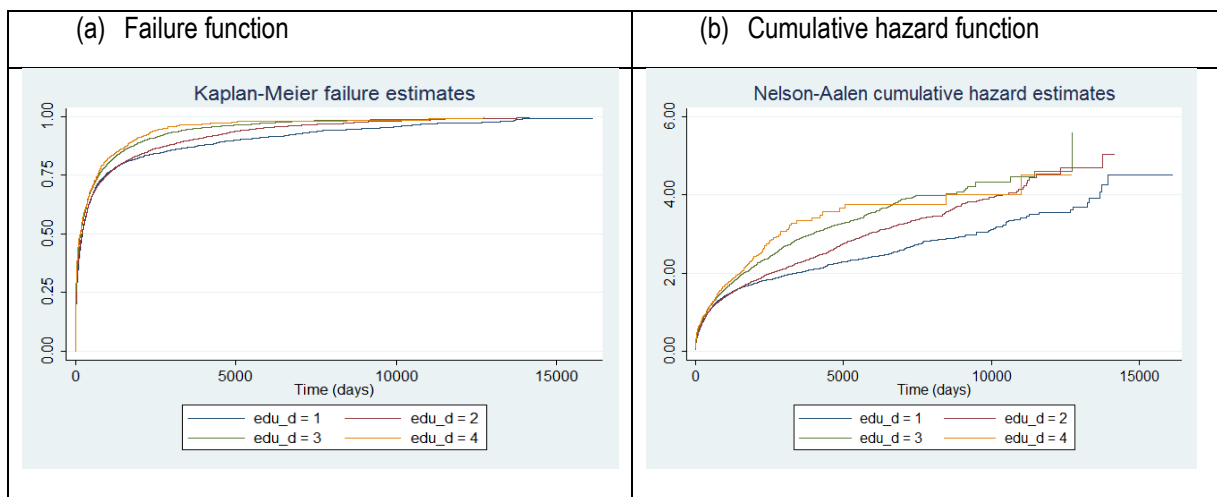


Figure 3 - The Kaplan-Meier failure functions by educational level

#### 4.2. Results from the Cox estimation

The main drawback of the non-parametric analysis is that since the effects of covariates are not modeled, it cannot reveal great insight in terms of an explorative analysis on the influence of certain variables on the duration of unemployment and the probability of employment. The semi-parametric approach by Cox (1972) is used to derive conclusions about the impact of the various variables. Now we estimate the effects of hazard factors (independent variables) on the probability of exit to employment.

The conditional hazard function is estimated in a manner that allows the explanatory variables to affect the employment hazard proportionally. Results of fitting the conditional gap time Cox regression to the unemployment spells are given in Table 5. The estimated coefficients imply the proportionate impact of each variable on the state-specific hazard. Table 5 presents the estimates for the Cox model of the probability of exit to employment for the total sample. The hazard ratios are an exponential value of coefficient estimates. Thus, a hazard ratio for any coefficients significantly above one implies that an increase in the corresponding variable leads to a significantly faster transition to employment.

Although several variables are not significantly estimated<sup>7</sup>, most of explanatory variables are significantly

<sup>7</sup> Marital status and growth region in their teens, however, have no significant effect on the duration of unemployment

estimated to explain the unemployment duration in Korea. Gender of an individual has significant effect on unemployment duration as depicted by the coefficient of the variable. The coefficient estimates of the female dummy variable are significant with a negative sign indicating that females suffer longer unemployment duration as compared to males. The results imply that due to the family responsibilities males tend accept any job offer as soon as possible as opposed to females. However, females have a lower chance of finding a job and leaving unemployment compared to males. For females, however, the exit rate from unemployment to employment is found to be higher for self-employed workers than for wage workers.

Table 5 - Conditional gap time Cox estimates of exits from unemployment

VARIANT FACTOR	TOTAL sample		Estimates by job type			
			Wage worker		Self-employed worker	
	Coefficient estimates	Hazard ratios	Coefficient estimates	Hazard ratios	Coefficient estimates	Hazard ratios
Female	-0.324*** (0.029)	0.723	-0.185*** (0.033)	0.831	1.148* (0.089)	3.152
<i>Age group</i>						
30-39	-0.081* (0.043)	0.922	-0.167*** (0.048)	0.846	0.267 (0.514)	1.306
40-49	-0.034 (0.047)	0.967	-0.244*** (0.053)	0.783	0.312 (0.509)	1.366
50-60	-0.262*** (0.049)	0.974	-0.326*** (0.057)	0.722	0.206 (0.509)	1.229
<i>Education</i>						
High school	0.027 (0.038)	1.027	0.022 (0.045)	1.022	0.145 (0.093)	1.156
Collage	0.126*** (0.043)	1.134	0.161*** (0.050)	1.175	0.398*** (0.104)	1.489
Graduate	0.166** (0.078)	1.181	0.250*** (0.094)	1.284	0.328* (0.174)	1.388
<i>Household characteristics</i>						
Married	-0.033 (0.038)	0.968	-0.005 (0.031)	0.995	0.117 (0.112)	1.124
Number of family	-0.024** (0.014)	0.976	-0.038 (0.031)	0.963	-0.057 (0.035)	0.945
Growth region	0.030 (0.027)	1.030	-0.067 (0.044)	0.935	0.184** (0.074)	1.202
Household background	-0.022 (0.027)	0.978	-0.052*** (0.016)	0.949	-0.029 (0.075)	0.971
Previously unemployed over 2 years	-0.236*** (0.034)	0.790	-0.257*** (0.039)	0.773	-0.276** (0.116)	0.759
<i>Current satisfaction</i>						
Sati1	-0.147*** (0.029)	0.863	-0.137*** (0.035)	0.872	-0.035 (0.080)	0.966
Sati2	0.049 (0.032)	1.050	0.013 (0.038)	1.013	0.064 (0.087)	1.066
Sati3	-0.077** (0.038)	0.926	-0.120*** (0.046)	0.887	-0.181 (0.118)	0.834
Sati4	-0.047 (0.073)	0.954	0.038 (0.093)	1.039	-0.101 (0.195)	0.904
Sati5	0.025 (0.081)	1.025	-0.060 (0.098)	0.942	0.024 (0.220)	1.024
Sati6	-0.257*** (0.089)	0.773	-0.120 (0.107)	0.887	-0.160 (0.227)	0.852
N (unemployment spells)	7,300		5,814		1,242	

Number of failures	6,357	4,693	874
Log likelihood	-37,932.415	-27,244.761	-4,446.192
Wald chi2 (18)	305.86***	280.45***	64.39***

Notes: Robust standard errors are reported in parentheses; \*, \*\*, \*\*\* indicate the significance of the Wald test statistics at the 10%, 5%, and 1% level, respectively; Log likelihood means the log pseudo-likelihood; Wald Chi2 is the Wald Chi-squared test statistic for the overall significance of the model.

One of the important factors influencing the unemployment duration is age. The next set of dummy variables is four different age groups. The reference category is age 19-29. An increase in individuals' age lowers the probability of exit to employment, and the unemployment duration increases as age increases. As expressed for wage workers, all age groups have significantly lower hazard rates relative to age 19-29 and workers over 50 have the lowest chances for finding a new job.

The next set of dummy variables indicates the educational attainment of the workers. The reference education level includes those who are graduates of middle school or under. EDU\_2 indicates graduates of high school. EDU\_3 indicates graduates of college and university. EDU\_4 is graduate school and beyond. Individuals with bachelor degrees and graduate degrees (and beyond) suffer less unemployment duration than the other groups. For example, the statistically significant hazard ratio of 1.18 for EDU\_4 means that an additional educational attainment increases the probability of employment by 18% relative to the reference category.

Positive parameter estimates regarding educational attainment are consistent with human capital theory. Results imply that, *ceteris paribus*, individuals who have higher educational attainment have significantly increased hazards to employment than individuals with a lower level of education. These higher exit rates among educated workers can be explained by their more efficient ability to search for a job due to better access to information, higher opportunity costs of unemployment, greater flexibility and wider range of alternatives for future employment.

Household characteristics of an individual have significant effects on the re-employment probability. Individuals belonging to large families suffer higher unemployment duration and this tends to reduce the probability of leaving unemployment for the total sample. This implies that individuals who have a large family size may be under less financial pressure to return to work, because of the possibility of income from other family members.

The effects of household background on the probability of leaving unemployment are not clear. However, it is interesting that individuals who grew up in a wealthy family were found to have a significant decreasing effect on the probability of leaving unemployment for wage workers. Thus the coefficients on the household background variables confirm that individuals who come from good families may be more likely to experience long-term durations of unemployment. This implies that individuals who grew up in a wealthy family may be under less financial pressure to return to work and they may have lower opportunity costs while staying unemployed and have the chance to search more intensively for a new job.

Workers previously unemployed for a long term can expect longer unemployment duration than others. So the experience of previous long term unemployment exerts significant negative impact on the probability of employment. The estimated coefficients of the previous unemployment duration variable, which is a dummy variable indicating those unemployed for over 2 years, were found to have a negative impact regardless of job type. Other things being equal, the results show that an individual experiencing long-term unemployment in the previous period has a lower probability of employment than somebody who has a short unemployment period. This result is consistent with the presence of a stigma or scarring effect, with unemployment experience having a significant effect on future labor market behavior.<sup>8</sup>

The additional set of dummy variables represents the effects of the individual's propensity to a current living environment. The estimated coefficients on satisfaction with family income, residential environment, and social familiarities are negative and statistically significant. This implies that individuals who have high satisfaction with their current family income, residential environment, and social contact with other people show decreased probability of exit to employment.<sup>9</sup> However, the satisfaction variables of leisure, family relations, and near relatives do not have significant influence on the transition probability to employment for the total sample.

<sup>8</sup> Unemployment incidence, as mentioned by Pissarides (1992), reduces individual human capital, and may be considered as an indicator of lower productivity. In a similar perspective, previous studies such as Phelps (1972), Lockwood (1991), and Blanchard and Diamond (1994) also support the phenomenon that employers use an individual's unemployment history as a screening device.

<sup>9</sup> This is because theoretically, some people who are highly satisfied with their wealth could develop a greater attraction for residential environment as well as less sincerity toward work, and less motivation or ambition.

## Conclusions

This paper examines the effect of individual characteristics on unemployment duration (probability of leaving unemployment) in Korea. By using the conditional gap time Cox models of exits to employment with the KLIPS survey dataset, the hazard rates are estimated for wage workers and self-employed workers separately. Our results suggest that most of demographic and economic variables, such as, gender, age, education level, family size, and prior unemployment experience, are significantly estimated to explain unemployment duration. These results are consistent with a number of previous studies that recognize the importance of individual characteristics in determining the risks associated with unemployment, and unemployment duration. (Nickell 1980, Jones 1988, Gorter and Gorter 1993)

In addition to the above conventional findings, this paper highlights a couple of empirical results. First, the education effect is prominent during the sub-periods, 1997-1998 and 2008-2009. This result provides the meaningful implication that a college level education plays more important role in exiting from unemployment. This is particularly true during periods of severe recession rather than during normal economic states. Second, individuals who have high satisfaction with current family income, residential environment, and social contact with other people have a decreased probability of exit to employment. This result highlights an important facet of personal psychological factors explaining unforced unemployment behaviors, those conflicts with conventional demographic and economic factors. It is useful to separate the unemployment duration variable into two different types: unforced-unemployment and forced-unemployment. Such separation helps to estimate the importance of psychological factors for unemployed duration. Also, experimental study is useful to obtain more precise personal perception on life-satisfaction, since experimental methods can capture immediate reactions regarding satisfaction. Such experimental research methods on unemployed workers are expected to extend the existing labor economics research to the new field of behavioral labor economics.

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## Formation of the Conception of Economic Opportunism in David Hume and Adam Smith`s Works

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### Abstract:

*The article analyzes the evolution of the issue of economic opportunism in the context of the history of economic mind – particularly, within the research of David Hume and Adam Smith. It is shown that in the process of search of English empirical philosophy of the 18<sup>th</sup> century for foundation of social order, the purely economic preconditions for social order are determined, their consequences are defined, and the basic notions of the conception of economic opportunism are formed. Historical fates of these ideas from the point of view of various courses of modern economic theory are described.*

**Keywords:** British empirical philosophy, morality and economics, social order, economic opportunism.

**JEL Classification:** D21.

### 1. Introduction

The issue of opportunism is one of the key problems which determine the modern understanding of economic processes. At the same time, this issue, in spite of the large number of publications, devoted to this topic, and unambiguity of evaluations of effects of opportunistic behavior, containing in the works on the economic theory, is still open. In particular, the very conception of opportunistic behavior is one of the main “gateways” for supplementing economic models with moral (societal) principles, where the efficiency is related to virtue, and allocation – to distribution. This is reflected in various variants of interpretation of trust as a factor of economic development.

Besides, within the theory of contracts, the use of approaches which are peculiar for the paradigm “structure-behavior-result” leads to decrease of explanatory potential of opportunism conception as to dynamic aspects of economy. The thing is that the stated paradigm usually supposes the pre-determined set of both structural characteristics of economic benefit or exchange process and varieties of contract relations which determine the agent strategies of transaction costs’ minimization. The models which are formed at this are advantageous operation-wise, but, as a matter of fact, static.

Not least of all, this situation may be preconditioned by the well-known obscurity of historical horizons of the economic opportunism conception. On the one hand, the opportunistic behavior is a “timeless” phenomenon, peculiar for any epoch, and on the other hand – the issue of economic opportunism was raised by the modern socio-economic mind (say, within O. Williamson’s theory). Meanwhile, if we acknowledge that economic opportunism conception is a purely historical phenomenon, *i.e.*, a developing and constantly changing phenomenon, then the search for conceptual reasoning of this theory is obvious and necessary.

As a starting point, one can use the study of B. Mandeville with the motto: “vices of individuals are virtues of society” and the reaction to this study of D. Hume and A. Smith. Surely, the stated problematics was in one way or another analyzed in the works of other early economists (in other words, the matter under inquiry is brought not *in statu nascendi*, but *in statu formandi*). However, our choice is determined by the fact that before B. Mandeville the topic of ambivalence of interaction of ethics and economy was not considered to be the central one during the study of social processes; D. Hume was one of the first to consistently and elaborately analyze the genesis of contracts and contract mechanisms of interests and actions of individuals *per se*, as well as of institutional and evolutionary aspects of agreements; finally, before A. Smith, the multi-dimensional nature of human actions in the context of the issue of interaction of moral, political, and economic institutions was not studied so thoroughly and in complex.

### 2. David Hume: value and morality

Thus, the change of paradigm of substantiation of social order from the medieval *ordo* (where the notion of

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utilitarian nature of the state was still closely connected with the general corporativity and hierarchy of world order) to immanent self-sustaining processes of early modern period was abound in counter-intuitive, often paradoxical inventions, among which the most prominent is the study of Mandeville (1974). Ethical nature of his theory, sudden opposition of individual actions – mostly, deceit, violation of agreements, and hypocrisy – as the vices, to the social result of their realization, as a virtue, led to the corresponding reaction of the social scientists of that epoch.

Thus, Hume sets forward his opinion as to the notions of “The Fable of the Bees” on the pages of book 3 of “A Treatise of Human Nature” – “Of Morals” (Hume 2001). This opinion may be compared to cold shrug of shoulders: “if someone likes to call self-love – the main feature of human nature – a vice,” - says Hume, - “well, let it be a vice.” Reflections of the Scottish philosopher lead, however, to different results, in which a modern researcher, without fear of ghosts of anachronism, could see the saplings of the main theories of the 20<sup>th</sup> century which take into account the economic opportunism. According to Hume, self-love is a natural basic behavioristic feature of a human, correlating at the biological level with the instinct of self-preservation (in other words, self-love here is not a moral principle as quintessence of social order, but a natural aspiration of an individual for satisfaction of wants; the importance of this remark will be demonstrated below). A specifically human feature of self-love is its dual nature: on the one hand, a human can more or less evaluate the consequences of his actions; on the other hand, a direct present interest often plays a leading role in the process of decision making.

In eternal solution of this dilemma Hume sees the peculiarity of human being which is manifested in the development of cooperative activity: self-love, or its mode, to be precise – is a strive for improvement of own position – directly preconditions the appearance of society, for a human is able to see that cooperative activity always produces a potentially better result than individual activity. At the same time, it is cooperation that enables the possibility of nonproductive beneficence, as resources are limited, and the results of labor in their natural state are estranged from the creative individuals and are not specified. Here comes the self-love that is based on the direct interest and which pushed an individual to acquire as much of the product of mutual labor as possible, which challenges the continuation of cooperation.

It should be noted that Hume considers this state of things with optimism and, developing Locke’s ideas, doesn’t see a huge problem in constant strain between individuals’ strive for cooperation and fear of being deprived in the result of cooperation. As self-love is an undeniable basis of human nature, it can be managed only with the help of self-love (*clavus clava*) – the correct system of stimuli can determine and determines our choice in favor of cooperative activity. Once the rules of determining the ownership of cooperative labor results are set, that is, the results’ independence is limited, and the relative sustainability of these rules are provided, the human’s self-love will inevitably stimulate him to preserve cooperation and society as a whole.

Where is the instrument which is capable of providing such conditions? Hume points it out – agreements, which are a system of mutual behavioristic expectations of individuals (which would later be called by N. Luhmann a double contingency). By such agreements an artificial virtue is formed – justice, this is a basis of social institutions, in particular, a basis of property rights. It is justice, determined by society’s interests and considerations of benefit, that is a center and quintessence of Hume’s study; “create abundance or extreme poverty...” – he writes in “An Inquiry Concerning the Principles of Morals” – “and, making the justice absolutely useless, you will thus destroy its essence” (Hume 1966-a, 229).

It is important that the mentioned mutual expectations of individuals are characterized by uncertainty and largely depend on the history of relations, trial and errors – in other words, on adaptation that forms a habit, an empirical belief which allows saving intellectual efforts, but which is not a strong determinant. Besides, the agreements are not based on the mutual promises (nodal moment), but only on the consequences of individuals’ actions (a famous example with oarsmen in a boat). Here we deal with the continuation of gnoseology (anti-inductivism) in morals issues: intentionality (in this case – of a deed) does not coincide with the reflexive side of affairs.

A gap between empirical and rational entities may be covered by language, rather, language experience, which is set by a philosopher between feelings and reason. Thus, Hume writes: “experience has taught us, that human affairs would be conducted much more for mutual advantage, were there certain symbols or signs instituted, by which we might give each other security of our conduct in any particular incident. After these signs are instituted, whoever uses them is immediately *bound by his interest* to execute his engagements” (Hume 2001). Then, Hume – in the same way, as does M. Olson nowadays, dealing with the essence of “prisoner’s dilemma” (though, with different results), – mentions two possible situations of realizations of agreements. In small societies, the control of performance of the agreements is easy and the consequences of violations are obvious, so the excesses may be solved at interpersonal level. It is not so in large societies. Reasons and consequences of actions are rarely empirically compatible, control is complicated, and the regulating center of gravity is shifted to the supraindividual

level. Here appears the moral which ensures the preservation of agreements; the moral is based on the feelings that allow effectively differentiating the virtues and vices, on the basis of primary human affects. Rational judgments, which are based on the categories of truth and deceit, are ousted from the sphere of morality.

In such system, the connection between acting agents is largely predetermined (as in Shaftesbury's works) by sympathy – sensual and speculative moment or special human feature, imagination, which allows reproducing the partner's feelings and providing solidarity of points of view as to the same circumstances (in *Second Enquiry* sympathy is partially substituted and partially supplemented by less reflexive benevolence).

Correspondingly, two aspects, in which Hume completely disagrees with Mandeville, become clear. Firstly, as was mentioned above, Hume is sure that Mandeville substituted the term: stating that vices are the basis of social well-being, he, actually, means self-love, not discerning its complex and ambiguous nature, thus simplifying and diluting the problem. Secondly, Hume, certainly, couldn't agree with Mandeville's thesis that the main source of morality is politics (though, he acknowledged that politicians could increase the influence of moral stances in society). This idea of morality's nature dates back from Plato's "The Republic" which emphasizes the role of "Phoenician lies" in moral practices, realized by wisemen-politicians for the sale of common good, further develops in conception of Hobbes's "Leviathan" and, on the contrary – suffers criticism from Hutcheson who claims that even the higher wisdom doesn't grant the right to rule the others. In his turn, Hume, supporting the idea of utilitarian and sensitive nature of morality, wasn't inclined to exaggerate the role of planned social engineering, leaving to it only the correcting activities.

Thus, Hume, orienting at specific gnoseology an empirical moral philosophy, forms the basis of understanding of social order, the characteristic feature of which is resting on the behavioristic human qualities. The latter include self-love which has dual nature and which determines the internal conflict of an individual who makes a decision – between motivations for keeping an agreement and motivations for violating an agreement (which is acknowledged by modern theory of optimal contract); capability for organization of agreements (contracts), – artificial basis for development of morality as a foundation of social order; sympathy as a psychologically colored holistic principle of agent's interaction. All of this determines the implicit non-separatedness of economic and moral problematics, which results in Hume's public morals becoming a unique economic resource (as in, for example, modern sociological conceptions of trust – say, in F. Fukuyama's variant), and economics includes moral motives.

The issue of opportunistic behavior per se is not raised by Hume: as in social life we deal with uncertainty, as instability of intentions is an unrecoverable "weakness of human nature" (essay "Of the Origin of Government") (Hume 1966c). Correspondingly, the economic opportunism by Hume cannot be discerned from vivid and forceful actions as to redistribution of property – attention is concentrated only on the methods of providing the "enforcement" of agreements which corresponds to the interests of society (it is necessary to make people consider their own unobvious interests – notes the philosopher in his essay "Of the Origin of Government") (Hume 1966c). At the beginning of the first chapter of the book "Of Morality" of "Treatise", Hume characteristically eliminates the epistemic side of the issue of moral content of the action: informational asymmetry determines only the technical side of a vice, while morality or immorality of an action are determined by the benefit principle.

Perhaps, Hume, realizing the complexity of the hidden intentions problem, uses the most certainty when describing the essence of opportunism in the third chapter of "Second Enquiry": the signs, as the external expression of individual's will, eventually became the main part of promises, and the secret deviation of the one who's making arrangement from the agreement doesn't cancel the explicit promise (Hume 1966a). Though the symbolic form of agreements is always incomplete, nonconcurrence of true intentions and thoughts of the contract parties cannot be a reason for contract being cancelled. At this, all these arguments are used by a philosopher just for emphasizing one more time that this system of social order is possible only under one condition – morality is based on the benefit principle. It is obvious, however, that the potential of these points is wider than illustrative side: a "space" between external and internal form of a contract, which was known even to ancient Romans, and contingency of social regulations are by no means a consequence of utilitarian intentions. Mandeville, whose influence on Hume is undeniable, developed this very theme.

#### Implicit problems of D. Hume's argumentation and basis for methodological turn of A. Smith

At first sight, A. Smith in "The Theory of Moral Sentiments" adheres to Hume's position and reproduces his argumentation: Mandeville uses the term unsuccessfully, including to the list of vices the movements of individual affects which are necessary for organization of social order, in particular, strive for actions, which are rewarded by society, and ambition (Smith 1997). However, there is certain hesitancy in the thinker's reasoning: this system (Mandeville's), according to him, caused the anxiety of justice's friends, for it is close in form to the truth. What

could possibly embarrass the philosopher?

Smith's doubts could be caused by a serious methodological problem which hadn't been completely solved in Hume's conception, where the morality's basis was benefit. Let us represent the possible Smith's argumentation for substantiation of necessity for special attention to interaction of benefit and morality, assuming that morality is indeed created because of reasons of benefit. Then a bad deed – for example, fraud, - hides the following logics. By violating the property rights, we act immorally and wrongly. Whereas, violating the regulations of justice, we break the agreements. We may break the agreement only when the benefit from realization of this act exceeds the benefit of being in society.

How is this possible? For it is the benefit of joint activity, which is larger than benefit in individual state, that causes the appearance of society. Hume thought that he was protected from such objections, having fixed the pragmatist, nonreflexive, and undeliberate nature of agreements, at which the motives of cooperation correspond to the principle of benefit, but lie outside the scope of direct rational account (morality is not modification of egoism, but inclination, direct affective grasp of benefit of social state). However, as the philosopher himself wrote that agreements and justice lead to appearance of obligations as a form of strive for preservation of social system, thus providing the sustainability of property rights, he indirectly acknowledged the emergence of agreements-promises out of agreements-actions. In its turn, this fact implicitly supposes availability of two motivations (and strategies), related to the wish for preservation of society: a direct benefit from social synergy (in the process of participation) and indirect interest, consisting in possibilities for exploiting the social form of agreements. Finally, it is possible to point out two ways of realization of indirect interest: search and organization of rent (for example, in the model "stationary bandit") and, actually, opportunism.

The latter is a main idea. Certainly, Hume realized (for example, stating in third appendix *Second Enquiry* that benefit from justice is realized due to the scheme, or system, of relations which inevitably covers all society), but within his conception didn't consider to be substantial the fact that opportunistic behavior (unlike the direct violation of agreements) is intentionally based on the necessity for preservation of cooperation – though, it is here that the sense and operational aspects of such action are included.

Correspondingly, it turns out that social entity leads to the appearance of a new round of "short-term" self-love, at which an individual takes advantage in being in society and not being in society. In other words, as modern economists say, any individual takes advantage from violation of agreement, under condition that all others keep these agreements. The conclusion is discouraging: society does not eliminate the uncertainty – even in the process of successive adaptation and mutual acknowledgment – but changes the nature of this uncertainty and direction of self-love's impulses. The institutional vacuum of "natural" state is substituted by semiotic, significant, conventional kaleidoscope of social state. And members of society become the very hypocrites of Mandeville, they become catchers of the chance for enriching themselves by means of partner – with constant strive for preservation of cooperative interaction which provides such possibilities.

The most unpleasant consequence is that morality in such a world should be based not only on the feeling, but on the postulates of reason. Indeed: a person trying to use the social resource omitting the social rules should put some effort into it – primarily, for covering his position. Moral mimicry is required not only to avoid the punishment or successfully realize the opportunistic plan, but to decrease losses related to reduction of social welfare due to the opportunistic activity (amount of rent of social welfare exploitation is inversely proportional to the number of its "exploiters"). Actually, the possibility of such situations was mentioned by Hume in the essay "Of the Origin of Government": in particular, in the case when a person thinks that his interests will benefit more from the lies than suffer from the gap which his unjust deed will create in the social union; such conclusion may be derived from the position of M. Olson as well (Hume 1966-b, 593, Olson 2012).

All mentioned above shows that Hume's theory is full of internal antinomies – same as with Mandeville's theory being full of vivid paradoxes. For example, it is imagination that organizes intersubjective environment and lies in the basis of habit, i.e., relative sustainability of relations that creates confidence and emotional believability which determines the possibility for deceit ruining the behavioristic predictability.

That's why, without giving up the main principles of his philosophy, Hume cannot reject the sympathy of holistic, nonreducing foundation of morality and benevolence – "atomic" non-utilitarian virtue. With the help of these categories, all facts get included in one category – but mostly at the expense of loss of predictability of individual's behavior (a human is a very changeful creature which complies with variety of opinions, principles, and rules of conduct – writes Hume in the essay "Of Commerce"), dependence of his inclinations (for egoism or benevolence) from circumstances, accidents, and the impossibility of final choice between rational and affective origins of human. Probably, that's why Hume considers it possible to partially derogate from his gnoseological postulates, acknowledging the realistic nature of casualty on the moral sphere, which has to determine the consistency of

behavioral coherence of society. The philosopher also thinks that it is very important to conduct the stimulating policy and push the agents to optimal choice, i.e. – particular paternalism (which actually corresponds to the utilitarian principle of maximization of public benefit).

#### Adam Smith: morality and economics

As was mentioned earlier, Smith, probably, realized the implicit inconsistency of the elder friend's position, so his morality is based only on the feeling of sympathy – actually, dual sympathy. However, in this case – once social approval which causes the feeling of moral satisfaction is so important for us (among other issues, it is a source of strive for improvement of the position and of passion for wealth), and ambition which is often indistinguishable from vanity, consists equally from “seem” and “actually be” – a strategy of mimesis, copying of signs of moral usefulness, becomes possible and rather attractive.

Then, apart from moral sense, which helps to differentiate virtues and vices, an important role is acquired by capabilities to discern and recognize the reality or falsity of the moral facts that we observe (the situation of recognizing observation is represented in, for example, theory of frames). It is the correspondence of my affects to the affects of another person that creates the recognition of adequacy of moral reaction. As Shumpeter said, it was for a reason that Smith developed ethics as a science which explains the human arguments on behavior and not as a science about behavior per se (Shumpeter 2001). In other words, the issue of truth and deceit, which is already present on the reflexive aspects of sympathy (unconcerned observer), returns to the plane of moral problematics, determining the revival of hypothesis on partially rational foundations of morality.

Dr. Smith cannot and, seemingly, doesn't want to leave the described paradox with the help of reductive synthesis, realizing that thus he would challenge the very essence of his system: sympathy as a sensitive foundation of moral relations (that which in utilitarian aspect of Hume provided the *possibility* of coincidence of individuals' points of view on one or another thing – with their interests being different, in Smith's works becomes the *core* of moral unity of the society). Even an impartial observer, as a backstop in moral issues, does not eliminate uncertainty, resting on categories of “deserved” approvals and disapprovals which possess a partial supersensory nature. At this, it is impossible to simply eliminate the clear pursuit of interests from the sphere of *normal* things in human life (even Shaftsbury and Hutcheson were not able to afford that). In other words, a huge importance is acquired by the issue of co-existence of moral and rational entities (including the variant of morality's exploitation) out of frame of utilitarian paradigm.

So Smith (largely remaining within paradigmatic boundaries of moral philosophy) finds a more radical solution than the Hume's one: denying *de jure* the direct connection of morality and benefit, he *de facto* describes two genetically related spheres of social ontology, in one of which – the moral one – the feelings, differentiating vices, and virtues continue to rule, independent of reasons of benefit (but within the frames of strive for pleasure), which allows a human to remain morally autonomous, while in the other one a principle of human's strive for improvement of his position by specific way of enrichment is substantiated. The latter sphere is, actually, economy.

From the point of view of problematics of this work, the philosopher made an attempt to substantiate antropodicea (allowing ourselves the transformation of Leibniz's term): Smith removes the intentions of self-love from the direct influence of morality – they interact with morality, but do not obey it, *individuum*, as Nietzsche notes, here paradoxically becomes *dividuum*. Correspondingly, the autonomy of an individual not only increases, but there is a substantial increase of freedom of individual actions and a conceptual basis for special type of social affairs is created (it relates indirectly the conditions of emergence of such scientific and practical phenomenon as marketing).

Thus, there is a separation (or rather segregation – as the autonomy of morality was mentioned by Shaftsbury, Hutcheson, and Hume) of economic and moral problematics (at the theoretical level, unlike the views of mercantilists, whom M. Blaug grants the palm of victory in this issue, but in the theses of which the economy wasn't clearly separated from policy and implicitly from morality). The tendency for search for self-reasoning of social order, which appeared in the works of Hobbes, is taken by Smith to a logic final, at the same time removing from ethics various external conditions (transcendent foundations) and forming its *alter ego* – the economy which, in its turn, requires the proofs of autonomy. While Hume, wishing to include into the social philosophy all observed facts, supplemented the benefit principle with unconcerned benevolence, Smith took the strive for enrichment as a counterpoint of ethical conception which requires a special interpretation and showed the relative independence of these behavioral patterns.

Let's try to reproduce the scheme of Smith's thinking and emphasize that in his research the Scot was always guided by the rule: to derive all phenomena from the smallest number of principles. In other words, self-love or personal interest, like the sphere of morality, are determined by the strive for pleasure which causes the corresponding *praxis*. However, what comes out of that? Here Smith is obliged to consider several fundamental

issues which are similar to the structure of substantiation of morality and the answers to which he provides consistently in "The Wealth of Nations". The questions are the following: how is interaction of individuals possible on the basis of striving for enrichment? How is this interaction conducted and reproduced (in operational sense, the theory of value is meant)? What can obstruct and what can facilitate the interaction of individuals? Finally, what does our idea of which actions in the viewed context should be preferred and which should be avoided depend on?

These aspects of individual behavior were analyzed by Smith in "The Theory of Moral Sentiments", where the desire for wealth was explained by the philosopher either as a result of moral pleasure from observing the success of others, or as Providence's cunning, with the help of which the most capable individuals are motivated for economic activity that provides means of living for less gifted brothers. The study of strive for improvement of one's position outside the moral paradigm required a bit different approach.

In other words, Smith, aspiring to provide the coherence of theory of morality, which was deprived of benefit, as a moral principle, had to make a sharp turn and indulge himself in providing the self-correspondence of robust (stable against the possible excesses) cooperation theory, developed on the basis of purely egoistic motives of enrichment (without interference of ethics – for the sake of ethics itself). The discussion of these questions is one of the main themes of "The Wealth of Nations" and runs like a golden thread through the whole work.

Smith's analysis shows: the influence of unlimited egoistic motivation of agreements formation on the results of exchanges is huge and actually determines the success of the cooperation itself. At that it emerges that moral evaluation or moral regulation is not needed. Free strive for improvement of one's position has in this case a decisive role; this strive is unbroken and in its action it conforms only to the current circumstances. In other words, if a free individual is capable of expanding the boundaries of limitations (which may include the interests of another individual), he will strive for that greatly.

Let us specify: individual's freedom, which is a guarantee of economic success, does not have any exceptions according to Smith. It is not advisable to impose the individual actions with a priori limitations of any nature, even if they pursue good aims, including moral regulations or society's interests. All above mentioned could be considered as usual variations on the law, were it not for one important aspect: intentionality of deeds, their aim at the organization of cooperation also remain stable at the individual level. In other words, the track of individual economic deeds is created by the strive for possession of the labor of others through influence on the egoistic interests of counteragent. While utilitarianism in soft variant of Hume supposed the care for social welfare as an indirect guarantor of individual welfare, the Smith's conception starts from individual interest without relation to any a priori teleological basis (except for rather abstract principles of "invisible hand" or inclination of a human for exchange), and that (an individual is not aware of his actions' consequences, but he's reflexively consistent, i.e., he's capable to take a position and take the other's egoism into account) requires the specific mechanisms of organization of social order.

Thus an economic image of moral category of "temptation" is formed, which creates in the variety of its manifestation the social ontology, where the effectiveness of deals is based on the immunity of freedom of egoistic aspirations of agents that determine their spontaneous nature and adaptive flexibility of strategies of search for cooperation possibilities; the contest, while performing the disciplinary influence, provides the best protection against the strive for usage of ignorance of counteragent or possibility to violate the agreement.

Certainly, this requires special conditions – first of all, the mechanism of specification of property; but the property institution according to Smith (as well as according to Hume), unlike the ideas of Locke – is not just a simple limitation or a natural law, but a structural link of logic of sociogenesis which is taking place under conditions of informational incompleteness, causing the development of various forms of individuals' interaction.

Only in this meaning Smith presents a state as an analytical rubric. The role of Leviathan in view of the Scot's study is obvious: the value of institutional (supraindividual, stereotype) methods for providing the sustainability of deals may be lower than the value of individual actions for advocacy of one's position, which, of course, can provide a stimulating effect on the development of exchanges – though, the price which is to be paid by economy for the implementation of imperative limitations of general character may be – and often is! – too high (in relation to morality, this issue was studied by Aristotle).

As a matter of fact, here a question can be asked: why does the Scot mentions management and regulations at all? Maybe, there is a normative aspect in the very human nature – in pursuing the interests? Smith's answer makes us to recall the modern theories of rent-oriented behavior (G. Tullock) and policy of differences (A. Young): homogeneity of tasks, solved by various groups of individuals under conditions of social division of labor, often makes the agents create collective quasi-subjects and think about conspiracy and monopolization, which, in its turn, leads to exploitation of one part of society by the other. Though this process is also natural, the reasons of long-term efficiency determine the possibility and practicability of measures against the described unions (Hume

mentioned this in the aspect of economic power in the essay “Of Commerce”). In other words, the minimal required influence consists partly in provision of independence of individual agents’ decisions, and partly in demand for acknowledgment of interests of certain social groups, which, however – in the form of specific function or instance – has, as was mentioned above, its disadvantages and generates its risks; this idea relates to both politics and morality.

Therefore, benevolence and vice in economic theory of Smith are replaced by efficiency and inefficiency (in relative sense of providing conditions for society welfare increase), which in view of our work determines the beginning of development of the conception of economic opportunism. This raises the duality of Smith’s position (as will be shown below): the economist does not resolve neither to exclude the elements of regulation of private exchanges, nor to accept these elements as granted – in both cases, the alternative expenses influence the efficiency, still remaining undetermined. The Scot is close to acknowledgment: both violation by the individuals of the agreements and strive for protection from this violation is necessary forms of realization of principle of improving one’s position.

### 3. Problematics of economic opportunism in “The Wealth of Nations”

Thus, the effects of egoistic behavior, which are not limited by the morality, become naturally involved in the sphere of economy, and Smith, in “The Wealth of Nations” dwells on the phenomena, related to opportunism, in three directions (united by the rubric of research of conditions for possibility for the state’s welfare increase, contextually combined in our case with the topic of protection of society from exploitation of any part of the society).

Firstly, after W. Petty (in “Political Arithmetic”, while discussing the institutional advantages of the Netherlands, he writes that ambiguity of quality of economic benefits, which are a part of deals, leads to avoiding these deals by conscientious agents), the Scot states (in chapters IX and X of book 1 and, at complex analysis of the issue – in chapter II of book 3 of “The Wealth of Nations”) that dishonesty in economic relations leads to degradation of markets and to their complete disappearance (Petty 1940, Smith 1993). In the 20<sup>th</sup> century, G. Akerlof reaches the same conclusions during the analysis of the formalized market of used cars (Akerlof 1994).

Besides, the problematics of chapter I of book 5 of “The Wealth of Nations” is close to the mentioned one; in it, Smith, while viewing the activity of educational establishments, analyzes – almost in the spirit of O. Williamson – the difference between motivational spaces of integrated and market structures, coming to the conclusion that ambiguity and weak motivations of hierarchical systems lead to opportunism and inefficiency, with opportunism being practiced by both principal and agent (Smith 1935, 287). Though Smith does not elaborate the algorithm of choice of institutional structures, certain remarks allow understanding the following: government replaces market, in spite of possible high losses, due to the variety of reasons, in particular – specificity of resources and peculiarities of evaluation of the process results. However, as was mentioned above, this also brings new problems.

Thus, neither the “invisible hand”, not the labor division, nor the inclination of human nature for exchange and for trade does not guarantee the effective “natural balance”. Still, this is not about the regulating power of morality, either: that was not the reason for Smith to deny the utilitarian ethics, to get back to it by roundabout ways at the first difficulties. “Credit from other persons must not depend on such an unreliable guarantee as honesty...” he writes. (Smith 1935, 375)

Correspondingly, secondly, it is not for no reason that Smith, like Hume and Mandeville, pays a lot of attention to the role of state in the sphere of economy. Although, like was mentioned, Smith hesitates here again. On the one hand, in the system of natural freedom every man, as long as he doesn’t violate the laws of justice, can pursue his interests, and the sovereign is freed of his ineffective duty, during performing which he shall be subject to constant deceits – of the duty to manage the labor of individuals and direct them to the activities which correspond better to the society’s interest; moreover, state can become – as Mandeville mentions and Smith shows in his historical analysis – a strong source of opportunism.

On the other hand – the state is capable of being an effective instrument of amending the ineffective processes in the system of social agreement, performing one of the three basic duties: protect citizens from injustice. In the modern economic theory, this theme is reflected in the conceptions of substantiation of democracy and rule of law as an appropriate political supplementation of market economy – for example, in the J. Buchanan’s variant of constitutionalism or in M. Olson’s theory of state; however, Hume in his essay “That Politics May Be Reduced to a Science” wrote: the most essential thing in any state structure is protection of common good from the greed of certain individuals – but at the same time, any structure has to provide the means against bad management. (Buchanan 2004, Olson 2012, Hume 1966-b)

Very similar is the theme of discussion of “The Wealth of Nations” chapter “Of Colonies”, where Smith describes the epoch’s characteristic corporate conflict of owners and management (Smith 1935, 190). Managers

of trading companies, which are located in the colonies, are inclined to create private monopolies, financed by themselves, writes Smith. Attempts to suppress such inclinations by direct bans – including the government ones – are not effective. Implicit monopoly costs more for the society: the losses here emerge not only from the monopolistic activity, but due to the costs of realization of covert operations. In his turn, Smith offers an approach, characteristic for his works: fewer limitations. Inclination of management for private operations is natural, and the main reason lies in the wrong system of motivations. Setting the clear rules of managers' participation in trading activities shall lead to the best – in current conditions – configuration of processes within the relations "principal-agent".

The Scottish thinker repeats again and again: forbidding and organizing monopolies leads to *temptation* which cannot be fought by any strictness of law (temptation is a feeling which, according to Hutcheson, due to external benefit of evil deeds, decreases their viciousness, if without this benefit the deed wouldn't have been performed) (Hutcheson 1973, 251). Here, in the sphere of economy, we see that which was earlier mentioned in relation to Hume's moral philosophy: the social state is capable of inducing egoistic behavior (secondary self-love), aimed (intentionally oriented) at the implicit exploitation of society. Although, Smith's position contains an important aspect: the possibilities of ethics are not decisive, but quite on the contrary – there emerges the argumentation of peculiar antropodicea, where the responsibility for opportunistic activity is laid on the managing instance that provides ineffective system of motivations.

"The law, despite all usual principles of justice, creates temptation at first and then punishes all who do not obey it," writes the Scot with a clear disapproval. (Smith 1935, 343). There is an example, characteristic for Smith, reflecting also the duality of his position: on the one hand, as the economist writes in "The Wealth of Nations", the smuggler, as a violator of laws, deserves the highest blame (*morality*), and on the other hand, he's simply not capable of violation of laws of natural justice and would be a great citizen, if the laws didn't turn into crime that which the nature never thought to acknowledge one (*economy*). Thus, the statements about refusal to buy smuggled goods are more vicious (*hypocritical*), than the contraband itself. (Smith 1935, 406)

Moreover, dwelling on physiocrats, Smith notes: Quesnay, speaking about necessity for absolute freedom for getting the best results from business, didn't take into account the fact that, in a politic organism, just the efforts of individuals for improvement of their position can amend the consequences of evil policy – otherwise, there would be no progress *et al.* (Smith 1935, 220). This refers not to the moral side of the matter, but to the efficiency – is appears that state may be a source of freedom mainly in the negative sense. A key to development should be looked for in the area of activity of experimenting individuals. Thus, as L. Dumont says, the proper standardization of economy is created, the prescriptions and descriptions are reunited in new reality, and the norm and fact find each other, while the feeling is naturally supplemented by the reasons of rationale which play a humble situational role (Dumont 2001). At that, Smith is surreptitiously ready to make a conclusion: it is limitations that create temptation which is the only means for pair of interests of autonomous individuals. Economic agents are doomed to specific activity of formation of counteragents' interest in cooperation within the set institutional limits. Correspondingly, the less obligatory and specific nature of limits are, the less the losses of society during provision of control and monitoring are.

In this sense, Smith's consistency in the analysis of state's role in economy cannot but be admired. Thus, for example, quoting Hume's "History of England", he cites the opinion of his elder friend – in the spirit of conception of "economic imperialism" – according to which the crafts, by serving society, brings benefit to the craftsmen themselves, so state shouldn't interfere into these processes; however, the activities of the church should be regulated – otherwise, in pursuit of profit, the priests will preach not the truth, but its opposition, that is, using the trust of crowd, they will appease the lowliest passions. In other words, in this case it is better to limit the agents' motivations by setting a constant state tax on liturgical mess (Smith 1935, 310).

Smith himself thinks that the mentioned danger becomes a reality only when the state itself interferes with the sphere of religion, creating monopolies or oligopolies of 2-3 opposing churches. And on the contrary – if the state does not meddle with the religious societies they form a specific sphere with monopolistic rivalry, where each sect, certainly, uses various tricks, but does not have enough power for influence on the religious "market" as a whole. Besides, in relatively small societies, a person is always in the public eye, and the most important factor of its activity is reputation (a type of guarantee of exchanges' efficiency, valued by Smith; very often, the Swiss cantons are held up as a model – in their self-administration one can see the prototype of institutions of civil society which play an important role in determining the market's efficiency).

Thus, neither in the phenomenon of state does Smith find the absolute and reliable guarantee of provision of fair exchanges. On the one hand, the state – as it takes upon itself the care for common interest – allows the private intentions to acquire the independence which is necessary for self-substantiation of economy (this thesis



was later developed by Marx). However, on the other hand, the state, with the required setting of institutions, is capable to relatively effectively protect only from obvious injustice, eliminate the violence with controlled violence, rather – with a threat of violence. The peculiarities of opportunistic activity complicate the process of regulation which itself may become a source of injustice and inefficiency. The search should be continued. The natural (effective) system of economy cannot be provided by the enforcement – even in the mild variant – of objective collective interest (which, like was stated above, relates Smith's economic to his moral study in the sense of solidarity of research programs of autonomy provision).

Correspondingly, thirdly, within the study of conditions of economy's results, Smith develops a study on productive and non-productive labor. Implicitly interacting with theory of Mandeville, who insisted on the productive nature of any activity and any expenses in the developing society, Smith's differentiation of labor – together with ideas of physiocrats and conceptions of later mercantilists – placed the foundation – though, distant and indirect – of modern theories of public good, according to which the reason for decrease of the latter is not clear transfers of utility from one individual to another, but the availability of non-productive expenses (of specific labor), including the ones that take place during the realization of opportunistic activity and protection from it (Tulloch 2004).

The underlying, though a bit abstracted, basis for differentiation of two types of labor, according to Smith, is the following: there is labor which is paid, i.e, it is a product and it possesses exchange value, but due to certain ontological lameness it doesn't add to the public wealth (Marx 1962). Without dipping into details of determining the categories of productive and non-productive labor, we shall point out that Smith's hypothesis has a clear concept, an idea, which is expressed on a rather high level of abstraction and relates to normative aspects of economic processes: it appears that the optimal state of economy cannot be reached due to the presence of non-productive expenses – at that, the expenses are viewed as, primarily, alternative expenses, capable – if effectively used – of increasing the public good.

In other words, non-productive labor causes the decrease of the level of nation's wealth not by virtue of direct use if these goods or transfer of wealth (once consuming is the main aim of production), but as a non-optimal alternative of development of economic processes. Hume thought otherwise, writing in the essay "Of Interest": lawyers and doctors do not produce anything and gain their wealth at the expense of others, so, increasing their wealth, they inevitably decrease the wealth of any of their fellow citizens.

Thus, within the implicit discussion, Smith assigns the problematics of Mandeville's works (role of social determinants of consuming in the development of economy) with a quite correct economic form; although, the implicitly put question about general principles of differentiation of productive and non-productive entities in the economy remained unsolved – similar to the issue of general principles of identification "at the margin" of opportunistic and conscientious behavior, which remains in the area of uncertainty.

Finally, while discussing the issues of taxation in chapter II of book 5 in "The wealth of Nations" and determining the optimal object of fiscal policy, Smith brings together the problematics of economic opportunism: informational asymmetry, optimal stimulation, non-productive expenses as effects of managing the opportunism (Smith 1935, 334). Once again, the position of the Scottish thinker is characterized by duality. On the one hand, acknowledging the deals under conditions of informational incompleteness and results of these deals as an essential part of the economy, and efforts for control of these deals – as a double-edged instrument, in the other hand, Smith is inclined to constructing the adequate (institutional) system of motivations, as the best method for providing effectiveness of economic processes.

In other words, paradox of economic opportunism remains a stumbling block for Smith. The philosopher's thought revolves around two paradigm-creating centers (also in the context of discussion on positive and normative things in economy): on the one hand, opportunistic behavior is often initiated by the undue management and implementation of unnecessary limits - and in this aspect opportunism is nothing more than an image of natural freedom of individual. On the other hand, almost every specific and historically reasoned system of agreements as a form of natural exchange processes becomes thus an enforcement, which an individual, based on the principles of self-love and free expression of will, wants to overcome (reduce the amount of labor for himself and lay it on the others) – again in the acts of opportunism which becomes a total basic behavioral principle that requires the interference of law or moral maxims, or, according to Hayek, concepts of "expanded order", determined by evolutionary political achievability, rather than normative value (Hayek 2001). With great reserve, it may be said that it is the same "alternative interpretation", which Buchanan, during substantiation of constitutionalism, considers being non-existing and which explains, why each individual *may be* viewed as a permanent potential revolutionary. (Zaostrovsev 2013)

## Conclusion

Determination of individuals at cooperation in a strong form (realization of interests, despite the moral effects), limitation of human capabilities for rationale, and unintentional nature of consequences of individual decisions – all these theses, as was mentioned, unite the conceptions of social order of Hume and Smith. Antinomies and paradoxes, which are present in their systems, have ample grounds, one of which is the problem of individuality. Existence of individual was to be dissected and re-created by the thinkers of the Modern epoch. The foreground was taken by the question, which can be viewed as a fundamental in social ontology: why the long-term coordinated cooperation of individuals, and not the world of permanent conflict, is possible (total redistribution within economic problematics)?

Since Hume and Smith, one can see the formation of a tradition which generates typical answers to this question: systems of motivations and institutions, which, with different level of violence and determinacy, coordinate the activity of agents who define the performance of the agreements, also under conditions of implicit intentions of the parties.

Though Smith had the understanding of duality of social order – enforcement of social connections is inseparably related to the unlimited strive of individuals for gaining mutual interest (*i.e.*, not only robustness of economic exchanges and condition of the possibility of their organization should be revealed, but also the dynamic interaction of the mentioned factors) – today, the opportunistic behavior turned into exogenous principle, “friction”, caused by the behavioral peculiarities of human; when this principle supplements the model construction, it increases the level of their correspondence to facts. At that, the role of opportunism in provision of socio-economic dynamics was partly omitted.

Besides, the methodological discussion on “realism of conditions” of economic theory should be mentioned in the following regard. The limitation of methodological individualism in our days is criticized both from the side of various institutional and behavioral conceptions and from the point of view of socio-ethical, egalitarian, and communitarian doctrines – in particular, within the theory of “good society” (vivid example – A. Etzioni’s socioeconomics). However, the supporters of “social person” version should take into account that paradigm of *Homo oeconomicus* is not just a “rough copy”. It was in the strive for preserving the autonomy of social origin in the life of society that Smith distinguished morality and economy into independent spheres of social existence, thus overcoming the ambiguity which characterizes the ethical concepts of Hume (utilitarian variant) and F. Hutcheson (non-utilitarian system). And on the contrary: the researchers which try to preserve the individual rationality – even at the expense of limitation of this rationality – should take into account that it was Hume’s skepticism, as one of early conceptions of unideal rationality, that led the philosopher to substantiation of morality as a main regulating institution in large societies.

The abovementioned largely relates to the modern concept of economic opportunism. For example, the research of O. Williamson, who interprets (within the theory of contracts) the opportunistic behavior as one of the main factors that determine the choice of one or another form of economic transactions, is a great illustration of possible ways for interpreting (expanding) the conception of D. Hume (the corresponding formulations of Williamson are very close to the ideas of Hume’s minor work “of the Original Contract”) (Williamson 1996, Hume, 1966). As a strong form of egoism is the very self-love of moral theory of the author of “The Treatise on Human Nature”, which emerges after the individuals realize the cooperative activity (before it, we deal with primary, “usual” self-love as a form of self-preservation), as it is this egoism (which affects individuals, according to both Williamson and Hume, in various degrees) which leads to emergence of whole classes of agreements and structures of interaction that allow saving intellectual efforts (reproducing routines and habits) under conditions of informational incompleteness.

However, the most important aspect consists in the fact that the basis for the choice of alternative forms of relations lies in the sphere of economic motives – minimization of transactions’ expenses (which is declared explicitly), and implicitly – in the sphere of morality. In Williamson’s conception, public morals are a normative source of the very possibility for emergence of opportunistic behavior and, correspondingly, realization of motivations which are forming within the frames of certain ways of organization of economic exchanges (informational asymmetry, like in Hume’s works, may be viewed rather as a technical aspect of contracts’ structuring). Therefore, Williamson’s theory is a tangle of conceptual motives of analysis of socio-economic problematics.

The danger of such approaches consist, in our opinion, in the preserving possibility for unexact mixture of morals and economy (syncretism of exogenous and endogenous elements of normative entities in economics), and, in a manner of speaking, emergence of certain party affiliation in economic research, which causes emergence of rather rigorist theories and methods of evaluation of institutional (including culturological and moral) characteristics of some or other societies from the point of view of economic efficiency – with inevitable ranking and segregation of individuals, groups of individuals, and whole societies.

Finally, the defining aspect is, probably, the clarity of initial conceptual conditions. Return to the origins of problematics of interaction of morality and economy within the framework of genesis of economic opportunism conception might be very productive in this regard.

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# Environmental Challenges, Externalities and Sustainable Policies in Transport Sector in Egypt

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## Abstract:

*The study analyzes the environmental effects, externalities and energy consumption in transport sector in Egypt. It focuses on external costs from transport sector and its economic impact on society expressed in monetary terms, and these external costs are mainly congestion, road accidents and air pollution caused by carbon dioxide emissions. The Human Capital approach is applied to estimate economic costs of road accidents in 2014 in terms of injuries, fatalities, damages in vehicles, suffer and loss and these economic costs are estimated to be 3.75 billion dollars. Moreover, the economic costs of air pollution mainly due to carbon dioxide emissions are estimated to be 2.8 billion dollars in 2014, and these estimated economic costs of both road accidents and air pollution are about 5% of GDP. In addition, environmental and safety transport policies are discussed. Also, internalization of externalities and policies adopted in transport sector in Egypt are illustrated and finally possible sustainable transport policies are recommended.*

**Keywords:** externalities, environmental effects, sustainable, internalization.

**JEL Classification:** H23, Q51, Q53, R4.

## 1. Introduction

Transportation is vital to the functioning of growing economy and efficient movement of people and exchanging of goods and services. However, there are certain environmental challenges related to transport sector represented in the negative impacts on the society in the form of externalities. Profillidis *et al.* (2014) differentiated between environmental impact due to the development of transport sector on the environment and on the society, as it has negative impact on the environment through its adverse effect on air pollution locally and globally through the emissions of carbon dioxide emissions, sulphur dioxide and hydrocarbons that contribute to the existence of smog acid rain and destroying ozone layer and decreasing fossil fuel reserves. In addition, it affects negatively the society in the form of changes in the land use, accidents and congestion.

The transport sector is a major source of carbon dioxide emissions and energy consumption and globally responsible for about 90% of urban air pollution, 14% of the greenhouse gases emissions worldwide and the death of nearly 80000 people (Kaysi and Chaaban 2015). And according to World Energy Council (2011), the global transport sector will face major challenges related to congestion, urbanization, population and growth in fuel demand over the next four decades. Total fuel demand in all transport modes is expected to increase by 30-82% over 2010 levels between 2010-2050, in addition to that fuel demand for less developed countries that constitutes about 52% of transport market is projected to increase by 51% in freeway and this will cause carbon dioxide emissions to increase which means that the greatest challenge will be providing sustainable transport sector fueled by clean energy.

In Egypt, the transport sector is considered an essential sector in achieving both economic and social development and although various energy efficiency policy reforms had been implemented, energy consumption levels in transport sector are still high. Moreover, population growth and urbanization and limited capacity of public transport that caused switch from public transport to private cars in Egypt have a severe impact on transport system and infrastructure in the form of traffic Jam and pollution especially in major crowded cities as Greater Cairo. Also, this leads to increase the imports of gasoline and diesel. (ESCWA 2014)

Sustainable development in Egypt requires efficient and safe transportation system depending on clean low carbon energy and this requires certain measures, instruments and sustainable transportation policies to internalize externalities and achieve sustainable development.

Therefore, from the mentioned above, it is essential to analyze environmental challenges related to transport sector in Egypt aiming at analyzing externalities and quantifying it in monetary units and suggesting certain sustainable transport policies.

The rest of the paper is organized as follows. Section 2 provides a brief review of the main characteristics of transport sector in Egypt. Section 3 explains the externalities from transport sector in Egypt. Section 4 is a discussion of environmental and safety transport policies. Sections 5, 6 and 7 analyze internalization of

externalities, policies adopted in transport sector and strategies for sustainable transport policies in Egypt respectively. Section 8 concludes the paper.

## 2. Main characteristics of transport sector in Egypt

The transport sector in Egypt is mainly characterized by depending on roads for freight and passenger activities. And as it can be shown from Table 1 that total passengers operations have increased from 65.359 billion passengers per kilometer in (1981/ 1982) to reach 264.094 billion passengers per kilometer in (2011/2012), with average annual growth rate 4.8% with road transport share accounted for about 68% compared to 32% for railways and almost 0% for river transport. Also, total freight operation has increased from 18.311 billion ton per kilometer in (1981/1982) to reach 68.333 billion ton per kilometer and average annual growth rate is 4.5 % with road transports here accounted for about 86% compared to 9% for rail ways and 5% for river transport.

Table 1 - Passengers and Freight operation (1981/1982-2011/2012)

Year	Road	Railways	River	TOTAL
Passenger operation (million passengers/km)				
1981/1982	47,449	17,903	7	65,359
1991/1992	77,494	46,517	12	124,023
2001/2002	112,815	39,083	15	151,914
2011/2012	180,340	83,730	24	264,094
Average annual growth rate (%)	4.6	5.3	4.2	4.8
Freight operation (million ton/km)				
1981/1982	13,890	2,307	2,114	18,311
1991/1992	26,261	3,229	1,761	31,251
2001/2002	40,605	4,188	3,712	48,505
2011/2012	58,776	6,280	3,277	68,333
Average annual growth rate (%)	4.9	3.4	1.5	4.5

Source: Economic and Social Commission for Western Asia (ESCWA), June 2014.

In addition, combustible energy commodities consumed by the transport sector in Egypt comprise diesel, gasoline and natural gas. Moreover, fuel oil is used for road paving activity while lube oils are used as lubricant for vehicles engines. The increased passengers and freight activities during the last three decades since the early 1980s resulted in a tremendous increase in energy consumption by transport sector and accordingly pollutants emissions. (ESCWA 2014)

It can be shown from Table 2 that total transport petroleum energy consumption has increased from 3756 thousand tons in (1981/1982) to reach 16230 thousand tons in (2012/2013) with annual average growth rate of 4.8%. Gasoline and gas oil have witnessed the largest average annual growth with average annual growth rate of 5% and 5.2% respectively. As for gasoline, the period (2001/2002-2012/2013) has witness the largest growth of gasoline consumption since it accounted for 9% annually with about 20% of gasoline consumption is currently imported. In addition, gas oil (diesel fuel) consumption has increased from 1740 thousand tons in 1981/1982 to reach 8462 thousand tons in 2012/2013 with an average annual growth rate of 5.2% during that period representing 67% of total gas oil consumption by all sectors during the same year (2012/2013) with almost 50% of gas oil is imported (ESCWA 2014). In addition, natural gas consumption in transport sector has increased from 244 thousand tons in 2001/2002 to reach 400 thousand tons in 2012/2013 with average annual growth rate 5% and this can be attributed to increasing the consumption of natural gas by vehicles in the transport sector in Egypt.

Moreover, government spent nearly 26 billion dollars on fossil-fuel subsidies in 2012, ranking as the eighth-highest spender of fossil fuel subsidies in the world and that contributes to rising energy demand and a high budget deficit. The transport sector share accounted for about 45% from these subsidies. Besides, the escalating energy consumption by transport resulted in pollutants emissions increase from that sector to reach more than 49 million tons of CO<sub>2</sub> in 2012/2013 representing 26% of total CO<sub>2</sub> emissions by all sectors during the same year in addition to 2.1 thousand tons of CH<sub>4</sub> and 0.4 thousand tons of N<sub>2</sub>O (ESCWA 2014). But beginning in July 2014, government began removing subsidies on petroleum products by 22% during the fiscal year (2014/2015) (EIA 2015).

Table 2 - Transport energy consumption (thousand tons)

	1981/1982	1991/1992	2001/2002	2012/2013	Growth rate (%)
Gasoline	1,349	2,041	2,386	6,079	5.0
Turbine	337	453	402	590	1.8
Gas oil	1,740	2,908	5,284	8,462	5.2
Fuel oil	103	155	750	279	3.3
Others	227	215	1,099	820	4.2
TOTAL petroleum products	3,756	5,772	9,921	16,230	4.8
Natural Gas	0	0	244	400	5.0
TOTAL	3,756	5,772	10,165	16,630	4.9

Source: Economic and Social Commission for Western Asia, June 2014.

### 3. Externalities from transport sector in Egypt

Although transport sector is essential in enhancing economic and social development, but it produces external costs which negatively affect the society and these externalities can be considered one of the forms of market failure that produce inefficient allocation of scarce resources (El-Guindy and Mahmoud 2013). These externalities are accidents, climate change, air pollution, congestion and noise which impose economic costs on the societies and thus, several studies have estimated the marginal externalities related to transport sector especially road transport (Jones-Lee 1990, Jansson 1994, Persson and Odegaard 1995, Small and Kazimi 1995, Maddison *et al.* 1996, Mayeres *et al.* 1996, Delucchi and McCubbin 1999, Mayeres and Proost 2001, Sen *et al.* 2010).

Transport sector in Egypt imposes environmental challenges and economic costs on the society and therefore, it is important to estimate some of these economic costs. This estimation needs various data items, and due to data unavailability and lack of reliable information in Egypt, estimating some of the external costs of transport in Egypt will depend on available data and price indices will be used for the unavailable data depending on the corresponding available estimates done by other researchers on Egypt.

#### 3.1. Accidents

According to World Health Organization (2015), 1.25 million people die from road traffic crashes, and 90% of world fatalities on the road occur in middle- and low-countries and road traffic death and injury rates are highest in the low- and middle-income countries of the African region.

Also, transport accidents are considered a major cause of death in Egypt, as according to Central Agency for Public Mobilization & Statistics (CAPMAS), rate of fatalities from road accidents reached approximately 18 dead and 61 injured people per day in the year (2013/2014) and these road traffic crashes were among the young people aged (15-30) years.

Thus, there are several approaches used by researchers to estimate the economic cost of road traffic accidents but the most widely known are Willingness to Pay (WTP) approach and the Human Capital (HC) approach. While the former is based upon estimating the value of a given improvement in safety by calculating the amount of money that people would be willing to pay to reduce the risk of loss of life, the latter is based upon equating the cost of fatality with loss of future output which is equal forgone earnings. (World Bank 2005)

In addition, there are several attempts employed to estimate the economic costs of road traffic accidents in Egypt. Aly and El-Araby (1996) estimated the economic costs in 1993 to be 77 million dollars. National Institute of transport (2007) reached that in (2005/2006) the average cost of a fatal or serious accidents, the average cost of slight accident and the average cost of property damage are 118, 13.4 and 12.8 thousand Egyptian Pound respectively. Ibrahiem (2008) estimated the average cost of a road traffic accident to be about 8500 Egyptian Pound. Ismail and Abdelmageed (2010) estimated the economic costs of road traffic accidents to be about 1.8 billion dollars in 2008. (Ismail and Abdelmageed 2010)

Following Ismail and Abdelmageed (2010) in using Human Capital (HC) approach in estimating the economic cost of road traffic accidents, the study begins by estimating the average cost of a fatality, injury and a damaged vehicle in 2014. Then these averages will be multiplied by the total number of a fatality, injury and a damaged vehicle which are 6236, 24154 and 21188 respectively based on data from CAPMAS. Then these total numbers are summed together with other cost components (damages in vehicles, damages in properties other than vehicles, travel delay, police service, insurance administration and pain, grief and suffering) to estimate the economic cost of road accidents in Egypt in 2014. The estimated cost of a fatality or an injury is the summation of calculated lost output, family and community loss which refers to the activities that would have been done after working hours if not experienced the accidents, medical treatment cost, lost experience of a fatality or an injury and lost quality of life.

Available data in Egypt are total number of fatalities, injuries and damaged vehicles. And for unavailable data the study depends on using price indices for corresponding available estimates done by Ismail and Abdelmageed (2010). Moreover, there are several assumptions that the study depends on in estimating economic cost of road accidents in Egypt following Ismail and Abdelmageed (2010) and these are based upon recommended assumptions in previous national and international literature. And therefore, the following assumptions are applied.

The lost output of a fatality is calculated using the following equation:

$$Loss = \sum_{i=1}^n \frac{Y(1+g)^i}{(1+r)^i} \tag{3.1}$$

Where Y is the annual GDP per capita in 2014, g is the average growth rate of the economy from the year 1980 till 2014, r is the discount rate and refers to the years of lost output that last n years. Data for GDP and average growth rate are obtained from World Bank indicators, while that for discount rate are obtained from Central Bank of Egypt.

Based on Ismail and Abdelmageed (2010) and ADB (2003) the average age of road traffic accident fatality is assumed to be 30 years. In addition, the average age of road traffic fatalities in Egypt supports this assumption. And so, number of years for loss of output due to death from road accidents is the difference between the average age of fatality 30 years and retirement age which is 60 years. And loss of output for injuries is calculated using equation (3.1) and based on assumption that the average time for loss of output is one month as in Ismail and Abdelmageed (2010).

Based on Al-Masaeid (1999) and Ismail and Abdelmageed (2010) the family and society loss of a fatality or an injury is calculated based on the assumption that 55% of loss of output is family and society loss. The data for average medical costs of a fatality or an injury, lost experience, pain, grief and suffering, damages in vehicles, travel delay, property damage are based on those calculated by Ismail and Abdelmageed (2010) but the data will be adjusted to prices in 2014 using price indices from World Bank indicators. In addition, costs for police service and insurance administration are calculated as 0.6% and 2.8% respectively of both travel delay costs and property and vehicles damages based on Ismail and Abdelmageed (2010). The results of estimation of economic cost of road traffic accidents fatalities and injuries and total economic cost of road traffic accidents in Egypt in 2014 are shown in Table 3 and Table 4 respectively.

Table 3 - The economic cost of road traffic accidents fatalities and injuries in Egypt in 2014

Cost component	Fatality cost per capita (Egyptian Pounds)	Total Fatalities (million Egyptian Pounds)	Injury cost per capita (Egyptian Pounds)	Total injuries (million Egyptian Pounds)
Output Lost	644,986.0	4,022.13	1,787.00	43.16
Family and society Loss	354,742.3	2,212.17	982.85	23.70
Medical costs	662.9	4.13	1,543.30	37.27
Lost experience	561,828.4	3,503.50	10,770.90	260.16
TOTAL	1,562,219.6	9,741.93	15,084.10	364.29



Table 4 - Economic Cost of Road Traffic accidents in Egypt in 2014

COST COMPONENT	VALUE (million Egyptian Pounds)
Fatalities	9,741.93
Injuries	364.29
Damages in vehicles	12,039.60
Damages in properties other than vehicles	1.23
Travel Delay	167.30
Police Service	73.24
Insurance administration	341.8
Pain, grief and suffering	4,179.00
TOTAL economic cost of road traffic accidents	26,908.39

It can be shown in Table 3 that economic cost of total fatalities is about 9.7 billion Egyptian pounds while that of total injuries are about 364 million Egyptian Pounds. Moreover, total economic cost of traffic road accidents in Egypt in 2014 is estimated to be about 26.9 billion Egyptian Pounds which is about 3.75 billion dollar using exchange rate between Egyptian Pound and Dollar which is 1US Dollar =7.16 Egyptian Pounds in 2014.

In addition to road accidents, there are railway accidents which may happen because of derailments, collisions and accidents to persons caused by rolling stock in motion, accidents involving level crossings and fires in rolling stock (Profillidis, *et al.* 2014). And according to data of CAPMAS, the number of railway accidents in Egypt has increased from 781 accidents in 2013 to reach 1044 accidents in 2014 with annual increase about 34%.

### 3.2. Climate change and air pollution

Transportation in Egypt is one of the major sector that contributes to air pollution especially carbon dioxide emissions which are considered the major source of global warming and climate change, and according to CAPMAS, it is responsible for about 20% of total carbon dioxide emissions (CO<sub>2</sub>) coming as the second sector after electricity sector in releasing CO<sub>2</sub> emissions in the year (2013/2014). And according to data of CAPMAS, carbon dioxide emissions from transport sector were estimated to be about 34.62 million tons in 2014, while economic cost from carbon dioxide emissions was estimated in the same year to be approximately 80 dollars per ton, so multiplying these together will result in estimating total economic cost of carbon dioxide emissions emitted from transport sector which is approximately about 2.8 billion dollars.

Thus, the estimated economic costs of both traffic road accidents and air pollution caused by mainly carbon dioxide emissions are about 5% of GDP.

### 3.3. Congestion

Traffic congestion is the most widespread urban transport problem in Arab cities, especially in Cairo referred to Greater Cairo Metropolitan area which is the largest urban area in Egypt, Middle East and Africa. It is considered one of the major problems especially during the peak hours of the day when people are going to work or returning back to home. When transport infrastructure is congested, then adding one more vehicle to the road decreases the travel time reliability of all users and the travel speed. (Proost and Dender 2012)

In spite of the great efforts by the Egyptian government to tackle traffic congestion and pollution by introducing a metro system and a comprehensive bus network, traffic congestion is still a serious problem in Cairo that negatively affects personal travel time, vehicle operating costs, air quality, public health, business environment and business operations. The main causes for this problem are the increase in the number of vehicles and fuel subsidies. Not only are the causes of traffic congestion complex, but also the range of possible policies and investments that could be directed to address the problem (World Bank 2010).

World Bank (2010) estimated total economic cost from Cairo traffic congestion to be between 13 and 14 billion Egyptian Pounds based on calculating direct costs of travel time delay imposes to users, cost of excess fuel consumption in vehicular transportation (gasoline and diesel), costs of travel time unreliability in passenger transportation and the associated cost of carbon dioxide emissions due to excess fuel consumption. So economic

cost after adjusted to prices in 2014 can be estimated to be approximately 19 billion Egyptian Pounds, which is equal to 2.6 billion US Dollar.

### 3.4. Noise pollution

Noise emissions from traffic pose an environmental problem of increasing importance. They have increased in recent decades as a result of mobility and continuous industrialization of human activities and increasing levels of urbanization. Roadways with large volumes of high speed traffic, airports and high-speed rail lines are very noisy. The effects of noise emissions differ according to transport modes and according to its loudness and nature and so have different effects on humans. They can disturb sleep and leisure, disrupt activities, hinder work and learning and cause stress that result in health impairments. (Jokanovic and Kamel 2014, Profillidis *et al.* 2014)

Disturbing noise emissions are mainly produced in Egypt by car horns, the high sound of cassette players, engine noise and the rolling noise. Also, the contact of the wheel with the rails, the motor operation and the vibrations of the above-ground railway structures produce the noise emissions of railway transport. These noise emissions which the people are exposed affect citizen's psychological and nervous health. According to the Egyptian Environmental Affairs Agency (EEAA), it has been noticed that noise levels in Egyptian streets have reached unacceptable limits locally and internationally. Measurements indicate that noise levels in major squares and streets may reach approximately 75–85 dB, violating permissible limits stipulated upon in Law 4/1994 on the Environment and its executive regulations not to exceed 60 dB by day, 55 dB in the evening, and 50 dB by night.

### 4. Environmental and safety transport policies

Air pollution, noise and traffic accidents are closely linked to common factors, such as: traffic flow, traffic speed, and traffic composition. The policies aiming to prevent accidents, air pollution and noise are based on the same principles: enhancing the use of modes that perform better in relation to safety and environmental protection, travel demand management, strengthening appropriate user behavior and encouraging the safety environmental performance of vehicles. (Hasson and Feypell 1998)

Nevertheless, these measures that aim at improving traffic safety may not lead automatically to positive effect on the environment. But these measures may affect negatively the environment and vice-versa making conflicts. Some examples of these conflicts are:

- The usage of electric vehicles can be beneficial in terms of reducing noise, air pollution and decreasing fuel consumption. But the silence of an electric engine will increase the safety risks for bicyclists, pedestrians and other road users as they may not take attention of moving vehicle until is too late.
- The construction of noise barriers will reduce the noise level of the near areas but might have a negative impact if the visibility of the pedestrian or the drivers is affected.
- Although porous asphalt pavement has been widely used to take advantage of its capacity to reduce road noise, it may encourage motorists to increase their speed and safety risks as low noise make them feel overconfident.

Table 5 illustrates a synthesis of the possible safety and environmental related conflicts and convergences of various policies. And in general reducing air pollution and accidents needs to act on certain elements which are road vehicles, traffic management, road infrastructure and transport planning. However, it is not easy to resolve all conflicts especially those between mobility and the environment, mobility and safety, and safety and the environment. But to get the best compromise between better environment and safer road system an early evaluation of the effect of road planning on both the environment and safety is needed to find solutions that can have the best results. (Hasson and Feypell 1998, Profillidis *et al.* 2014)

Table 5 - Possible conflicts and convergence between safety and environmental policies

		Energy conservation	CO <sub>2</sub> reduction	Air quality	Noise reduction	Landscape	Safety
Road vehicles	Vehicle weight reduction	+	+	∅	?	∅	-
	Power reduction	+	+	+	?	∅	+
	Limiting maximum speed	+	+	+	+	∅	+
	Electrified vehicle	?	+/-	+	+	∅	+/-
	Vehicle check	+	+	+	+	∅	+
	Driver training	+	+	+	+	+	+
Transport policy	Transfer to rail	+	+	+	+	+/-	+
	Intermodal transport in urban areas	+	+	+	+	∅	-
Road infrastructure	By-passes	+/-	+/-	+	+/-	-	+
	Noise barriers	∅	∅	+	+	-	+
	Roundabouts	?	?	?	?	-	+
	Porous asphalt	∅	∅	∅	+	∅	+/-
	De-icing salt	?	∅	∅	-	-	+/-
Traffic	Reduction in speed limits	+	+	+	+	∅	+
	Control of speed	+	+	+	+	∅	+
	Traffic calming	+/-	+/-	∅/+	+	+	+
	Congestion management	+	+	+	-	∅	-
	Access restrictions	+	+	+	+	+	+

Note: +positive effect ∅no effect -negative effect ? uncertain effect +/-effect maybe either way

Source: Hasson and Feypell, 1998.

Moreover, Figueroa and Ribeiro (2013) illustrate in Table 6 the impact of transport policies on economic and urban development, health, environment protection and energy.

Table 6 - Transport policies and impact on economic and urban development, health, environment protection and energy security (Figueroa and Ribeiro 2013, Profillidis *et al.* 2014)

System goal	Category related to sustainable transport goals	Example of indicative approach for assessing progress	Reduce Need to Use Car and Expand Mobility Options and Services					Improve Vehicles	Promote-Uptake Alternative fuels			
			Promote compact, transit oriented, mixed land use development	Build-upgrade non-motorized transport infrastructure	Adopt pricing policies over car ownership, distance based tariff	Adopt strict parking regulation and pricing	Promote and upgrade public transport options	Innovate and expand mobility services	Use of Information Technology Systems (ITS)	Adopt efficiency and emission reduction standards for conventional technology vehicles	Incentives supporting research and development	Adopt standards (e.g. low carbon fuel, renewable fuel)
Economic Development	Functionality and Efficiency	Reduced travel time, travel cost and trip uncertainty										
	Operation	Quality of system condition. Percent of lane-kms by pavement conditions. Infrastructure maintenance expenses.										
	Support General Economy	Cost/benefit new facilities. Indirect job supported (created). Lost time due to congestion										

Urban Development and Equity	Accessibility	Ease of reaching opportunities. Reduced access time from origin to destination. Good conditions for biking-walking											
	Affordability	Passenger trips per house hold. % of income used to pay for transport services (<20%)											
Health and Environment Protection	Traffic Safety	Reduction of road traffic deaths and injuries											
	Universal Access	Access provided for the elderly, very young and people with disabilities											
	Physical Activity	Public health benefits from increased physical activity											
	Air Pollution	Air pollution level reduction											
	Noise	Noise level reduction											
	Ecosystem Impacts	Land use area-Sprawl: % suburb and welling - Biodiversity protection											
GHG	Green House Gase missions	Green House Gas emissions reduction											
Energy security	Diversification of Energy Sources	Alternative fuel consumption per vehicle and passenger km											
	Resilience	Sectoris secure from, ready for and resilient to threats and hazards											
	Independence from Fossil Fuels	Percentage reduction in use of fossil fuels											
Essential: academic agreement, positive examples of implementation													
Uncertain: academic dissent, of lack of substantive evidence													
Limited/potential opposite: academic agreement and evidence of limited oropposite effect													

They illustrated an exploratory method consisting of four steps, first: outlining the challenges of using energy in road passenger transport and the main systemic sustainable development goals departing from the literature; second, matching the system goals with sustainable transport areas and existing indicators from the literature, that exemplify ways to measure progress toward these goals; third: choosing transport policies among those most distinguished in current academic debates as examples of three type of interventions in transport and energy: decreasing mobility services and reducing car use, enhancing vehicle efficiency and promoting alternative fuels; and fourth, aligning the selected goals against policies in a table as shown in Table 6. The types of interactions are defined as essential, uncertain and limited/opposite. Each category is based on the level of scholarly agreement or dissent identified within the scope of this literature review and, the availability of existing positive examples of implementation. An essential interaction indicates strong academic agreement of a positive effect between policy and goal and available examples of successful implementation. Uncertain reflects that a degree of disagree mentor lack of certain studies in the area is clear and also few examples of implementation had been identified. And finally, limited/opposite interaction indicates the policy is found to have limited effects toward the goal within empirical and practical evidence of implementation.

The cross tabulation of policies and goals illustrated in Table 6 maps out a large set of interactions that focus on reducing petroleum used in road passenger transport with sustainable development goals. And the five system goals can follow correspondence to the three dimensions of sustainability economic including energy security, health and environmental-climate, and social (urban development and equity).

Moreover, the policies mentioned cover most of these categories: incentives, voluntary agreement, regulatory and market driven interventions all oriented toward the goal of reducing fossil fuel consumption in the passenger transport sector and facilitating the usage of alternative clean fuels. The twelve policies are grouped as: firstly, reduce the need to travel by car, including policies enhancing a modal shift to the most energy-efficient mode for a certain trip, using integrated land use and transport planning to facilitate shorter trip destinations, and targeting

behavior through pricing, regulations and via personal information for public awareness and acceptance; secondly, improve the efficiency of conventional vehicles and finally, make incentives for the use of alternative clean fuels. (Figueroa and Ribeiro 2013)

## 5. Internalization of externalities in transport sector

The above mentioned externalities are considered external costs that are generally not borne by transport users only, so internalization through policy intervention is essential to take into consideration these costs (European Commission 2014). Internalization of external costs from transportation has become an important issue for policy makers in worldwide and it means that every transport mode will pay the external costs it causes, and that means that internalization of these costs will make externalities' effects part of the decision making process of transport users. This can be achieved directly through regulation as command and control approach or indirectly through market-based approach (charges, taxes...) and providing the right incentives to transport users.

Command and control measures are considered one method of internalization of external costs and can be achieved through direct government intervention and establishment of laws and standards. (Jokanovic and Kamel 2014) They can be done by imposing limits in vehicle usage by restricting access to certain urban area. And this policy has been put in place in various European downtown areas to limit the access to local residents aiming to preserve historical sites and buildings from the corrosive effects of transportation emissions. (Ruta 2002)

But command and control measures, as limiting traffic in certain areas may disregard the difference between users. It can be found that drivers that are ruled out from the restricting area would be willing to pay a price higher than the marginal social costs and vice-versa as drivers allowed to access the restricted area may have marginal costs above marginal benefits from using it. (Ruta 2002)

Therefore, internalization of external costs through usage of market-based measures is generally regarded as more efficient way than command and control measures (European Commission 2014). This can be achieved by applying the following measures (Ruta 2002, Cozet 2004, Van Dender 2009, Macharis *et al.* 2010, Profillidis *et al.* 2014):

- Application of public transport subsidies, but must be fair and relevant and it must be taken into consideration that sometimes the demand for public transport might be very inelastic which needs very strong subsidies.
- Introduction of road pricing schemes for passenger cars, as imposing taxes or charges on road usage equal to marginal external cost of congestion, measured in monetary units per vehicle kilometer. Also, differentiation of taxes or charges can be done depending upon the power and net weight of cars, in addition emission of pollutants.
- Application of fuel price scheme for all transport modes taking into consideration the external costs of every transport mode, and generally there is positive correlation between road congestion and using fuel. Higher congestion leads to lowering speed and increasing waiting times, implying higher fuel consumption.
- Using alternative clean fuel.
- Encouraging alternatives to transport as it has been suggested that the development of new communication technologies as videoconferencing, telecommuting, and teleshopping may limit vehicles uses.
- Application carbon or fuel taxes which are considered price instruments that are preferred by economists as by applying these taxes, consumers benefit as they can reduce emissions in the way that is best suit them. Japan and Europe used diesel and gasoline taxes, such that taxes are often more than 200% of the product prices. (Proost and Van Dender 2012)

Although some efforts to internalize external costs of transportation sector based upon legislation has failed, the most efficient are those efforts based on fuel pricing scheme that take into consideration all external costs for every transport mode. (Profillidis *et al.* 2014)

## 6. Policies adopted in Egypt for addressing externalities from transport sector

Egypt as one country in the Arab world has been suffering from rapid sprawling in major cities, poor car maintenance, inefficient and inadequate public transport systems, aging vehicle fleet and poor urban planning systems. These are the main causes for unsustainable forms of transportation (Kaysi and Chaaban 2015), and therefore government has adopted the following policy reform and measures aiming at internalizing externalities to improve both air quality and energy efficiency. (ESCWA 2014)

### 6.1 Alternative fuel

The ministry of Petroleum began in 1990s establishing a fuel switching policy to use compressed natural gas (CNG) as a clean alternative fuel. The government has succeeded in increasing CNG vehicles in Egypt through the development of CNG infrastructure and applying incentives to enhance switching to natural gas such as making tax reduction on CNG components and lowering natural gas prices. The number of CNG vehicles in Egypt greatly exceeds those in other Arab nations, with Egypt also ranking 11<sup>th</sup> worldwide in terms of CNG vehicle usage. Natural gas consumed by vehicles in the transport sector in Egypt has increased by an average annual growth rate of 22.4% during the period (1997/1998-2012/2013) to reach 398 thousand tons in 2012/2013. This result in reduction of carbon dioxide emissions CO<sub>2</sub> with about 11.8 million tons, depending on estimating the reduction of CO<sub>2</sub> as result of CNG used as a fuel; gasoline has been used as the main fuel replaced by natural gas. Total amount of replaced gasoline by natural gas estimated at more than 3.8 million tons during the period (1997/1998 - 2012/2013) (ESCWA 2014).

### 6.2 Inspection and import regulations

One of the major problems that contributes to the inefficient use of energy in the transport sector in Egypt and the increase of pollutant emissions is the existence of significant number of old vehicles which are characterized by poor maintenance and low efficiency engines. So, the government aims at setting some import regulations. It banned the import of vehicles older than three years and that the imported vehicles must have a catalytic converter because the main problem associated to old vehicles is their frequent breakdown that causes traffic jams and bottlenecks and in turn increases fuel consumption and greenhouse gas emissions.

In order to overcome the problems associated to the operation of old vehicles in areas with heavy traffic and high population density such as Greater Cairo Region, the old Vehicles Scrapping and recycling (OVSRP) was developed. Historically, the idea of OVSRP in Egypt was originally initiated in 2009 by the Clean Development Mechanism Awareness and Promotion Unit CDM APU which affiliate to the Egyptian Environmental Affairs Agency (EEAA) aiming at reducing greenhouse gas emissions through the scrapping and replacement of old vehicles by new and fuel efficient ones. Total number of scrapped and recycled vehicles during the two pilot projects of the program in 2005 and 2009 and its commercial implementation during the period 2010 till the end of 2013 accounted for 49 thousand vehicles. Moreover, total fuel saving and greenhouse gases emissions reduction estimated at about 0.6 million tons of oil equivalent and more than 1.7 million tons of carbon dioxide emissions during the period 2005 till 2013. (ESCWA 2014, Korkor 2014)

### 6.3 Energy efficiency potential of Cairo metro

Several metro lines have been constructed and became in operation in Greater Cairo Region since the year 1983, and still there are metro lines that are under construction. It is the first in Africa and the Middle East and the greatest implemented project in Egypt in the 20<sup>th</sup> century.

It is considered as a good example of the importance of public transport that results in energy savings and pollutants emissions reduction in large and crowded cities like Cairo.

ESCWA (2014) estimated the expected fuel saving and avoided CO<sub>2</sub> emissions as a result of the construction and operation of the metro lines and its utilization instead of private cars and poor maintained and old public buses and concluded that for the case of passengers which switch from private cars to metro: gasoline savings are expected to increase to reach about 4.1 million tons of oil equivalent (mtoe) in 2021 after the completion and operation of all metro lines and compared to 1.8 (mtoe) in 1989. Thus, total accumulated gasoline savings during the period (1989-2021) estimated at 81 mtoe. Accordingly, avoided CO<sub>2</sub> emissions are estimated at about 11.4 million tons in 2021 compared to about 5 million tons in 1989. Therefore, total avoided CO<sub>2</sub> emissions during the period (1989-2021) are estimated at 228 million tons.

Moreover, ESCWA (2014) estimated the expected diesel fuel saving for the case of passengers which switch from public buses to metro to reach about 1 mtoe in 2021 after the completion and operation of all metro lines by the end of the year 2020 compared to 0.4 mtoe in 1989. Therefore, total accumulated diesel fuel saving during the period (1989-2021) is estimated at 18 mtoe. Accordingly, avoided CO<sub>2</sub> emissions are expected to increase to reach about 2.6 million tons in 2021 compared to about 1.1 million tons in 1989. Therefore, total avoided CO<sub>2</sub> emissions during the period (1989-2021) are estimated at 51.2 million tons.

## 7. Strategies for sustainable transport policies in Egypt

Although Egypt has adopted the above mentioned policies to internalize externalities and to reduce the negative environmental effects from transport sector, but still transport sector imposes serious problems that need

to be addressed and there are many challenges and barriers that negatively affect the effectiveness of sustainable policies, as there is significant growth of vehicles from 1.1 million in 1990 to reach 8.3 million in 2015 with an average annual growth rate of approximately 9% during that period according to CAPMAS.

Moreover, lack of funding, lack of existence of technical expertise, the strong need of cooperation among stakeholders and lack of creation of strong incentives to attract the necessary investments are considered major challenges. And so, based upon the problems and challenges in transport sector in Arab world including Egypt, Kaysi and Chaaban (2015) proposed several policies and classified it as short, medium and long-term strategies and these are summarized in Table 7.

Table 7 - Recommendations for sustainable transport policies

	US/Europe Intervention	Success Factors	Challenges/ Impediments to Arab World including Egypt	Recommendations
Vehicle/Fuel Technology	Fuel Standards	<ul style="list-style-type: none"> <li>Stringent standards;</li> <li>Strict monitoring and penalties.</li> </ul>	<ul style="list-style-type: none"> <li>Failure to apply standards.</li> </ul>	<ul style="list-style-type: none"> <li><i>Long-term strategy:</i> Imposing strict policies to implement fuel standards for vehicle fleets.</li> </ul>
	Fuel Efficiency	<ul style="list-style-type: none"> <li>Gas Guzzler Tax;</li> <li>Fuel Tax.</li> </ul>	<ul style="list-style-type: none"> <li>Lack of regulations and policies.</li> </ul>	<ul style="list-style-type: none"> <li><i>Medium-term strategy:</i> Impose fuel efficiency standards on importers of vehicles in phases.</li> </ul>
	Electric and Alternative Fuel Vehicles (EVs)	<ul style="list-style-type: none"> <li>Charging stations;</li> <li>Financial incentives.</li> </ul>	<ul style="list-style-type: none"> <li>Lack of incentives for widespread use of modern technology;</li> <li>Lack of infrastructure to support modern technologies.</li> </ul>	<ul style="list-style-type: none"> <li><i>Long-term strategy:</i> Provide financial incentives and adequate charging stations for EVs and alternative fuel vehicles.</li> </ul>
Road/Vehicle Operations Improvements	Speed Control	<ul style="list-style-type: none"> <li>Public acceptance and consultation;</li> <li>Implementation and operation;</li> <li>Effective enforcement.</li> </ul>		<ul style="list-style-type: none"> <li><i>Short-term strategy:</i> Impose strict speed limits with proper monitoring and enforcement through the use of cameras that capture the license plate numbers of non-compliant drivers.</li> </ul>
	Traffic Signal Timing	<ul style="list-style-type: none"> <li>Accurate traffic volume use.</li> </ul>		<ul style="list-style-type: none"> <li><i>Short-term strategy:</i> Reassess traffic volumes after certain periods of time to ensure accurate signal timing optimization.</li> </ul>
	High Occupancy Vehicle (HOV) Lanes	<ul style="list-style-type: none"> <li>Awareness of the availability of use of HOV lanes;</li> <li>Fuel tax to prevent induced traffic.</li> </ul>		<ul style="list-style-type: none"> <li><i>Long-term strategy:</i> Provision of HOV lanes with awareness on their availability and fuel tax policies to discourage induced traffic.</li> </ul>
Demand Management	Public Transit	<ul style="list-style-type: none"> <li>Exclusive right of way transit systems;</li> <li>Smart cards;</li> <li>Affordable tickets;</li> <li>Reliable scheduling.</li> </ul>	<ul style="list-style-type: none"> <li>Inaccurate demand projection;</li> <li>Unreliable public transit;</li> <li>Lack of policies and incentives to enhance shift from private vehicles.</li> </ul>	<ul style="list-style-type: none"> <li><i>Short-term strategy:</i> Accurate scheduling, affordable tickets, and smart cards;</li> <li><i>Long-term strategy:</i> Provision of public transit system.</li> </ul>

	Fuel Tax	<ul style="list-style-type: none"> <li>• High fuel tax</li> <li>• Alternative, cheaper modes of transport</li> <li>• Incentives to switch to alternative fuel vehicles</li> </ul>	<ul style="list-style-type: none"> <li>• Unreliable public transport.</li> </ul>	<ul style="list-style-type: none"> <li>▪ <i>Short-term strategy:</i></li> <li>▪ Impose a high fuel tax and offer incentives to switch to cleaner modes of transport.</li> </ul>
	Pricing Incentives/ Disincentives	<ul style="list-style-type: none"> <li>▪ Public acceptance and consultation;</li> <li>▪ Strong leadership and political engagement;</li> <li>▪ Research and monitoring;</li> <li>▪ Awareness raising.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Limited funding.</li> </ul>	<ul style="list-style-type: none"> <li>▪ <i>Medium-term strategy:</i> Public acceptance and consultation, provision of financial incentives, strong leadership and political engagement.</li> </ul>
	Inspection and Import regulations		<ul style="list-style-type: none"> <li>• Lack of emission standards;</li> <li>• Failure to implement emission control strategies.</li> </ul>	<ul style="list-style-type: none"> <li>▪ <i>Short-term strategy:</i> Impose emissions standards;</li> <li>▪ <i>Medium-term strategy:</i> Apply emission control strategies</li> </ul>
	Ride sharing	<ul style="list-style-type: none"> <li>• Effective land use planning;</li> <li>• Road tolls;</li> <li>• High parking fees.</li> </ul>		<ul style="list-style-type: none"> <li>▪ <i>Short-term strategy:</i> Increase parking and toll fees;</li> <li>▪ <i>Long-term strategy:</i> Impose toll fees and land use.</li> </ul>

Source: Kaysi and Chaaban 2015.

It is shown in Table 7 that Kaysi and Chaaban (2015) summarized sustainable transport policies implemented in Europe and United States as well as success factors. Based on these, they presented recommendations on the implementations of different policies in the Arab world including Egypt. Most of these sustainable transportation policies fall into one of three categories: vehicle/fuel technology changes, road/vehicle operations improvements and demand management.

Vehicle/Fuel technology is the first sustainable transportation policy and it includes imposing fuel efficiency standards on vehicle manufacturers and encouraging using low emissions vehicles as electric vehicles aiming at reducing greenhouse gas emissions. A Road/Vehicle operations improvement is the second sustainable transport policy category and it deals with road and vehicle operations improvements. It is concerned with conventional traffic flow improvements such as ramp metering, traffic signal timing, flow metering, and bottleneck removal which might reduce greenhouse gas emissions and lower noise levels by altering traffic flow characteristics and reducing stop-and-go driving. Moreover, reduction of harmful emissions can be achieved by educating drivers on the negative effects of heavy accelerations and decelerations and the fuel consumption associated with high speeds. Demand management is the third and last sustainable transportation policy that is concerned with encouraging public transit and ridesharing, imposing fuel taxes and providing pricing incentives and disincentives.

These sustainable transportation strategies are classified as short, medium, and long-term strategies. Short-term strategies such as imposing fuel taxes which benefit both government and the environment and these taxes generate money which could be used to finance other sustainable projects for transport sector. In addition, ridesharing could be made more attractive through increasing toll and parking fees. Also, it is important that the provision of public transport be accompanied with accurate scheduling and smart cards that facilitate the access to public transit facilities. Speed control also can be established through enforcement that ensures the penalization of non-compliant drivers.

Moreover, medium strategies such as imposing fuel efficiency standard and in phases increased to reach specified targets are important strategies. Also, long-term strategies include the provision of high occupancy vehicle (HOV) lanes which include vehicles carrying three or more passengers. The lanes are set up in order to reduce traffic volumes, vehicle miles traveled and vehicle trips, which would result in reducing air pollution and lowering greenhouse gases emissions. (Kaysi and Chaaban 2015)



Therefore, sustainable transport policies must be implemented in Egypt as well as the Arab world to reduce energy consumption and greenhouse gas emissions.

## Conclusion

Although the transport sector is an important facilitator of economic growth, it imposes negative impact and environmental challenges on the society. The dependence of transport sector on fossil fuel resulted in emitting harmful emissions mainly carbon dioxide emissions that harm human beings and whole ecosystem.

The transport sector plays a vital role in achieving economic and social development in Egypt. Nevertheless, it is one of the major energy consuming sectors that emitted high level of emissions. The high growth of population and travel demand for both passengers and freight transport in addition to the existence of significant number of old vehicles and poor and inconvenient public transport systems resulted in transport sector severe problems that include traffic jams, noise emissions, inefficient fuel consumption and high rate of accidents imposing high economic costs on the society. (Korkor 2014)

Therefore, this study aims at discussing and quantifying the environmental effects and externalities resulted from transport sector in Egypt. In addition, environmental and safety transport policies are analyzed. Also, internalization of externalities and policies adopted in transport sector in Egypt as using alternative fuel and inspection and import regulations that resulted in considerable energy savings and pollutants emissions reduction are discussed. Finally, possible sustainable transport policies are recommended to reduce environmental effects resulted from transport sector since the implementation of sustainable transport policies will lead to better living standards for citizens and economic prosperity to the entire nation.

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## Improvement of the Intellectual Asset Management in the Information Economy

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### Abstract:

*Intellectual property acquires a particular importance in terms of the information economy and the mobilization of a global movement of capital. Therefore, a study is dictated by the need to find innovative mechanisms for intellectual asset management – intellectual property in the new economy. Methods of logic, intellectual property valuation, determination of economic performance, effect, license price were used. The article defines the basic properties of innovations: scientific and technological innovation, industrial applicability and tradability. We have considered the project life cycle to create innovations and structuring of intellectual property. A conceptual scheme of informational systems usage in the investment design is proposed. A universal algorithm for informational technology investment management is developed, which allows considering several alternatives to solve tasks of intellectual property management of an enterprise in the information economy. The research is aimed at improving the informational technology investment management process as an intellectual property. The results allow conducting the intelligent management simulation to improve the efficiency of innovation projects creation in the information economy.*

**Keywords:** information economy, innovation, innovative project, intellectual property, intellectual property management.

**JEL Classification:** O34, O3, O30.

### 1. Introduction

In today's information economy, within the market competitive struggle intellectual property is the main instrument of innovation. In foreign countries intellectual property consists up to 70% of the enterprise value, and intellectual assets are the basis for the creation of innovations. Major world leaders of high technologies sphere hold hundreds of patents, which gives them the opportunity to receive additional cash income from the use of intellectual property, to conduct an active policy of conquering markets, introduction of innovations and recruitment of the best staff. The greatest Russian companies own a much smaller number of patents, which is an inhibiting factor for the domestic economy development.

### 2. Main text

Currently, Russia is undergoing a kind of innovation boom: forms and methods of economic management are changing. Under these conditions, all organizations and entities, from public administration to a newly established limited liability company in the sphere of small business, must take part in the innovation activities.

Innovation management can be successful providing long-term study of innovations that is necessary for their selection and use. First of all, it is necessary to distinguish between innovations and insignificant modifications in products and processes; minor technical or external changes in products, leaving unchanged the design concept and not having significant effect on the parameters, properties, the product price, as well as the cost of materials and components included in it; expanding the range of products through the development of manufacture of products that were not produced before at this enterprise, but are already well-known on the market. We can agree with the opinion that innovations are the created (used in) or (and) improved competitive technologies, products or services, as well as organizational and technical solutions of industrial, administrative, commercial or other nature which substantially improve the structure and quality of production or (and) of the social sphere.

In this case, intellectual property management becomes an important part of the overall management of innovation processes. Therefore, the effectiveness of intellectual property management mechanism largely determines the efficiency of the entire innovation system, and ultimately has a significant impact on the GDP growth.

The development of the information economy nowadays is accompanied by an increase in the role of intellectual capital. Thus, currently, mechanisms for managing innovative intellectual assets – the intellectual property of an enterprise in the new information economy are highly required.

Problems of innovative activity management are considered in the works by Russian and foreign scientists. They focus on issues of innovation economy theory as Bell (1967, 1973, 1989), Brzezinski (1970), Coomaraswamy (1914), Crawford (1991), Drucker (1973), innovative management as Vasilenko and Shmatko (2006), Penty (1917), modeling of innovative development of enterprises: Vinarchik (2003), Pyatibratov (2009), Waterman (2003), evaluation of innovation effectiveness: Zavlin and Vasilyev (2007), Nalivaychenko (2007), Porat and Rubin (1978), etc. Since any progressive development of society is closely connected straight to innovation, this topic is constantly relevant to any developing economic system.

An analysis of scientific publications on innovation management (Zavlin and Vasilyev 2007, Krakhmaleva 2007, Pedulova *et al.* 2010, AKIS 2010, Christoplos 1996, European Technology Platforms 2012, Global consulting market) suggests that the issues of project intellectual asset management and intellectual property valuation in the process of innovative projects management are poorly formalized. Main attention is paid to management of project material resources. These works dealing with intellectual property assessment lack methods of structuring intellectual property valuation in the information economy. In addition, the development of intellectual property valuation methods is required to justify the need to attract credit resources from domestic banks as the participants in innovative projects. Intellectual property management of the company, including the use of informational technology remains understudied; organizational and economic mechanisms for managing the company's intellectual property and the technology of their changes depending on the specifics of ongoing projects are absent.

The aim of this study is to examine the general directions and priorities of innovation development in the current economic conditions, the search for optimal mechanisms of intellectual property management in the information economy, the implementation of the innovation criteria and options for calculating the appropriate economic effect, the formulation of the necessary principles of state innovation policy.

### **3. Main study results**

Since the adoption for the distribution, an innovation acquires a new quality – it becomes a novation (innovation) (Guzhva and Postovoy 2009, 16). The process of introducing innovations to the market is commonly referred to as a commercialization process (Krakhmaleva 2007, 85). The time period between the emergence of novelty and its embodiment in the innovation is called an innovative lag (Pyatibratov 2009, 178). The indispensable qualities of innovation are scientific and technical novelty and industrial applicability. Tradability in relation to innovation acts as a potential property, to achieve which some efforts are required. Scientific and technical innovation characterizes the final result of the research and production cycle, which acts as a special commodity – scientific and technical production and is the materialization of new scientific ideas and knowledge, discoveries, inventions and developments in the production with a view to tradability to meet specific needs.

An analysis of scientists' studies shows that an innovation – the result should be considered as dealing with the innovation process (Waterman 2003, 36-38).

In our opinion, all three properties are equally important for innovation: scientific and technological innovation, industrial applicability and tradability. The absence of either of them has a negative effect on the innovation process. Commercial aspect defines innovation as an economic necessity, realized through the needs of the market. It is necessary to pay attention to two things: "materialization" of innovations, inventions and developments in new technologically advanced industrial products, means and tools of labor, technologies and organization of production and "commercialization" turning them into a source of income. Therefore, a scientific and technological innovation must: a) exhibit novelty; b) satisfy the market demand and bring profit to the manufacturer (Vinarchik 2003, 15-26).

While transforming the innovation process into the trade one its two organic phases stand out: a) creation and distribution; b) diffusion of innovations.

Diffusion of innovations, in our opinion, is the distribution of already once mastered and used innovation in a new environment or fields of application. Diffusion of innovation is an informational process (Masuda 1981), the shape and speed of which depend on the power of communication channels, peculiarities of information perception by business entities, their abilities to the practical application of this information, etc. One of the important factors in the diffusion of any innovation is its interaction with the corresponding socio-economic environment, an essential element of which is competing technologies. According to the Schumpeter's theory of innovation, diffusion of innovation is a process of cumulative increase in the number of imitators, introducing innovations following the innovator in anticipation of higher profits (Vinarchik 2003, 27).

The intellectual property will be taken to mean the exclusive right of a person or entity to the results of intellectual and creative activity. Intellectual properties (hereinafter IP) in the economy are considered to be scientific results, inventive work, design work, administrative work, software, copyrights, expressed in objective

form, and recorded on tangible media. In the information economy, the IP can be also placed on the information carriers. (Mahlup 1962)

Each IP type contributes its share in the formation of the value the customer ascribes to the product in the preparation and implementation of an innovative project. (Nalivaychenko 2013) The subject of innovation is the main result of the project, while IP are an additional result, bringing the owner additional income from their commercialization.

The situation is typical for Russian companies when determining the innovative project cost, only material resources are estimated, excluding the cost of intellectual property rights. Accordingly, the economic effect of the implementation of innovative projects is significantly undervalued. Underestimation of the intellectual assets leads to a loss of advantages in relation to competitors and negatively affects the prestige of the enterprise, which is inextricably linked to competitiveness of created innovations.

The difficulty of determining the input parameters and low reliability is a common shortcoming of existing IP valuation methods (cost, market and income methods) due to the use of a large amount of forecast data, which makes them inapplicable in carrying out large-scale projects to create high-tech innovations. Therefore, IP assessment and licensing methods are necessary, applicable to the conditions of production enterprise in the informational economy.

Consider the life cycle of a project establishing an innovation (Figure 1). At the design phase, we carried out scientific and research and development work, in the process of which the IP identification and patenting are carried out, trademarks are registered and the IP licensing is realized (Nalivaychenko 2013). At the pre-production phase the IP identification is carried out with the help of patent research, contracts with the authors for the payment of remuneration for the IP creation are concluded, the most effective IP projects are patented. (Krakhmaleva 2007) To effectively manage the IP of innovation creation project we must first make their structuring, during which the IP list is determined, they are classified, the cost-effectiveness and impact of the IP implementation at the enterprise is assessed and recommendations for the further commercial use in the project are given (see Figure 2).

For structuring we should choose only those IP, which form the project cost, *i.e.* are related to scientific, technical and industrial areas:

- industrial property: inventions, utility models, industrial designs, trademarks;
- the right to trade secrets: know-how and trade secrets;
- objects of copyright: Research and Advanced Development results, computer programs, databases, integrated micro schemes, scientific works.

To determine the possible additional income from the use of the project intellectual assets at the stage of its development it is necessary to choose the IP valuation method, in accordance with which its further commercialization will be held. The method of determining the IP cost-effectiveness is based on the calculation of the future IP value at the end of the period of patent validity (Nalivaychenko 2007). When using the method royalty values are taken as the cash flows. The index value of the cumulative net cash flow (NCF) is selected as the commercial importance of the IP.

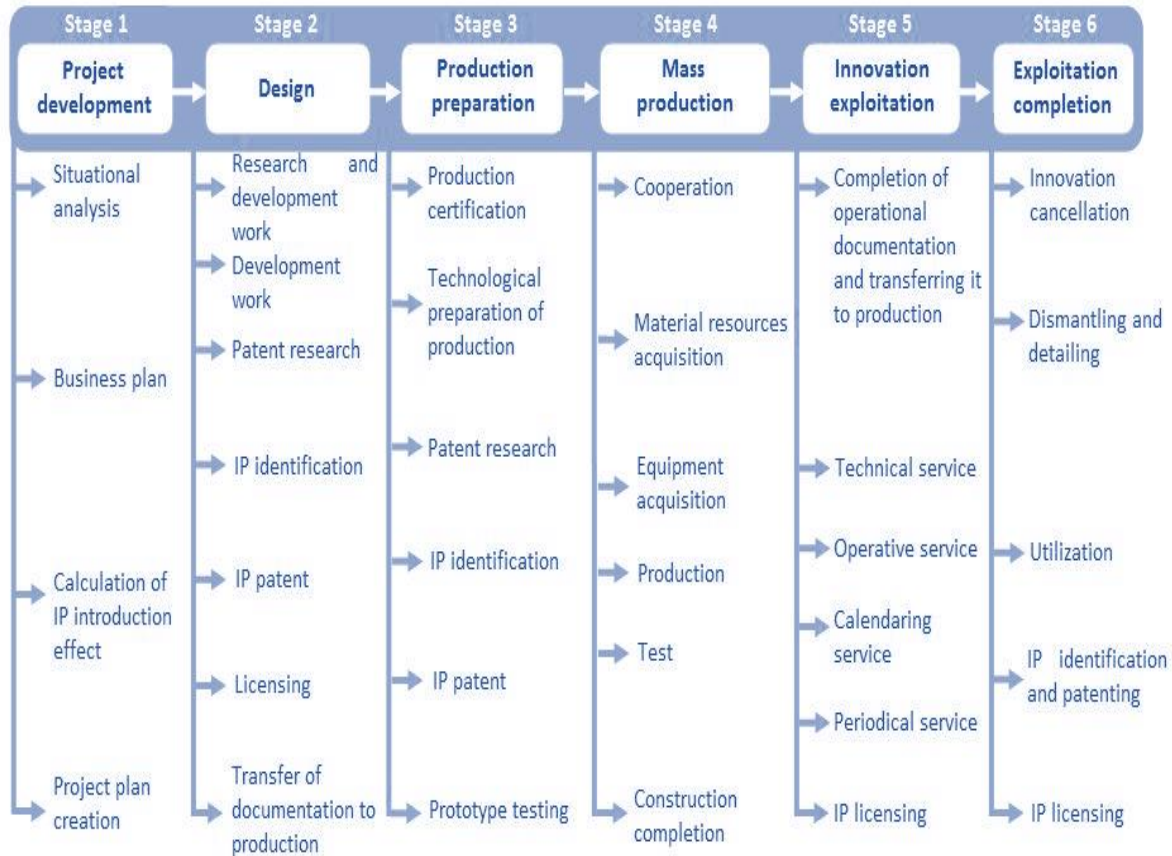


Figure 1 - Project life cycle of innovation creation

Net Present Value shows the distribution of cash flows during the information project execution. With this indicator the project manager monitors increase or decrease in the profit from the project implementation (Pedulova *et al.* 2010). The performance indicator of the PI project effectiveness (Profitability Index) serves as a final project characteristic in this method.

In the framework of IP structuring the method of evaluation of IP implementation effect due to the IP introduction in the company can be used to choose IP for commercialization (Porter and Opstal 2001).

Then it is necessary to solve the problem of optimization of IP creation costs, selected on the basis of determining the effect from IP implementation (Shapiro and Varian 1999). With the use of a target function by the *Simplex* method we can find the optimal IP for each of the selected groups under the given constraints in terms of capital costs and annual operating costs of the project (Nalivaychenko 2007).

Furthermore, the method of determining the license pricing can be applied which is based on the assessment of the size of the patentee's losses from the unlawful use of IP (Pyatibratov 2009). In accordance with the Russian legislation the IP owner is able to provide the right to use IP through the conclusion of a license agreement for a specified period, to transfer the IP ownership for a fee, as well as to use IP in its own production, thereby increasing the competitiveness of its products and profit from their use.

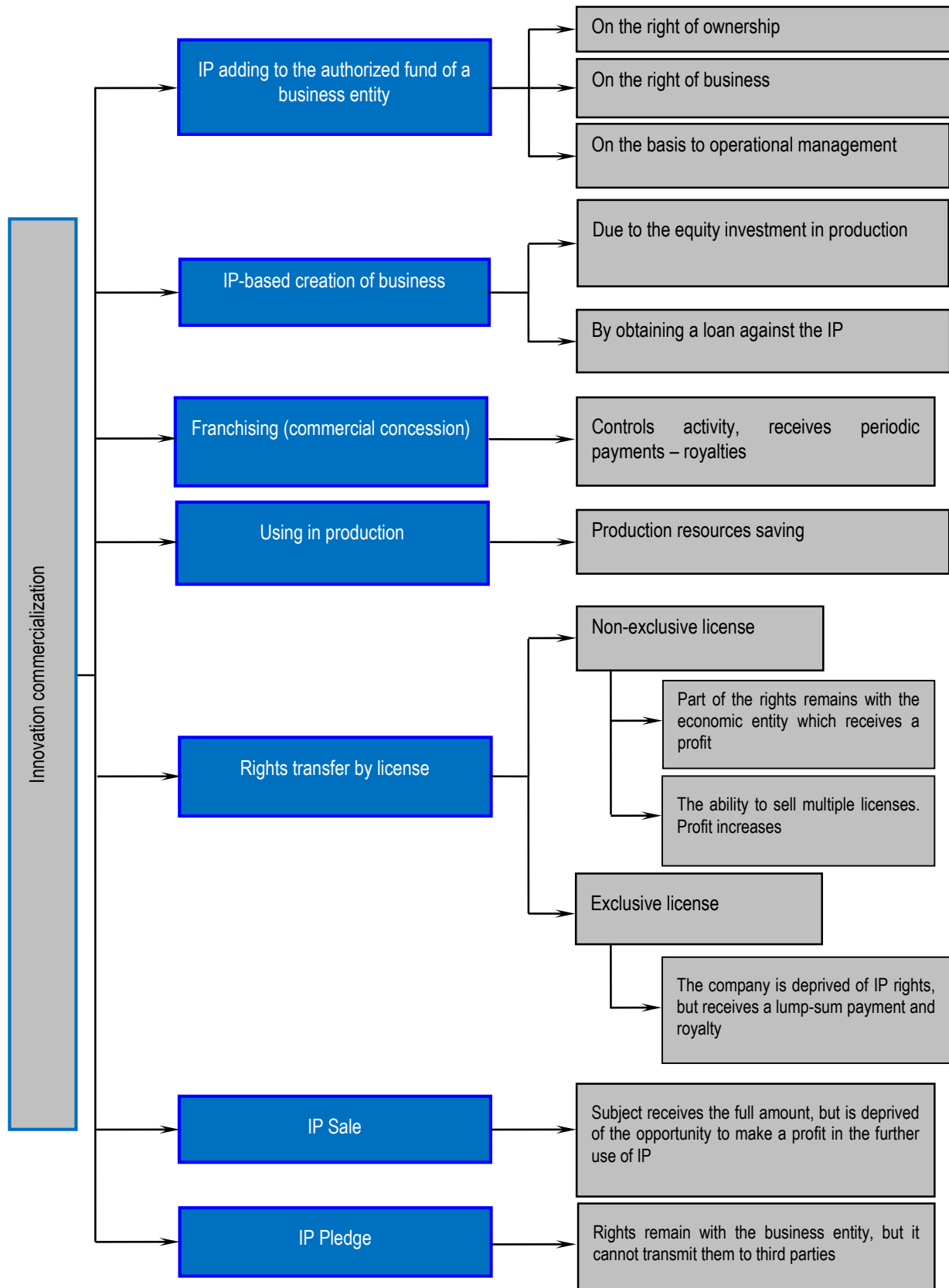


Figure 2 - Structuring of kinds of commercialization of innovations as intellectual properties

Consider the current objective conditions for the introduction of innovative IP as an example of the ARC economy. In Crimea, an annual growth of investments is observed that affects the development of the relevant information complex. Investment attractiveness of the Crimean Federal District of Russia is quite high for foreign

investors. The indicator of foreign direct investment (FDI) in the Crimea makes on average 6% compared to the Russian FDI level. FDI per capita in the Crimea was RUB 23,840 (or USD 747) in 2013, more than four times higher than the Russian average level, constituting RUB 5,816 (or USD 182), and was at a level between the FDI indicator for Moscow (USD 854.7) and for the Kaluga region (USD 668) (Foreign Investors in the Crimea 2015).

Since the beginning of 2014 foreign investors invested USD 10.6 million in the republic's economy (with regard to currency exchange rate differences, capital revaluation and retirement). Volume of investment per capita amounted to USD 752.9. The main areas of capital investment (since the beginning of investing) include:

- industry - USD 642.6 million (43.6% of the total);
- temporary accommodation and catering facilities - USD 409.2 million (27.8%);
- real estate companies - USD 125.1 million (8.5%);
- health care and social assistance institutions - USD 90.6 million (6.1%)

Investments came from 50 countries. The five main investor countries (from the beginning of investing) are: Cyprus (USD 389.5 million), Russian Federation (USD 338.9 million), British Virgin Islands (USD 138.6 million), The Netherlands (USD 119.2 million), and Germany (USD 102.1 million). (MED RC 2014)

According to the Ministry of Economic Development of the Crimea, foreign investors showed great interest in the Crimean Peninsula in 2015. Chinese businessmen were interested in the implementation of civil engineering infrastructure projects and reconstruction of ports and roads. Turkish business took increased interest in the creation of industrial parks in the Crimea, to the hotel and residential development on the peninsula. French investors are ready to invest serious money in Crimea in the sphere of leisure, tourism and entertainment industry. Israeli businessmen are attracted by various projects in agriculture – viniculture, horticulture, vegetable growing and processing of agricultural products. A characteristic feature of the investment climate in the Republic of Crimea is the fact that none of the previously initiated investment projects has been discontinued because of the changed political situation or economic sanctions against the Crimea.

Currently more than 80 investment projects for a total investment amount of about 700 million rubles are implemented in the Republic of Crimea (Foreign Investors in the Crimea 2015). All figures show the high investment potential of the Crimea, the interest in it on the part of domestic and international business.

Information technology is an important object of intellectual property in conditions of information economy formation (Sakaiya 1991, Shapiro and Varian 1999). The cost of developing a new electronic information product depends on the skills of the work performed by programmers, so in largest companies this is another article of reducing product prices. In connection with the simplification of procedures for electronic information product development the number of professional programmers is constantly increasing, the lack of which in the past was often a barrier for creating or duplicating the IP–software.

Currently, the leading position among the number of programmers is occupied by the United States. But the situation is changing. According to Evans Data Corporation statistics (WIPO), by 2020 there will be more than 26 million programmers in the world. But only 18% of them will live in the United States. Now there are 14.5 million of software developers and only 23% of them are Americans. In the Asia-Pacific region, on the contrary, the number of programmers increases. Now 37% of professionals in the field of software live there, and in five years there will be 45% of them. Now 35% of developers are living in Europe, the Middle East and Africa, but up to 2020, this figure will drop to 30%. The number of programmers in Latin America will not change – 6%. All of these changes will take place not so much due to the outflow of experts from one region to another, but due to different growth rates of the number of developers. In the next 3-5 years, the number of programmers in North America will increase only by 3-4%, but this increase will make 15% in the Asia-Pacific region and 8-10% in Europe, the Middle East and Africa.

All the above mentioned figures show the information economy development and the need to find methods for effective management by innovative projects as IP.

For the efficient allocation of innovative projects funds let us consider the problem of optimizing costs of IP creation. Currently, the cost of IP, in our opinion, depends on the additional factors, namely:

- owner exclusive rights to the intellectual property patent (registration);
- cost of organizing the use of intellectual property which includes marketing costs;
- cost of intellectual property insurance;
- term of the patent, certificate at the time of its value assessment;
- expected receipts of royalties from this property in case of recording the volume of license contract payments which are registered pursuant to the current effective legislation;
- expected cash receipts from the sale of product copies;
- expected savings in operational costs when using intellectual property in the production.



Thus, we believe that the conceptual scheme of the use of information systems in the investment planning should be based on the involvement of information systems for the fundamental and technical analysis procedures (Figure 3).

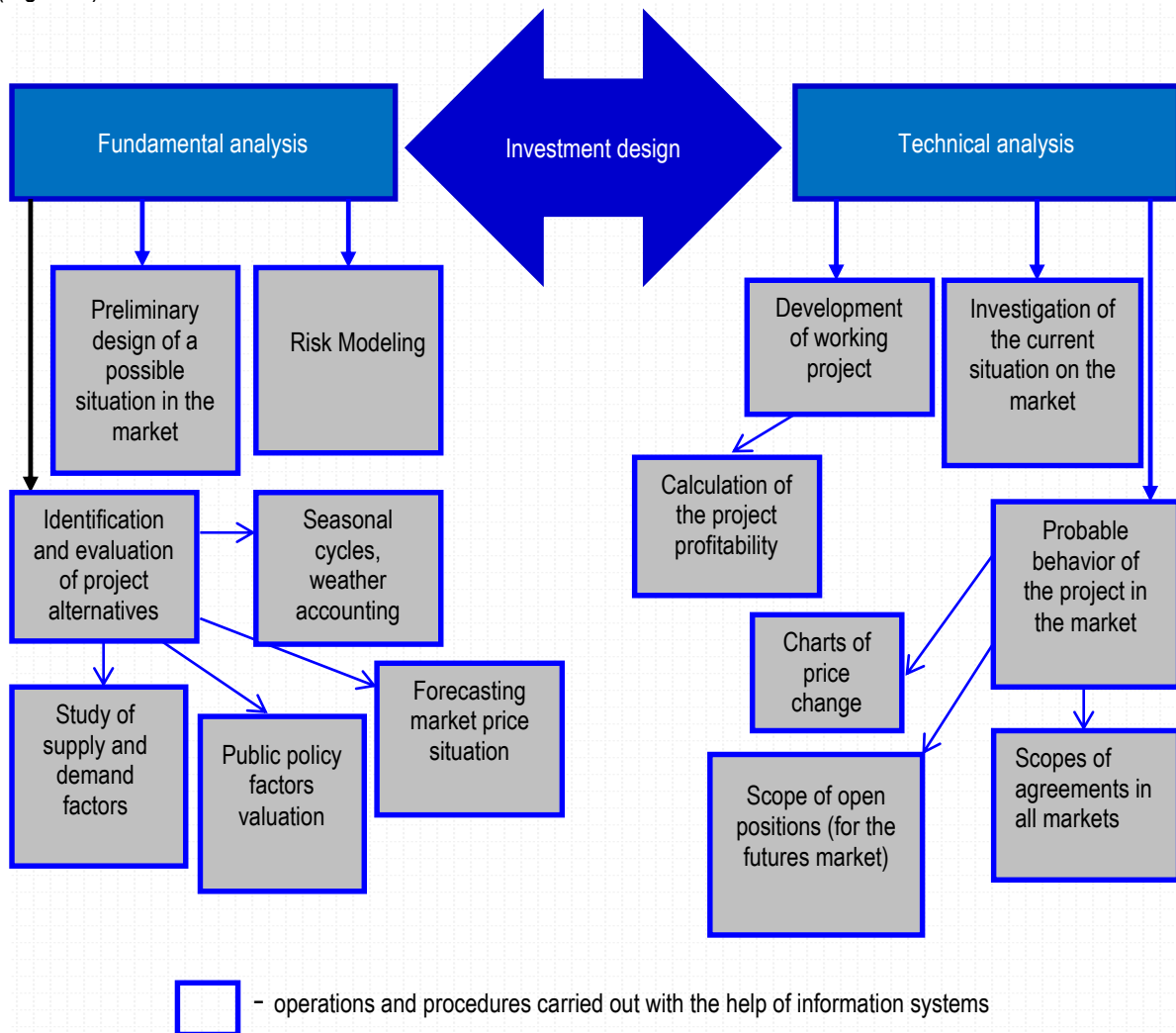


Figure 3 - Scheme of information systems use in the investment design

The process of the information technology (IT) investment management of an enterprise as an object of intellectual property is offered to be represented as a flowchart of stepwise algorithm (Figure 4).

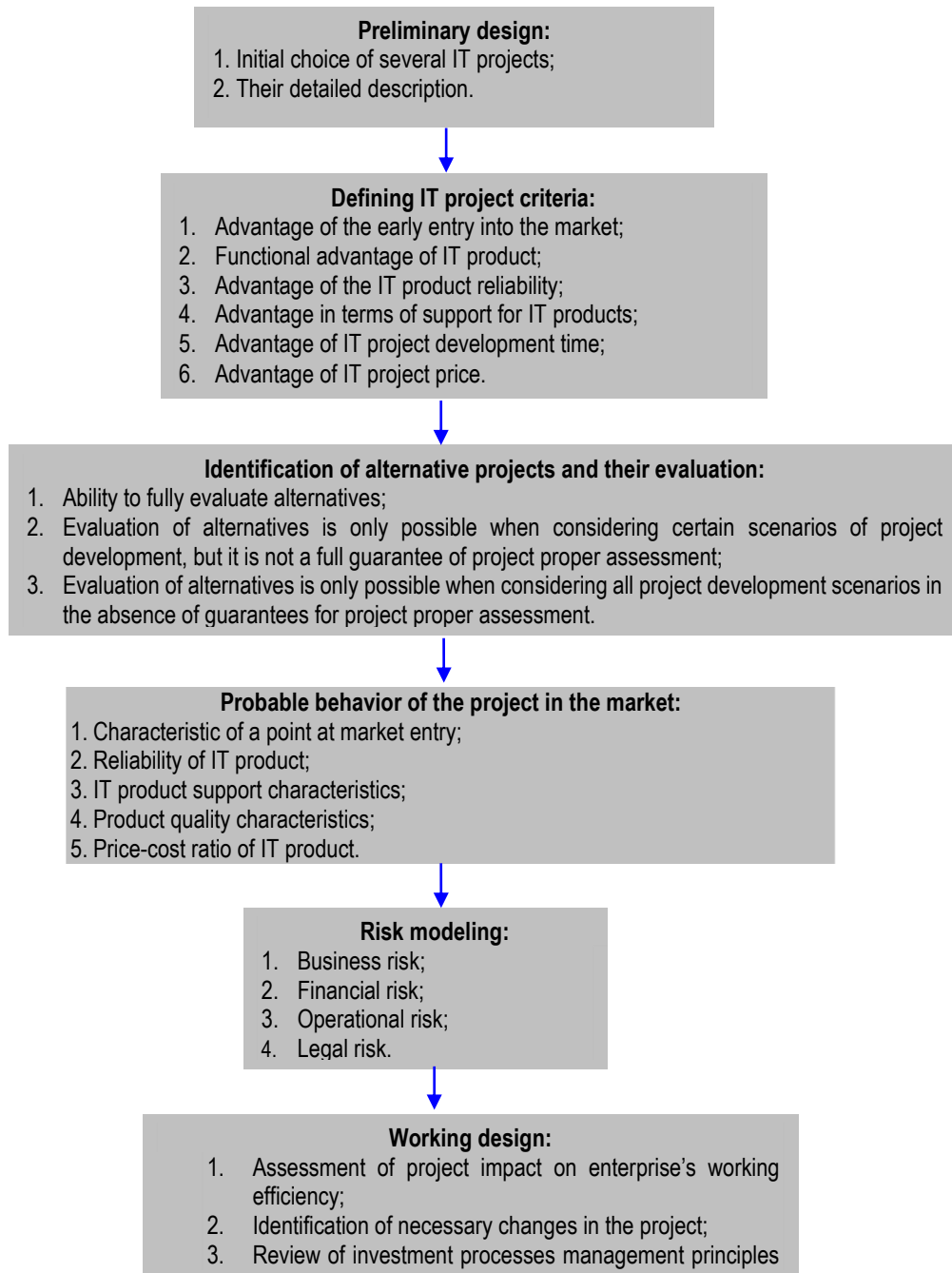


Figure 4 - Universal algorithm of investment management in information technologies as the intellectual property of the enterprise

To find an effective investment project we should select several foreseen projects and evaluate the benefits of each intellectual property. Thus, there are several alternatives to solve the problem of choosing the organizational mechanism for an enterprise's intellectual property management. There should also be a full assessment of alternatives, considering the envisaged risk of electronic information product operation, specifics of its behavior in the market.

## Conclusion

Innovative activity management is related to the creation, development and diffusion of innovations. The creators of innovations (innovators), in our opinion, should be guided by the main criteria such as the product life cycle and economic efficiency. This strategy aims to outperform the competitors, to create a novelty that will be recognized as unique in a certain area.

The problem of determining the economic effect and selecting the most preferred innovation implementation requires, on the one hand, the excess of final results from their use over the cost of development, manufacturing and implementation, and on the other hand – the comparison of the obtained results with the results from the use of other innovations similar by assignment.

The obtained results allow modeling innovative intellectual asset management mechanisms to improve the efficiency of creation of innovation projects in the information economy.

The universal algorithm developed for investment management in information technology has the following steps: preliminary design, the definition of criteria for IT project, calculation of the main indicators of IT project, identification of alternative projects and their assessment, probability of the behavior of IT products in the market, risk modeling; the detailed design allows simulating a number of alternatives to solve the problem of choosing the institutional mechanism for intellectual property management at an enterprise.

The practical use of the research results allows simulating the processes of intellectual property management; improving the efficiency of innovative projects and business processes in terms of information technologies.

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## Impact of Oil Prices on Economic Growth in Latin American Oil Exporting Countries (1990-2014): A Panel Data Analysis

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### Abstract:

*This paper estimates the significance and sign of the impact of oil price changes on the GDP growth rate of a sample of net oil-exporting Latin American countries (Argentina, Colombia, Ecuador, Mexico and Venezuela), for the period 1990-2014. Most previous studies on the impact of oil price fluctuations on GDP growth were made for developed, net oil importing countries. By contrast, this study focuses on modeling the impact of oil price fluctuations on GDP growth rates of net oil exporting Latin American countries. Using annual data for the 1990-2014 period, pooled regression analysis and different panel data techniques, empirical results suggest that crude oil price fluctuations have a positive sign and a highly significant effect on the levels of economic activity for the sample countries. The importance of oil revenues for the public finances and for an important number of private companies, as well as the multiplier effects those activities have on economic activity validate the econometric results.*

**Keywords:** impact of oil prices on GDP, relative importance of the oil industry, Latin American oil exporting countries.

**JEL Classification:** P28, Q43, O54.

### 1. Introduction

The impact of the price of the West Texas Intermediate marker crude oil price (WTI) on the growth rate of the GDP of exporting Latin American countries is an important current issue. Five net oil-exporting Latin American countries will be next examined: Argentina, Colombia, Ecuador, Mexico and Venezuela. A better understanding of the elasticity of their economic activity in response to oil prices fluctuations is a first objective towards a more complete mapping of the different channels through which oil prices impact different economic sectors. We propose an econometric methodological approach that provides relevant evidence for government economic policy designers and private-sector decision makers. The methodology consists of the estimation of a Pooled Regression, a Panel Data model with Fixed and Random Effects, and a Generalized Method of Moments Panel Estimation. The main empirical results suggest that oil price variations are positively related to the growth of the economy of the sample of net oil exporting Latin American countries and, for that reason, the relative importance of the oil industry in their economies makes their GDP growth are exposed to the ups and downs of the global oil market prices.

Latin American net oil exporting countries have been active participants in the global oil market for many years and have experienced both the benefits and the negative consequences of oil prices' significant secular volatility. For example, during the second half of the 1970s, Mexico carried out large-scale investments to explore for oil deposits and to build up the necessary infrastructure that would enable their exploitation.

However, the sustained decline in international prices that started during the summer of 1981 led to a moratorium on the country's international financial commitments (Garzón and Hafsi 1992). The economic boom generated by the large oil exports in Venezuela caused political dissent and also represented a turning point in the evolution of its economic model that made it highly dependent on oil exports and, logically, on the price of crude oil (Nariño-Rodríguez 2013). The important deposits discovered in the territorial waters of Brazil brought wealth and created the conditions for the diversification of the capital goods industry, but also disinterest in modernizing the rest of the economy (Nagao-Menezes 2012). In Colombia and Ecuador, the discovery of oilfields generated exceptional revenue for the government coffers but, since 2014, the decline of oil prices has slowed down their economic growth.

The paper is organized as follows: section 2 deals with a review of representative studies on the subject matter of this work, and performs a brief digression on the determinants of oil prices; section 3 examines the impact of oil prices on economic growth; section 4 describes the data; section 5 puts forward the methodological approach;

section 6 presents and discusses the empirical results; finally, the concluding section provides some general policy recommendations for oil companies and governments exposed to oil prices volatility.

## 2. Literature review on oil dynamics and economic growth

Most studies on the effects of oil prices volatility on economic growth have been focused on the more developed countries, which usually are net importers of oil; see, for example, an excellent survey in Rotemberg and Woodford (1996); other representative studies include: Hamilton (1983, 1985), Keane and Prasad (1991), Mork (1989), and Barsky and Kilian (2004).

As Allegret *et al.* (2014) or Arezki and Hasanov (2013), this paper focuses on the macroeconomic consequences of oil price fluctuations on the GDP growth of Latin American emerging net oil exporting countries, and not on the potential disrupting consequences for oil importers, as has been the most frequently explored phenomenon. The first thing to point out is that, while the channel of transmission of oil prices impact on the macro economy of more developed importing countries works mainly through the effects it may have on domestic energy costs that, transmitted to all goods' and services' costs via cost-push inflation, induce relative prices distortions and motivate a monetary policy response (see, for example, Bernanke, Gertler and Watson 1997). By contrast, in emerging oil exporting countries, oil prices fluctuations impact the macroeconomy through very different channels. In most cases, oil exports represent an important component of national rent that may either be channeled through the government's finances, via taxes and rights collected, and allocated to different economic sectors through public expenditure, or spent or invested by private domestic oil producing and exporting firms. Public expenditure may be used to build infrastructure, improve social services, including education, health services, etc. and represent an important flow of funds to the rest of the economy, with all the multiplier effects associated. Private firm's profits may be reinvested and also produce multiplier effects via new employment and consumption, or may be distributed to shareholders, thus generating additional purchasing power for different social constituencies.

A starting point to understand the oil price dynamics is to recognize that it is determined at a global scale, by the interaction of supply and demand forces which are themselves the outcome of complex market interests. So many production and consumption factors affect the supply and demand for oil, but not only since the psychology of market participants is also significant, that rigorous econometric techniques are needed to capture its nature.

After more than forty years of relative price stability in the global oil market, in October 16, 1973, the Organization of Petroleum Exporting Countries (OPEC) decided to freeze production and embargoed oil shipments as a reprisal against countries that supported Israel during the Yom Kippur War<sup>1</sup> that, just a few days earlier (Hamilton 2009). That decision forced an unprecedented increase in the price of crude oil that had important economic consequences (Hammes and Wills 2005).

The consequences of the OPEC embargo were rapidly transmitted across nations and continents. In the case of industrialized countries that were net importers of crude, oil price increases produced sudden cost inflation, and eventually caused the global economic recession of 1974-1975 (Kilian and Vigfusson 2014). However, the initial effects of the embargo were followed by a sustained increase in the price of crude oil for the rest of the decade. During the period from 1973 to 1981, a barrel of oil went from less than five dollars to a maximum of thirty-two dollars, driven not only by market forces in search of equilibrium between supply and demand, but also as a response to a speculative reasoning of geopolitical order around historical developments in some of the major producing countries in the Middle East (e.g., the overthrow of Shah Reza Pahlavi in Iran, and the war between that country and Iraq shortly after).

The countries in which oil reserve exploitation was economically unfeasible at the price levels that prevailed prior to the embargo, found themselves in a privileged position to benefit from their natural resources. As expected, in most cases there was a significant economic growth driven mainly by investments in infrastructure aimed at building up the oil industry.<sup>2</sup> The way the process was managed was very different from one country to another, but, in most cases, after a relatively short boom, there were severe macroeconomic imbalances. At the same time, other important changes were taking place; for example, there was a rapid increase in the number of oil producing countries, which led to an increase in the global industry supply, but also a better coordinated effort to curve down

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<sup>1</sup> The Yom Kippur War between Israel, against Egypt and Syria, started on October 6, 1973. A cease fire went into effect on October 25, that same year. Retrieved from: <http://www.history.com/topics/yom-kippur-war>

<sup>2</sup> For example, since the announcement of the discovery of important oil reserves in the southeast of the country, the government of Mexico began an aggressive investment policy in the exploration of new fields and oil extraction that soon turned the country into a major oil exporter. However, important investments were also made in the construction of petrochemical facilities and refineries (Garzón and Hafsi 1992).

consumption by implementing energy conservation policies (Lapointe and Civettini 2001). The combination of these two economic forces would eventually produce a turning point to the upswing of oil prices towards summer of 1981.

Finally, there was a surge of financial flows paid by oil importers to oil exporters, and from the latter towards international financial centers, like Paris and London, from where those resources were recycled to finance less developed countries foreign currency needs. The increasingly high oil prices and their structural dependence on imported oil forced them to borrow handsomely (mostly through international financial entities). The very limited international competitiveness of those countries' exports did not allow them to maintain a balanced current account, and eventually resulted in a significant buildup of their foreign debt, the devaluation of their currencies and, in many cases, economic recessions. (Wiegand 2008)<sup>3</sup>

Oil remains as an economic variable of great importance that, frequently contaminated by geopolitical events and by the global economic cycle, represents a chronic source of uncertainty for oil producers and consumers. Notwithstanding the growing number of oil producing and exporting countries in the supply side of the market as a natural response to the attraction of obtaining important oil revenues, and the attempts of OPEC members to stabilize the market, the ups and downs in the price of crude oil are permanent. (Till 2008)

Faced with the high prices that crude reached during specific periods, in recent decades, industrialized countries engaged in successful efforts to diversify their energy sources, as well as to improve the efficiency of their use. Briefly, those efforts have achieved a marginal reduction in the dependence on oil as the most important source of energy worldwide. However, the unpredictability of geopolitical developments and the recurrent temporary imbalances between supply and demand usually associated to lags between investments in exploration and the development of new fields, as well as the economic-cycle driven demand peaks, invariably have destabilizing effects and significantly affect the world economy at large. (Kilian and Vigfusson 2014)

More recent geopolitical and economic events have produced significant oil market turbulence. For example, between 2003 and 2011 include the United States' invasion of Iraq, in response to the 2001 terrorist attacks in New York<sup>4</sup>; a foreign trade embargo on Iran (and its oil exports), to curve down that country's plans to develop nuclear weapons; political problems in Venezuela that at some point threatened its role as a major oil exporter; the so-called "Arab Spring", in 2011<sup>5</sup>, affecting Libya, another major member of the OPEC; all of them generated speculation and price increases. Finally, a factor that represents a significant change in the equilibrium of the global oil market is the constant growth of oil demand resulting from the rapid industrialization of China's economy which, nevertheless, is showing some signs of fatigue after a long period of extraordinary growth rates.

In addition to the above geopolitical and economic events, an important technological change has redefined the conditions that prevail in the international oil market. During the late years of the first decade of the new century, the energy dependence of the United States with respect to the rest of the world declined significantly as a result of breakthrough developments that made the production of vast amounts of natural gas from shale rock (shale gas) possible. (Erbach 2014)

More recently, the global economic slowdown that resulted from the 2007-2009 financial crisis and the sovereign debt crises in several European countries during 2010-2012, resulted in a decline in the global demand for oil. The slowdown of China's economy after many years of record economic growth also reduced global demand for crude.

At the present, a lack of agreement to coordinate their contribution to global oil supply among OPEC member countries, and the reinstatement of Iran's exports<sup>6</sup>, have created the conditions for a new equilibrium at much lower oil price levels than in 2011. The inability to predict the erratic behavior of oil prices justifies the study of those economic variables that are directly or indirectly affected by it. That knowledge should contribute to build a solid platform that can support the design of governments' public policies and private-sector companies' strategies, and to develop tools and mechanisms that minimize the exposure they have with respect to oil prices.

Although it is logical to assume that oil price fluctuations may be explained by demand shocks, there are still several non-resolved technical issues before econometrics can be of help. Two such problems are, for example: a) the lack of indices that make possible to capture the response of oil demand to fluctuations in the economy; and

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<sup>3</sup> The recycling of "petrodollars" funded those countries whose oil import requirements could not be paid with their own exports, and that was the prelude of the so-called "External Debt Crisis" that affected the world in 1982.

<sup>4</sup> On September 11 2001, the world watched in disbelief as terrorists attacked the World Trade Center in New York. That was the preamble to the Gulf War fifteen months later.

<sup>5</sup> The average oil price reached \$120 USD per barrel in April that year.

<sup>6</sup> After the signing of a historic agreement with the United States and its allies for the control of nuclear technology and the production of radioactive material in 2015, the following year Iran's oil exports began to flow again, after many years of trade-embargo.

b) the inability to observe changes in the expectations that underlie precautionary demand. To overcome some of these difficulties, Kilian (2009) proposes the utilization of a structural VAR model that captures the rich dynamics of the global oil market, and helps understand the response of the United States economy to oil price changes. His model includes dynamic effects of different types of shocks on the real price of crude oil, and provides an assessment of the influence of each during the period 1975-2007. According to Kilian's interpretation, the decomposition of oil price fluctuations shows that the shocks are mainly a combination of demand and precautionary demand shocks, rather than supply side shocks. Hamilton (2009) questions Kilian's (2009) preference to minimize the influence of historically determined supply disruptions on the determination of oil prices levels and breakpoints, emphasizing precautionary demand only. Precautionary demand refers to any movement in the real price of oil that cannot be explained statistically by Kilian's measures of shock to supply and demand but, according to Hamilton, one might measure the contribution of precautionary demand by looking at changes in inventories. Accordingly, he presents evidence that monthly changes in U.S. inventories of crude oil during periods were going down instead of up, at the time of the sharpest price up movements, which he interprets as inventories mitigating (rather than aggravating) the price shocks.

Subsequently, Kilian (2010) goes back to the argument of a disaggregation of fluctuations in the price of crude oil, in which shocks that have occurred on the demand side, most of them associated with the overall economic cycle, explain the fluctuations observed during 1973-1974, 1979-1980 and 2003-2008. However, speculative shocks also played a major role in certain episodes such as, for example: the revolution in Iran, in 1979; the almost collapse of OPEC, in 1986; the invasion of Kuwait, between 1990 and 1991; subsequent to the Asian crisis, the period from 1997 through 2000; and, finally, toward the end of 2008, the consequences of the Global Financial Crisis. The substantial increase in crude oil prices recorded between 2003 and 2008 may also be explained by fluctuations in the overall economic cycle and, more specifically, to the important role of the extraordinary economic growth recorded in South East Asia, including China, but robust economic growth in the OECD countries also contributed to that trend.

When the devastating effects of the Subprime Mortgages financial crisis spread to the real sector of the economy, a sharp economic slow-down resulted, and recessionary expectations pushed oil prices to much lower levels. By the same token, the gradual recovery of prices observed during 2009 can be attributed to a reversal of those expectations. In support of that assertion, aggregate demand recovery during the post-crisis global turnaround and the price increase of all commodities for industrial consumption, was in consonance with the behavior of crude oil prices.

Hamilton (2009) suggests that the single most important influence on oil quantity demanded is income. To prove his point, he uses a graphical representation of the close association that exists between the U.S. petroleum consumption and that country's GDP over the last 60 years and concludes that, "despite the huge fluctuations in the relative price of oil over this period, petroleum consumption followed income growth remarkably steadily". This author also suggests that to determine the consequences of oil price increases in the U.S. economy, it is important to pay attention to the income elasticity of demand, which has been significantly below one during the last decades. As the percentage growth in energy use is below the growth in income, the expenditure on energy will decline in time. Based on that evidence, one would be tempted to think that oil price fluctuations have an also declining impact on aggregate expenditure and, as a consequence, on economic activity.

As this brief sample of theoretical discussions on the underlying forces that determine oil prices in the global market illustrates, what is obvious is that the international oil market it is very complex and sophisticated. Ongoing efforts are being directed towards and elucidation of its operation, as oil prices still have a very significant importance for move developed economies but, conceptually, more relative importance for the economic stability and growth of a number of emerging oil exporting countries; however, no immediate conclusion is at sight. What can be done while the oil market studies find more solid grounds to explain oil prices determination is to study the economic impact of their fluctuations.

### **3. The relationship between oil prices and real variables**

Research studies in which the main hypothesis is that international oil price shocks can explain global economic cycles or, at least, developed countries' economic cycles are relatively abundant. For example, Rotemberg and Woodford (1996) discuss in detail a number of studies in which changes in oil prices seem to have a significant effect on economic activity, and others papers in which geo-political and economic shocks affecting oil



prices produce substantial fluctuations in the economy<sup>7</sup>. However, they recognize that there does not seem to be any consensus on the specific mechanism through which the price of oil affects the economy as a whole.

Barsky (2001) affirms that oil price increases were not an essential component of the mechanism that generated the period of stagflation in the late 1970s and early 1980s, as is generally accepted. He discusses the reasons why it is not possible to attribute greater importance to the supply shocks of commodities in general and, during the periods 1973-1974 and 1979-1980, to the shocks affecting oil prices.

Barsky and Kilian (2004) present a synthesis on the causal relationship between crude oil price fluctuations and macroeconomic aggregates in the United States, on the basis of which they seek to establish a distinction between the idiosyncratic aspects of oil produced crises and their contemporary systemic effects. These authors postulate that the belief that various political events in the Middle East caused recessions in industrialized countries through sharp increases in the price of oil, is widespread. However, such a belief, supported mostly by statistical relationships between apparently close political events in that region and the recessions in the United States<sup>8</sup>, is difficult to substantiate due to the often lengthy periods between the decisions and actions of major producing countries, and the beginning of an official period of recession. The inconsistency of the patterns questions the mono-causal role attributed to the oil market in economic activity, but is consistent with the argument that events in the oil market contribute to cause recessions. They consider the possibility that a shock in the oil market may impact inflation in the United States but, once again, the relationship between oil prices and the behavior of inflation is inconsistent and even contradictory<sup>9</sup>.

According to Hamilton (2005), nine out of ten recessions in the United States since the Second World War were preceded by a rise in crude oil prices. Such regularity would seem too persistent to be a random phenomenon. Therefore, this author proposes to investigate whether they were mere coincidences by running a regression analysis between the real growth rates of the quarterly Gross Domestic Product as the dependent variable and the lagging variations in growth rates of the same variable, plus the lags of the logarithmic variations of nominal oil prices. Moreover, Rogoff (2006) argues that the rise in oil prices during the first five years of the twenty-first century made energy prices stand once again in the foreground of interest of economic analysts. In this work, Rogoff presents a careful introduction to some of the themes of economic policy surrounding this phenomenon.

Among the most relevant theoretical questions discussed by those interested in recent macroeconomic history is the relative importance of monetary policy, contrasted with the 1970s oil price shocks, in the explanation of the stagflation period in the United States during the early 1980s. For example, Kilian (2009) develops an extensive digression on the subject and, while he does not arrive to a definitive answer, he stresses the need to understand which decisions were right and which were not, as important lessons to be learned from that period.

An explanation of the true causes of the early 1980s stagflation by Barsky and Kilian (2001) is that the profound changes in the way central banks around the world designed and implemented monetary policy during the previous years played a major role in the rise of oil prices during the 1970s, and led to stagflation in that period<sup>10</sup>, not the changes related to the endogenous evolution of the oil market, as is frequently assumed. These authors conclude that innovations in the international oil market are probably less relevant for the macroeconomic performance of the United States than what has been commonly accepted.

In contrast with the position of Barsky and Kilian (2001), Bernanke, Gertler and Watson (1997) argue that a macroeconomic shock, as is the case of a sudden increase in the price of crude oil resulting from conditions and events that are exogenous to international macroeconomic conditions, induces an endogenous response in monetary policy that affects economic activity, but only indirectly. Their empirical analysis using Autoregressive Vectors to break down the economic effects of an exogenous shock on a first component directly attributable to the shock, and another component from the policy response, produced results that corroborate that the recessive impact of an oil shock is mainly due to the response of a restrictive monetary policy response, rather than to the increase in oil prices.

Blanchard and Gali (2007) study the relationship between the unexpected fluctuations in the price of oil, the behavior of inflation and GDP growth in a sample of countries, including the G7, the twelve founding members of

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<sup>7</sup> Recessions are delimited in time by Barsky and Kilian (2005) according to the criteria and information provided by the National Bureau of Economic Research (NBER).

<sup>8</sup> Barsky and Kilian (2005) mention that different episodes of importance for the international oil market like, for example, the Iran-Iraq war in 1980, did not have a significant impact on the Consumer Price Index, or that the military operations in Afghanistan in 2001 and the Iraq war of 2003 were associated in time with a decline in the inflation of the United States.

<sup>9</sup> "Stagflation" is an atypical and some what contradictory phenomenon that occurs when an economy is in a recession and experiencing a high inflation rate at the same time.

<sup>10</sup> The assumption here is that the fundamental structure and relations among economic sectors has not changed much.

the Eurozone and the OECD member countries. They focus on the lower magnitude of response to unexpected fluctuations in the price of oil after the mid-1980s, in comparison with those recorded during the decade of the 1970s, and conclude that while the cross-section effects of the increase in the price of oil may have been similar during the two periods<sup>11</sup>, the economic circumstances prevailing in each were different.

During the 1970s, in parallel to the upward trend in the price of crude, there was a general increase in the price of other commodities and, during the 1980s, 1990s and 2000s, there has been a rapid growth in productivity, thanks to the incorporation of new technologies in manufacturing, communications and transportation. At the same time, multinational agreements that drastically reduced the barriers to international trade and led to a remarkable expansion of the world aggregate demand were established. Such matches could distort any objective measurement of the impact of the price of crude oil, if it only takes into account the movements of the aggregate variables in each period.

To test that hypothesis, they isolate the component of macroeconomic fluctuations related to exogenous changes in the price of crude oil through a structural Vector Auto-Regression (VAR) model with two variants: in the first one, they incorporate a structural break in the sample from the mid-1980s, while in the second they use a phased (rolling) bivariate VAR model that includes the price of oil and a different macroeconomic variable for each occasion. The second approach allows a gradual change in the estimated effects of a given shock, without imposing the restriction of a break in a single discrete period. The main conclusions are that: 1) actually, there are other negative shocks, in addition to those caused by OPEC in 1973, and the revolution in Iran in 1979; 2) the macroeconomic effects of a variation in the price of crude oil have changed substantially over time.

Still today there is a widespread belief that sudden increases in the price of oil can cause recessions, but that fact only reflects that the issue has not yet been adequately studied. The work of Kilian and Vigfusson (2014) is probably one of the first to propose a formal analysis of this problem in the US for the periods 1974 Q2 and 2012Q4, discussing not only the immediate effect of a price shock on the economy, but also the possible effects of price shocks over time. In their analysis, they quantify the accumulated conditional recessive effect of an oil shock and compare the results with those obtained using a linear model, to conclude that the cumulative effect of a shock over the next two years is much greater than that estimated with the simpler model.

Even when it is possible that net increases in oil prices are highly correlated with other variables that might explain recessionary periods during the time horizon of analysis, the explanatory power of the price of oil remains after the model incorporates variables such as the conditions of the supply of credit, the monetary stance of the authorities, and consumer confidence. The model evaluates and rejects the hypothesis of asymmetry of response, even in those cases in which the shock's magnitude is significant. However, it captures changes in the magnitude of response of real GDP to oil shocks, measured as the net price change over time. In that sense, the structure of the model is similar to that of a VAR model with time-changing parameters. They also demonstrate that the magnitude of the conditional response is correlated with various other macroeconomic indicators, such as consumer confidence, the presence of financial stress, the proportion of oil to GDP, and interest rate expectations. These variables, the authors argue, can be used to determine whether an economy presents greater vulnerability to oil price shocks.

While the conclusions of previous two studies are similar, Kilian and Vigfusson (2014) also present a decomposition of the predicted structural conditional error, which rigorously quantifies the role of oil prices as explanatory of the recessions in the United States. From the point of view of the economic authorities, determining which of the two models is more reliable is of utmost importance. The strategy to follow in face of a new oil price shock requires the model to be calibrated with the greatest precision, so one recommendation that can be derived from these results is to continue the study of the properties of nonlinear models proposed by these authors, and test their reliability in order to gain certainty on which approach offers greater interpretive benefits as a platform for public policy design in response to oil price shocks.

Finally, we refer to the work of Oladosu (2015), as it contributes to a research line that seeks to clarify the relationship between the oil market and the economy, based on an empirical assessment of the impact of various oil shocks of supply and demand, identified through the review of the pattern of their impact on the economic performance of the U.S.

The impact of the shocks recorded in the international oil market on the U.S. economy is assessed estimating a Structural Vector Error Correction model with 10 variables and quarterly data from 1973Q1 to 2011Q3, which includes variables that are endogenous to the oil market and other variables of a macro-economic nature. Among the former, are the price per barrel of oil measured with the West Texas Intermediate (WTI) crude marker;

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<sup>11</sup> For a more detailed data panel analysis, see Baltagi (1995).

the daily production of crude oil from the countries that are not members of OPEC; the daily overall consumption of barrels of oil; the unused capacity of oil production of OPEC countries; and the stock of oil reserves of OECD member countries, including crude and petroleum products. The latter variables included the Gross Domestic Product of the United States in real terms; the Federal Funds Rate; the exchange rate of the US dollar, weighted with respect to major currencies; a measure of the money supply aggregate (M1); and the inflation rate in the United States, as measured by the Consumer Price Index.

Based on their results, these authors corroborate that both global supply and demand and non-systematic oil price shocks have significant economic implications, even after controlling for the influence attributable to monetary policy variables.

#### 4. Statistical description of the variables

The relevant variables used in this study regarding the dynamics of oil prices and growth are presented in the following Table.

Table 1 - Macroeconomic variables used in the estimated models

VARIABLE	DESCRIPTION
Gross Domestic Product, at constant prices, in domestic currency	This variable is expressed in billions of domestic currency units. The calculation is based on the aggregate expenditure in the economy. It includes final total expenditure at buyers price (f.o.b.) of exports of goods and services, less the value (f.o.b.) of imports of goods and services.
Gross Total Investment as a percentage of GDP	The ratio of Total Investments over GDP (both variables expressed in domestic currency terms). Its two main components are Gross Investments in Capital Goods, Inventory Variations, and Other Acquisitions, less Disposed Assets.
Average Annual price of the WTI type oil	The monthly closing price of WTI type oil averaged from January to December each year, to obtain the Average Annual price.

Source: From 1990 to 2014, for the first two variables, the World Economic and Financial Surveys, World Economic Outlook Database, International Monetary Fund, available at: <http://www.imf.org/external/pubs/ft/weo/2013/01/weodata/index.aspx>. The annual monthly-average of WTI type oil was obtained from Bloomberg.

To make the data adequate for the estimated panel models, some transformations were required. The GDP figures for the different countries studied, expressed in constant prices and in domestic currency were transformed to their corresponding annual growth rates. The Total Investment as percentage of GDP was transformed into its corresponding annual growth rates. Last, the WTI price annual variation was transformed also into its annual growth rate. The general statistics of the variables used in the econometric model are presented in Table 2, below:

Table 2 - Descriptive Statistics of the variables of interest

	Notation	Mean	Median	Max	Min	Std. Dev.	Jarque-Bera	Prob.
Annual growth rate in the GDP at Constant Prices	GDPGR	0.033	0.039	0.183	-0.109	0.043	18.410	0.000
Total Investment Annual Variation (as % of GDP)	TIP%GDP	0.018	0.029	0.603	-0.417	0.148	35.782	0.000
Average WTI PRICE annual variation	WTI%	0.054	0.053	0.415	-0.433	0.207	3.959	0.138

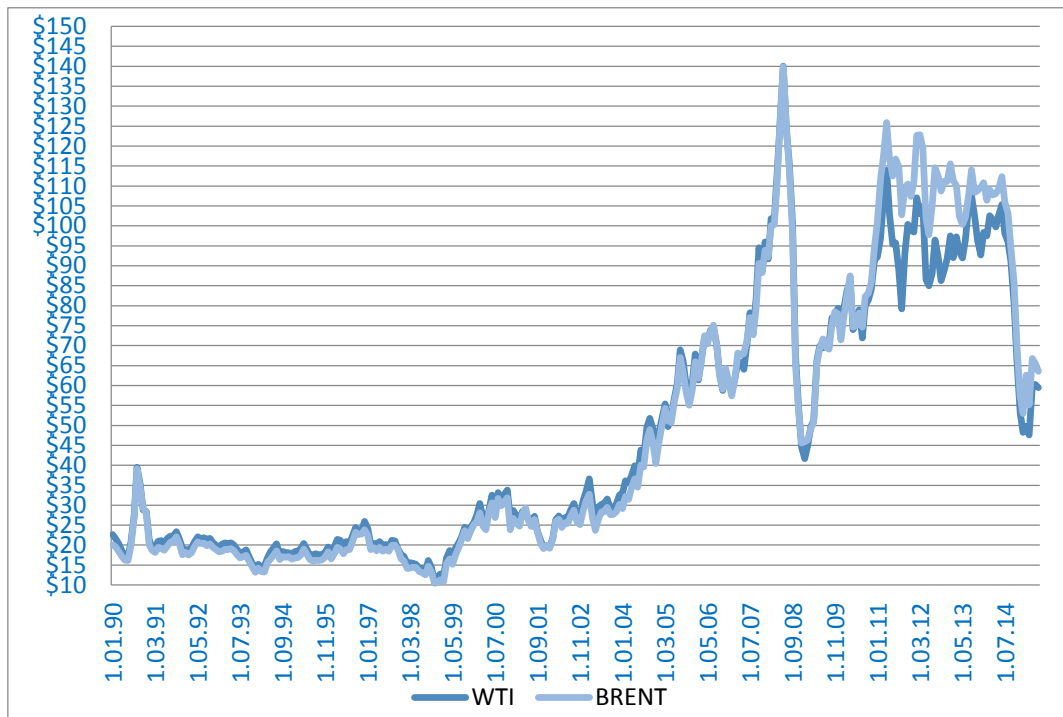
Source: World Economic and Financial Surveys, World Economic Outlook Database, International Monetary Fund, and [Bloomberg](#)

The monthly average annualized price of the West Texas Intermediate (WTI) crude for the period of analysis was obtained from Bloomberg Financial Services Database. While the marker price of reference for Latin American oil exports is the WTI, it is interesting to see the close resemblance it has with respect to the North Sea Brent Oil price through time.

As illustrated in Graph 1, during the twenty-five years of interest to this analysis, the behavior of oil prices went through different stochastic regimes. From 1990 until the end of the century, the price of a barrel of oil fluctuated between \$10 and \$40. With the beginning of the second Gulf War in 2003, a bullish phase in the global oil market sent oil prices to their maximum historical level of \$140 per barrel in June of 2008.

The prices of both crudes observed a very similar pattern, with constant increases between 2003 and 2008 until, all of a sudden, they plummeted in August 2008, reaching a level of less than \$50 in December that same year. During the following months, the price recovered and remained marginally above \$100 until finally, between August 2014 and the same month in 2015, the price collapsed to levels under \$50 dollars per barrel and, more

recently, below \$30. The parallelism observed between the price of the two types crude since 1990, and marginal dissociation during the past five years, is remarkable (see Figure 1).



Source: Bloomberg.

Figure 1 - Monthly Average Price of the Brent and the West Texas Intermediate Marker Crudes, 1990-2015.

The sample of five Latin American net oil exporting countries includes Argentina, Colombia, Ecuador, Mexico and Venezuela. The criterion for inclusion is that the country’s annual Current Account oil balance should be positive in at least one of the twenty-five years covered by the sample. Some Latin American countries that count with a major oil industry were excluded from the sample because their productive capacity is not enough to supply their domestic consumption needs, and they depend on imports. Such is the case of Brazil, whose oil industry development has been remarkable over the past ten years, but has not achieved total autonomy; and Peru, whose exploitation of oilfields was, until very recently, marginal.

### 5. Panel data analysis

The use of panel data analysis is becoming increasingly common, due to the benefits it offers for applied research. Panel Data Analysis consists of a combination of time-series and cross-sectional data, i.e. it uses a sample of the features of many units of analysis (in this research, countries) over a period of time (twenty-five years of annual observations). The general model for our panel data analysis is as follows:

$$y_{it} = \alpha + \beta X_{it} + u_{it} \tag{5.1}$$

where  $y_{it}$  represents the logarithmic variations of the Gross Domestic Product expressed in constant domestic currency prices for each country  $i$ , and  $t$ , represents the number of years included in the sample,  $X_{it}$  is a vector of exogenous variables and  $u_{it}$  represents random disturbances.

The parameters estimated with Ordinary Least Squares (OLS) produce errors that are correlated with the cross-sectional explanatory variables and, as such, are biased. To avoid this, alternative models to pool regressions are frequently used. The technique of nesting the data works includes the Fixed Effects model (FE) and the Random Effects model (RA), which will be discussed in more detail.

The use of panel data offers several benefits because it takes advantage of a greater number of observations, supports more variables and minimizes the multicollinearity between the explanatory variables, while allowing a greater efficiency in the estimate. Another advantage of the use of panel data is that a follow-up of each unit of observation can be done. It also solves the problem of omitted variables, since the variables that do not

change over time can be eliminated using differences<sup>12</sup>. The main advantage of panel data is that individual effects (heterogeneity) can be dealt with by allowing the constant term to vary across individuals (Greene 2012).

Of course, Panel Data Analysis also has some limitations. For example, if not all the characteristics that explain the GDP growth of a country are observable, then the error terms of the regressions will be correlated with the exogenous variables, and the OLS estimates will be inconsistent.

The Fixed Effects Model implies fewer assumptions about the nature of the residuals. In this case, the model to estimate is different from (5.1), as follows:

$$y_{it} = \alpha + \beta X_{it} + \varepsilon_{it} \tag{5.2}$$

$$\varepsilon_{it} = v_i + u_{it},$$

which assumes the statistical error of the model can be decomposed into a random component,  $u_{it}$ , and a component which is idiosyncratic for each of the units of observation,  $v_i$ . Therefore, the equation now looks as follows:

$$y_{it} = \alpha + \beta X_{it} + v_i + u_{it}, \tag{5.3}$$

which is equivalent to running a regression and giving each observation unit a different intercept.

The practical implication of incorporating this additional degree of freedom into the estimation is to allow the idiosyncratic component to capture the different (idiosyncratic) characteristics of each country, as well as the information corresponding to possible omitted variables, so that the coefficients of the exogenous variables reflect the contribution of each one of them to explain the dependent variable with greater precision.

The random effects model (RE) follows the same mathematical specification as the fixed effects, except that the term  $v_i$ , instead of being a fixed value for each country and constant over time, is a random variable with mean value  $E[v_i]$  and variance  $\text{Var}(v_i) \neq 0$ . Then, the specification of the model is:

$$y_{it} = \alpha + \beta X_{it} + v_i + u_{it} \tag{5.4}$$

where  $v_i$  is now a random variable. It should be mentioned that the RE model is more efficient,<sup>13</sup> but less consistent than the FE model<sup>14</sup>.

A panel data model may be subject to the potential bias that results in the estimated parameters when one (or more) of the explanatory variables may be the source of endogeneity. In such cases, a GMM panel data model estimation is recommended. The basic GMM panel estimators are based on moments of the form:

$$g(\beta) = \sum_{i=1}^M g_i(\beta) = \sum_{i=1}^M Z_i' \varepsilon_i(\beta), \tag{5.5}$$

where  $Z_i$  is a  $T_i \times p$  matrix of instruments for cross-section  $i$ , and:

$$\varepsilon_i(\beta) = (Y_i - f(X_{it}, \beta)). \tag{5.6}$$

GMM estimation minimizes the quadratic form:

$$S(\beta) = \left( \sum_{i=1}^M Z_i' \varepsilon_i(\beta) \right)' H \left( \sum_{i=1}^M Z_i' \varepsilon_i(\beta) \right) = g(\beta)' H g(\beta) \tag{5.7}$$

with respect to  $\beta$  for a chosen  $p \times p$  weighting matrix  $H$ .<sup>15</sup>

## 6. Discussion of empirical results

This section develops four panel data models that estimate the sensitivity of GDP growth rates to fluctuation in WTI oil prices, Total Investment as a percentage of GDP and a dummy variable, D(Recession) that identifies the years of recession in each of the five countries of the sample<sup>16</sup>. The price of oil prices and the total investment as a proportion of GDP are expected to have a positive sign (positive correlation) with GDP growth, the sign of the dummy variable that identifies recession years is expected to have a negative sign. In all four models, the exogenous variables parameters appear statistically significant and with the correct signs (see Table 3).

<sup>12</sup> The variance of the RE estimate is smaller, making it more efficient.

<sup>13</sup> See, Arellano and Bond (1991).

<sup>14</sup> See EViews 7 User Guide II. Quantitative Micro Software (2009), pp. 678-679, for further development of this model.

<sup>15</sup> Cross section and period fixed and random effects were attempted in equations 2, 3 and 4, but are not reported here for reasons of economy of space. The reported models FE, RE and GMM reported were the best fit of all combinations.

<sup>16</sup> An endogeneity problem occurs when an explanatory variable is correlated with the error term.

The first model in equation (5.1) is a simple pooled regression OLS, with statistically significant coefficients for the three explanatory variables, with an F test of 89.0, significant at more than 1%. While the sign and high significance of the coefficients is satisfactory, the possibility there is a second degree autocorrelation problem motivates the utilization of the FE, RE, and GMM treatments. The cross section FE model (model 2) preserves the significance and correct expected sign of the three explanatory variables coefficients, and the F test value is 41.259, again significant at more than 1%. Both redundancy tests (Cross Section F and Cross Section Chi Square) are significant at a 10% level, rejecting the null that the cross-section effects are redundant.

The RE equation (model 3) again preserves a correct sign and a highly significant F test value of 93.16. The Hausman test Chi square probability of 0.489 indicates that there is little evidence against the null hypothesis that there is no misspecification. Since there is a clear possibility that the inclusion of Total Investment as a percentage of GDP variations poses a problem of endogeneity<sup>17</sup> (as GDP is equal to the sum of Consumption, Investment, and Exports, minus Imports), econometric theory suggests the use of the GMM estimation method. Model 4 reports the results of the GMM estimation. A Chi square Hausman test that is far from rejecting the null of no misspecification, suggests this is a reliable model of GDP growth.

Table 3 - Estimations of Pooled, Fixed Effects, Random Effects and GMM-EGLS models  
Dependent variable: GDPGR

	(1) Pooled Regression OLS	(2) Fixed Effects (Cross Section)	(3) Random Effects (Cross Section)	(4) GMM EGLS (Cross Section random effects)
Constant	0.038772***	0.039873***	0.039327***	0.046374***
Standard deviation	(0.002595)	0.002585	0.003464	0.000407
WTI %	0.118272***	0.109231	0.113699***	0.094016***
Standard deviation	(0.017317)	0.017403	0.01717	0.009277
TIP%GDP	0.036251***	0.036184***	0.036217***	0.026657***
Standard deviation	(0.010631)	0.010393	0.010393	0.010266
D(Recession)	-0.063832***	-0.070089***	-0.066989***	-0.110407
Standard deviation	0.007161	0.007554	0.007285	0.005956
F Statistic	89.0025***	41.25894***	93.16037***	-
Redundancy Test (Cross Section F)	-	2.34814*	-	-
Redundancy Test (Cross Section Chi-square)	-	9.663687*	-	-
Hausman Test	-	-	Prob>Chi <sup>2</sup> =0.4786	Prob>Chi <sup>2</sup> =0.9674
Periods included	24	24	24	23
Number of countries	5	5	5	5
Number of observations	120	120	120	115

Source: World Economic and Financial Surveys, World Economic Outlook Database, International Monetary Fund, and Bloomberg

More robust econometrics improve the quality of the estimated models, but what should be noted is the consistency of the sign and high statistical significance of the coefficients, congruent with what economic theory suggests. These results represent evidence of the importance of oil prices fluctuations for the rate growth of the economy of Argentina, Colombia, Ecuador, Mexico and Venezuela. Further studies focused on more specific sectorial effects should reveal valuable information for the design of hedging strategies for both, governments and firms in those countries.

## Conclusions

<sup>17</sup> Stock index is an index of stocks, where "stocks" are stocks and possibly their derivatives. Stock index can include all the stocks of the same kind (one stock exchange, of all the stock exchanges of the country/world etc.) or only selected stocks (then they generally are representative stocks). The aim of the index is to show the development of a group of enterprises / an industry / a country and to offer a benchmark for evaluating the performance of a company or a mutual fund.

The ups and downs of the international price of crude oil should have a noticeable influence on the level of economic activity. In those countries where the oil industry represents a productive activity of significant economic weight and, particularly for those that are net oil exporters. The revenue from crude and derivative products (in case there are any) exports, as well as the continuous investments in prospecting, drilling, and other expenses to build up an oil industry infrastructure, plus the operating expenses of wells and refineries, plus the purchases of various kinds of inputs and the salaries received by the labor force employed in the industry, all represent a powerful dynamic force for oil exporting economies.

In such cases, the measurement of the sensitivity of economic activity to the ups and downs of oil prices, as well as the importance of the oil industry as an integral component of the country's productive activity due to its productive enchainment with other industries and multiplier effects, are a matter of interest. A more precise understanding of the dynamics of these relations is a necessary condition for the development of short-term action plans and medium/long-term economic development strategies.

In this work we use Panel Data Analysis to measure the sensitivity of the GDP Growth of crude oil exporting Latin American countries to fluctuations in crude prices. This econometric technique substantially improves the measurement of the impact of oil market innovations on economic activity, as it creates the possibility to take into consideration the specific differences of each of the countries under study, using the Fixed and Random Effects Techniques, as well as a dynamic estimation using the Generalized Method of Moments (GMM).

Oil prices are subject to a number of economic and often-times non-economic (mostly, geopolitical) influences. Both the ups and downs of the economic cycle of major industrialized net oil importing countries, as well as unexpected geopolitical events influence their evolution. The importance of oil as the most popular source of energy in the planet and the highly significant financial stakes involved are a continuous source of uncertainty among oil market players. Oil exporting countries benefit when prices increase, but their income diminishes when there is a downturn.

The governments of oil exporting countries would like to have more influence over the global oil market equilibrium, and in some cases they have joined specific cross-national organizations to coordinate their policies, like the OPEC. However, after decades of an almost unilateral control by the OPEC, the global oil market has become more pulverized and no single participant, including the OPEC countries as a group, have an absolute control of global oil prices.

While many attempts have been made to predict the future evolution of oil prices, none have been successful and, except for very general anticipation trends, not much else is possible. It would seem that, as in other commodity markets, no individual player can influence the market, but beyond potential initiatives to do so, the arrival of news is one of the major determinants of oil prices.

Latin American Oil Exporting Countries have benefited from the windfall of their oil exports' earned resources, but sometimes have also been affected when international oil prices collapse. For that reason, it is important to develop empirical analyses that shed some light on the significance of oil price fluctuations over exporting countries' GDP. The benefits of using Panel Data Analysis are evident when the different models are compared, and all the models validate the statistical significance of oil price variations for the determination of economic growth rates in Latin American Oil Exporting Countries, a relationship that needs further study to determine the magnitude and timing of hedging needs or macroeconomic policy adjustments and other financial measures required to capitalize on windfalls and minimize the exposure of net oil exporting Latin American economies to secular falls of oil international prices.

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## Stock Indices and Their Role in Prediction Czech and Slovak Business Cycle

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### Abstract:

*The paper demonstrates the importance of stock indices in predicting the development of the Czech and Slovak business cycles. At present, there are several international and national institutions which deal with the analysis of how the selected economic indicators influence the development and prediction of a business cycle, mainly through a construction of composite leading indicators, which are often used for short-term prediction of business cycles. All these institutions also examine the abilities of stock indices to predict the development of an economy, their findings, however, differ. International institutions, such as Eurostat and OECD, considers stock indices important, whereas at national levels the situation is different. We aim to analyse the real predictive abilities of stock indices in relation to the Czech and Slovak business cycles using our own methodology and to present conclusions of our analysis, i.e. whether it is really appropriate to use stock indices in predicting business cycles for these two countries.*

**Keywords:** stock market; stock index; business cycles; composite leading indicator.

**JEL Classification:** E3, E32.

### 1. Introduction

In the past decades there has been an increase in the influence of stock market on the real economy and, subsequently, on a country's business cycle development. In the past, stock market development used to be parallel to the development of a business cycle. In the 1990s, however, we can observe a lead of stock market development against the development of business cycle. It means that the stock market, or its selected indicators, such as stock indices, has the ability to predict business cycle developments and hence, give us a view of a possible future economic development. However, this is not the case in every country.

The need to know the basic indicators, which can predict a country's business cycle development, arose mainly under the influence of the global financial crisis, which had started to spread from the USA in 2007. The crisis has confirmed that the instability in the financial sector can result not only in a financial crisis but in an economic one as well (Dietrich *et al.* 2011), which subsequently affects a country's economic (Siničáková and Pavličková 2011). Apart from predicting unfavourable economic events, it is also important to know the time when an economy is to experience economic growth, which often affects the development of the financial, sector as well (Botrić and Slijepčević 2008).

The aim of our paper is to analyse predictive power of selected stock indices in relation to the Czech and Slovak business cycles. Based on this analysis, we will try to find out whether there are stock market indices, which we can use for a short-term prediction of a business cycle development; and we will also focus on examining the quality of prediction of these indicators.

### 2. Business cycle and its prediction

The term business cycle (or economic cycle) is associated with economic fluctuations in the manufacturing industry, or in business activity, lasting for several months or years. These fluctuations include periods of relatively quick economic growth and periods of relative stagnation or decline (O'Sullivan, Arthur and Sheffrin 2003). They are most often measured through the real Gross Domestic Product growth rate. Despite the fact that they are referred to as cycles, most of these fluctuations in economic activity do not occur mechanically or predictably.

In 1819, Sismondi, the French economist, introduced the first systematic explanation of periodic behaviour of the economy and the inception of economic crises. At the time, he was against the economic equilibrium theory. At that time, the inception of negative economic fluctuations was associated exclusively with external factors, mainly war periods (Barta 2002). The works of Simondi later served as the basis for the analysis of periodic behaviour of the economy, mainly in the theory of alternating cycles by Charles Dunoyera (Benkemoune, 2009) and later by Johann Karl Rodbertus.

The American economist W.C. Mitchell also dealt with the analysis of business cycle and in 1913, in his work *Business cycle* he talks about the economic cycle as a problem of the economy. In his work "A definition of business cycle" from 1927 Mitchell laid out the fundamentals of the economic cycle definition. Then he elaborated and rewrote this definition in cooperation with A. F Burns (1946, 16), and they concluded that "*Business cycles are a type of fluctuation found in the aggregate economic activity of nations that organize their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle*". At present it is thought that the economic cycle is a cyclical component of time series lasting for more than 18 months and less than 96 months. In case of GDP, where there are mostly quarterly data available (quarters), frequencies between 6 to 32 quarters are being analogically studied. Fluctuations at higher frequency (less than 18 months) are mostly referred to as seasonal fluctuations or insignificant short-term shocks. Lower fluctuation frequencies (of a length exceeding 8 years) are no longer referred to as a business cycle but as a trend movement (Barter and King 1999, Massmann and Mitchell 2003).

Lucas (1977, 21) also presented his own view of the business cycle; in his work *Understanding business cycles*, he defined the business cycle as a fluctuation from real GDP, or a fluctuation of aggregate real output from trend. Lucas' view of the business cycle was followed by Kydland and Prescott (1990), who claimed that in order to analyse a business cycle, it is necessary to focus on a detailed observation of economic indicators' time series, which can have a different relation to a business cycle development itself, as represented by real GDP or by aggregate output. The methodology of Kydland and Prescott based on researching the relationship between GDP and key macroeconomic indicators served as the basis for the studies of Wolf (1991), Serletis and Kraus (1996) in the case of the United States of America, of Backus and Kehoe (1992) regarding a group of nine countries (Australia, Canada, Germany, Italy, Japan, Norway, Sweden, Great Britain and USA), for the studies of Kim, Bucklehp and Hall (1994) regarding New Zealand and for the works of Crossby, Otto, Fisher (1996) and Voss (1996) regarding Australia. Brandner and Neuser (1992) examined the facts about the economic cycle for Australia and Germany using an analysis similar to that presented by Kydland and Prescott.

The American economist Moore, of the Economic Cycle Research Institute, was the first to elaborate detailed studies aimed at analysing the relation of selected economic indicators to the development of a business cycle represented by GDP. He constructed a composite leading indicator enabling a short-term prediction of the US business cycle. This original composite leading indicator he then transformed, back in 1960, into an index of leading economic indicators (LEI). Since then, many economists and international organizations have used leading cyclical indicators in their analyses and predictions of a business cycle (Economic Cycle Research Institute 2011). Among the international organizations which deal with the construction of composite leading indicators (CLI) are Eurostat, OECD, and American Conference Board, there are also national institutions which are interested in the construction of a CLI with regard to the specificities of their countries.

The composite leading indicator (CLI) can be defined as an aggregate time series showing a lead against reference series representing a country's business cycle (OECD 2012). The combination of several lead indicators enables a more accurate prediction of the reference series development than just the leading indicators themselves. CLIs are constructed so as to predict a business cycle development, which is mostly represented by either industrial production index or GDP. CLIs are calculated as a sum of components which cover the key sectors of an economy. They represent a simple tool for empirical analyses of available data. CLIs offer timely and relevant information on present and future economic situation and hence provide an important aid in short-term predictions of changes in an economy. It is, however, necessary to point out that CLIs can only supplement, not replace, quantitative or long-term predictions made using econometric models (OECD 1998).

Being constructed from time series which best predict the development of a state's economy, CLIs can serve as the basis for indicating economic areas which are the first indicators of changes in a business cycle of any country. Among the most common cyclical indicators with these properties are foreign trade indicators, monetary aggregates, industry-related indicators, confidence indicators, or stock indices. Composition of CLIs can differ among countries, what suits one country, does not necessarily have to be suitable for another, in terms of predicting its business cycle.

In our paper we focus on the analysis of the relation of a selected group of indicators, namely stock indices, to the development of the Czech and Slovak business cycles. We are mainly interested to find out whether stock indices are of such importance in these countries that they are classified as leading indicators, which CLIs for these countries comprise.

### 3. Stock market and business cycles

It is known from the theory of finance that the stock market is tightly connected to the business cycle, which is most often studied through gross domestic product (Garcia and Liu 1999). In the long run, the stock market studied through stock indices<sup>1</sup> copies the development of GDP. In the short (medium) run, it does not have to be true, and the stock market can realistically lead against the development of the economy, or there can be a decline in stock markets, even when the real economy grows.

At the beginning of the 1970s up until the end of the 1990s, the stock markets truly copied the economic development. The situation changed, however, by the end of the 1990s, when the stock market started to lead against the economic development and hence created the famous phenomenon of "bubble economy" or the formation of stock market bubbles, which can lead to a collapse of the financial system. There are several approaches to this issue which we can find in the works of J. Stiglitz, P. Krugman, B. Eichengreen, S. Fisher, M. D. Bordo, O. Kaminsky, C. M. Reinhart, S. K. Cooper, or of the American economist Lyndon H. Padoch. The interconnecting components of these views, and of the views of other experts as well, are the problems resulting from the globalization of the world economy, thus they are problems of stock markets as well, and from the so-called "virtualization of the economy". The dramatic stock market boom in the 1990s was connected mainly to the emergence of the so-called Internet economy, or new economy. At that time, we could observe the following two tendencies on the stock markets. Significant increase in the number of companies connected to the internet economy in stock indices and Increase in the number of financial services in stock indices. (Chovancová and Malacká 2011)

The increase in the share of the financial sector, and its services, in GDP has been significant in recent years especially. The influence of this sector has increased so much that it is considered one of the determinants of a country's economic growth (Próchniak 2011). The main problem of this sector is the great volume of fictitious assets, various transactions and a great number of overvalued products (Gavurová and Soltés 2015). That way, the financial sector contributes to the afore-mentioned virtualization of the economy and of the financial system. Despite this fact, in the economy itself there has been a shift of the core of the economy from productive industries to financial services and a new term "financialisation of the economy" has been introduced (Foster and Magdoff 2009). This issue was pointed out also by Sweezy (1987), already back in 1987, when he stated that financial expansion was connected with a stagnation of other economic spheres.

Structural changes within the economic sectors help us to describe the business cycle (Kolosok and Myroshnychenko 2015). The change in the structure of the economy has a significant influence also on the prediction of the business cycle, mainly as far as the composition of indices, which are used to predict it, is concerned. In addition, European integration and creation of monetary union, which caused that exchange rates and foreign trade policy have lost their significance as instruments of economic flexibility, have an unquestionable impact in case of European countries (Bartóková and Gontkovičová 2014). Subsequently, it is the growing interest in financial services and the increase in the significance and influence of stock indices on the development of the economy that have led to the fact that in many countries of the world CLI, which enables short-term predictions of a country's business cycle development, includes also the financial sector indicators, namely stock indices. It is difficult to estimate which country includes stock index in its CLI and in order to precisely determine predictive abilities of stock indices, it is necessary to select an appropriate method of calculation. A certain indicator, which would indicate that a country's CLI includes a stock index, is the level of functioning of the country's stock exchange. In the case of the Czech Republic and Slovakia, we could therefore presume that the Czech CLI will include a stock index, whereas in the case of Slovakia, it does not have to be that way, considering the functioning of the Stock Exchange in our country.

### 4. Stock indices and their position in the Czech and Slovak CLIs

In order to examine the importance of stock indices in the prediction of the Czech and Slovak business cycles, we will analyse the composition of CLIs constructed by Eurostat, OECD, the Slovak Infostat and the Czech Statistical Office (ČSÚ). We will be interested to find out whether they consider stock indices to be leading cyclical indicators which belong to CLI and what weight they assign to them in the CLI composition.

#### 4.1. Eurostat

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<sup>1</sup> Appropriateness of a combination of leading indicator groups, which we will include in CLI, is, however, verified by a selected method which is further described in the paper "Composite leading indicator of Czech business cycle" (Tkáčová, 2012).

In case of Eurostat gross domestic product in constant prices, monitored quarterly, is considered an indicator representing a business cycle. The composite leading indicator is constructed from the same cyclical indicators for all the studied countries, where soft data are more or less used (Ozyildirim, Schaitkin and Zarnowitz 2009). Apart from the indicator of consumer confidence and the building industry confidence indicator, CLI comprises a stock price index of the country for which the CLI is constructed, in order to predict its business cycle (Czesaný 2006). It means that Eurostat constructs such a composition of CLI for the Czech Republic and Slovakia which includes a stock index. Eurostat assigns a simple system of weights to the individual components; the components are divided into two groups. The other group (indicator of building industry confidence, and stock price index) has a half of the weight compared to the first group (industrial confidence indicator and consumer confidence indicator). This means that Eurostat assigns a weight of 1/6 to the stock indices in CLI.

#### 4.2. Organisation for Economic Co-operation and Development (OECD)

In the case of OECD up until March 2012 the industrial production index, with a monthly periodicity, was used as an indicator representing a country's business cycle. Since then, this institution, too, has decided to replace the industrial production index with GDP. OECD has long considered this to be the best indicator for monitoring a business cycle development (Tuveri 1997). However, when changing the reference series, OECD kept the monthly periodicity of data, which required a creation of a method to decompose quarterly GDP into monthly data. This process is demanding, therefore, the industrial production index is still used for many countries (among them the Czech Republic and Slovakia) as the reference series index (OECD 2012).

OECD is of the opinion that it is not possible to compose the same composite indicators for different economies, therefore, they use various sets of leading indicators. According to the studies of Nilsson (2000), this is one of the reasons why the indicators used by OECD have a better validity than the indicators used by the European Union. Among the most used leading indicators are business surveys, currency and financial indicators, orders and inventory, retails sales, prices and indicators of foreign trade (OECD 2008).

This means that, in general, stock indices are not listed among leading indicators which CLI comprises. That, however, does not mean that it could not be so in case of the Czech Republic and Slovakia, as displayed in Table 1.

Table 1 - CLI composition for the Czech Republic and Slovakia according to OECD

COUNTRY	CLI composition
Czech Republic	BOP Capital account, debit (CZK)
	Demand evolution (Services): future tendency (% balance)
	Production (manuf.): tendency (%)
	CPI Harmonised All items (2010=100) inverted
	Consumer confidence indicator (% balance)
	ITS Exports f.o.b. total (CZK)
	Share prices: PX-50 index (2010=100)
Slovakia	Confidence indicator (Retail trade) (% balance)
	Total retail trade (Volume) (2010=100)
	Consumer: expected economic situation (% balance)
	Share prices: SAX index (2010=100)
	Imports f.o.b. total (USD)

Source: OECD, 2016.

According to the OECD calculations, Czech and Slovak stock indices can predict short-term business cycle development of these countries so reliably that they have included them among leading indicators composing CLI. The weights, which are assigned to the individual stock indices in CLI, depend on the number of cyclical indicators which they are made of, while it remains true that all cyclical indicators in CLI have the same weights (Gyomai and Guiedette 2012). It means that in case of the Czech Republic the stock index has a weight of 1/7 and in case of Slovakia 1/5.

Except for Slovakia and the Czech Republic, we can be found stock indices in CLI of these countries of OECD: Netherlands, Estonia, Finland, Hungary, Portugal, Spain, France, Ireland, Norway, Sweden, Switzerland, United Kingdom, Ireland and Norway.

#### 4.3. Infostat

In Slovakia, it is Infostat (Institute of Informatics and Statistics) that deals with the construction of CLI. The construction of CLI in Slovakia, but in the Czech Republic too, is problematic due to short time series and instability of economic development caused by the transformation of economies (Klíčik 2009). In spite of this, Infostat tries to create a high quality alternative to CLI, when compared to the CLIs of OECD and Eurostat. In the works of M. Klíčik and J. Haluška we can find a method of calculating one's own CLI where the industrial production index or a created reference series is considered as a reference series. Just like OECD and Eurostat, Infostat, too, included stock indices in the studied sample, while monitoring their predictive ability in relation to the business cycle. In their works the authors do not mention the exact number or names of monitored indices, however, they introduce the final formula for the calculation of the Slovak CLI, which can lead against the reference series development by seven months (Klíčik and Haluška 2008).

$$\text{CLI} = (0.61449 * \text{Loans granted to households} + 0.8507 * \text{Exports} + 0.8579 * \text{M1} + 0.806 * \text{Employment expectations}) / 3.0734 \quad (4.1)$$

This formula allows one to calculate CLI, the industrial production index is considered to be a reference series. We can see that stock indices were not at such a level, quality-wise, so as to be included, according to the method introduced by these authors, in the composite leading indicator for Slovakia. There is the first difference between the contents of CLIs constructed by OECD, Eurostat and Slovak Infostat. While OECD and Eurostat included SAX stock index in CLI, Infostat did not. It is only possible to guess what the main reason for this difference was. It is likely that the different method of CLI calculation plays an important role in the inclusion or non-inclusion of stock indices in CLI. It is also possible that in the construction of CLI Infostat, as a Slovak institution, takes into consideration the specificities of Slovakia and, the already mentioned level of functioning of the Slovak Stock Exchange, SAX has not been of such importance so as to get into the Slovak CLI.

Another CLI calculation approach, by Infostat, is based on the precondition that we will select a composite time series constructed by this institution as a reference series. Here, Infostat already presents the SAX index position, where the value of cross-correlation is at 0.837 and the lead-time is three months. Even despite having the properties of a leading indicator, SAX has not been included in the final group of indicators which the Slovak CLI comprises.

#### 4.4. Czech statistical office

The Czech Statistical Office, in cooperation with S. Czesaný and Z. Jeřábková, also deal with the construction of CLI, and stock indices are among the monitored indicators. They use quarterly real GDP as a reference series (Czesaný, Macháčková and Sedláček 2007). Table 2 displays the results of cross-correlations of stock indices' cyclical component, and a cyclical component of GDP in constant prices, reference year 2000, which represents the business cycle. Time series, which were studied, are quarterly data from 1996-2007.

Table 2 - Results of cross-correlations between the cyclical component of GDP and the cyclical component of stock indices for the Czech Republic

INDICATOR	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5
PX Index, 2001=100	0.078	0.111	0.155	0.206	0.266	0.336	0.404	<u>0.450</u>	0.445	0.375	0.241
PX Index 2001=100, trade	-0.002	0.012	0,050	0,110	0.192	0.292	0.393	0.471	<u>0.488</u>	0.425	0.289

Source: Czesaný, 2009.

Table 2 displays the results of cross-correlations of five periods before and after. The correlation coefficient value is determinant. To include a stock index in leading indicators, the highest absolute value of the correlation coefficient must be in time  $t-1$  to  $t-5$  and it must be the highest (Czesaný and Jeřábková 2009), however, it is not mentioned how high exactly the value is to be, or from which value of cross-correlation can the given indicator be included in the leading indicators.

In Table 2 we can see that the Czech stock index, using the ČŠÚ methodology, does not show any properties of a leading indicator. On the contrary, the highest values of cross-correlations are achieved in time lagging the business cycle in times  $t+2$  and  $t+3$ . It would mean that according to ČŠÚ, the Czech stock index lags behind the development of the Czech business cycle, which is contrary to the results of Eurostat and OECD, whose CLI comprises stock indices. ČŠÚ constructed their own CLI as well, the calculation of which can be expressed using the following relation (Czesaný and Jeřábková 2009):

$$\begin{aligned} \text{Czech CLI} = & 1/7 * \text{Labour productivity in industry} + 1/7 * \text{Change in inventories (stále ceny roku 2000)} + 1/7 * \\ & \text{Exports of goods and services (constant prices, reference year 2000)} + 1/7 * \text{Gross value added in industry} \\ & \text{(constant prices, reference year 2000)} + 1/7 * \text{EU15 GDP (constant prices, reference year 2000)} + 1/7 * \\ & \text{Service sales index (2000=100)} + 1/7 * \text{Retail sales index (2000=100)} \end{aligned} \quad (4.2)$$

The formulas for the CLI calculation is composed of seven indicators, stock indices, however, are not among them. That means that according to the methodology of ČŠÚ and that of Czesaný stock indices do not have sufficient predictive power to be considered leading indicators and therefore they cannot be included in the Czech CLI.

After having examined the behaviour of stock indices and their positions in CLI, we did not reach an unequivocal conclusion. While Eurostat and OECD consider stock indices of the given countries economically and statistically significant to such extent that they include them in the leading indicators which CLI comprises, it is not so in the case of Infostat and ČŠÚ. Stock index was not among the indicators that CLI comprises neither in Slovakia nor in the Czech Republic, in the case of ČŠÚ the stock index did not even have properties of a leading indicator. Due to these discrepancies in opinion on the ability of stock indices to predict the development of the Czech and Slovak business cycles, we have decided to analyse the relation between stock indices and business cycles of these countries using our own methodology, where the finding whether a stock index is a leading indicator is not sufficient for us, we have focused also on finding out whether it is of such quality that it can be included even in the newly constructed Czech and Slovak CLIs.

## 5. Aim, hypotheses and research methodology

The main aim of this paper is to analyse the predictive power of selected stock indices in relation to business cycles of the given countries. The point of the main aim of the paper is to verify the predictive power of selected stock indices in relation to the business cycle, which represents a reference series depending upon the methodology of CLI calculation. Apart from the main aim, we have also set out three hypotheses, which we will test and subsequently accept or reject.

- H1: Prague Stock Exchange 50 Index (PX Index) is a leading indicator in relation to the Czech business cycle.
- H2: Slovak Share Index (SAX) is a leading indicator in relation to the Slovak business cycle.
- H3: Prague Stock Exchange 50 Index and Slovak Share Index belong to the leading indicators, which the composite leading indicators (CLIs) for the Czech and Slovak business cycles comprise.

When studying the Czech and Slovak business cycles, we selected the quarterly GDP in constant prices, reference year 2010, to be the reference series. In order to determine the predictive power of stock indices in the Czech and Slovak business cycles, and especially their importance in predicting a business cycle using CLI, it was necessary to examine the relation of the whole set of economic indicators to these business cycles. These were indicators related to industry, building industry, retail, services, labour market, state budget, balance of payments foreign trade, retail and consumer prices, monetary aggregates, and, of course, stock indices.

The database sources were the databases of OECD, Eurostat, statistical offices of the countries and their central banks, therefore, these were secondary data, which were of both qualitative and quantitative nature. For the needs of our analysis, it was not possible to use unadjusted data found directly in the databases. Therefore, we had to make calculations to get the data form, which satisfies the needs of a business cycle analysis, where the fundamental step was to remove the seasonal component and trend and to keep the cyclical component, which is key to the analysis of a relationship between any indicator and the business cycle. The process of such adjustment is time consuming, mainly due to the great number of time series, which have to be cleaned. For the Czech Republic we have selected 118 indicators and for Slovakia 112 indicators. In the selection of indicators mainly the following properties were taken into consideration: relevance, cyclical behaviour, quality of data, accuracy, comparability, completeness, accessibility, and clarity. Out of the stock indices for both countries we have selected the following ones for the database of studied time series: EURONEXT global index, DowJones EURO STOXX 50, DowJones EURO STOXX Broad, DowJones STOXX 50 (Europe) and DowJones STOXX Broad (Europe). For the Czech Republic we have added PX Index, for Slovakia SAX. Apart from the stock index, we have also selected an indicator of market capitalization, which represents a large number of stocks multiplied by their market value.

In order to know, if the stock indices are in the CLI for the Czech Republic and Slovakia, it was necessary to calculate them. Here is a short summary of steps which will take us to the construction of the Czech and Slovak CLIs:

- *Deseasonalising of time series (seasonal indices)* – from original data it is necessary to get the cyclical component, therefore, we first have to deseason the time series, for which we will use the smoothing method with seasonal indices.
- *Trend removal (Hodrick-Prescott filter)* – The Hodrick-Prescott filter separates a time series  $y_t$  into a trend component  $T_t$  and a cyclical component  $C_t$  such that  $y_t = T_t + C_t$ . It is equivalent to a cubic spline smoother, with the smoothed portion in  $T_t$ .

The objective function for the filter has the form:

$$\sum_{t=1}^m C_t^2 + \lambda \sum_{t=2}^{m-1} ((T_{t+1} - T_t) - (T_t - T_{t-1}))^2 \quad (5.1)$$

Where  $m$  is the number of samples and  $\lambda$  is the smoothing parameter. The programming problem is to minimize the objective over all  $T_1, \dots, T_m$ . The first sum minimizes the difference between the time series and its trend component (which is its cyclical component). The second sum minimizes the second-order difference of the trend component (which is analogous to minimization of the second derivative of the trend component) (Hodrick and Prescott 1997). One of the reasons for choosing the HP filter was that it can remove a trend in a single operation and, at the same time, it can smooth the whole time series (Schlicht 2005). Hence, it is possible to get cyclical components of time series, which are necessary for the analysis of business cycles.

*Cross-correlation* – enables to express the relationship between a reference series and time series of cyclical indicators which we have studied. We have performed cross-correlations moving five periods back and forth, using Pearson's correlation coefficient, which expresses linear dependence between the variables (Luboš *et al.* 2007). If this relationship is nonlinear, which we can find out from a chart, we will linearise it by transforming the variables (e.g. to logarithmise them) and subsequently we can calculate a new correlation.

*Creation of groups of cyclical indicators (coincident, lagging, leading)* – based on the value of the correlation coefficient, we can create three groups of cyclical indicators; however, in the group of leading indicators we include only the cyclical indicators which meet the conditions we have selected:

- The highest absolute value of the correlation coefficient in time  $t-1$  to  $t-5$ ,
- The second highest absolute value of a correlation coefficient must be at least 0.55.

*Method of selection and scoring* – when selecting suitable leading indicators included in CLI, we perform a selection of data and use a scoring method where their economic and statistical significance is evaluated:

- *Economic significance (10 points)* – economic interpretation in relation to the business cycle (10 points),
- *Statistical significance (30 points)* – correlation coefficient (15 points), number of lead times (15 points),
- *Statistical quality (10 points)* – accessibility in terms of time (5 points), update (5 points).

*Data normalisation (standardisation)* – the main reason for the normalisation is that we want to be able to include in CLI the data in different units. In our case of data normalisation, we will use a standardisation method. Standardisation of time series is performed using the following equation (OECD 2008):

$$I_{qc}^t = \frac{X_{qc}^t - X_{qc=\bar{c}}^t}{\sigma_{qc=\bar{c}}^t} \quad (5.2)$$

where  $I_{qc}^t$  represents normalized value,  $X_{qc}^t$  is real value,  $X_{qc=\bar{c}}^t$  is average value,  $\sigma_{qc=\bar{c}}^t$  is standard deviation.

*Setting of weights* – For the composition of CLI we will compare the appropriateness of the same and different weights. The same weights will be calculated using a simple formula:

$$v = \frac{1}{n} \quad (5.3)$$

where  $v$  is weight, for each leading indicator entering CLI, and  $n$  is the number of leading cyclical indicators entering CLI. For setting weights we will use the values of correlation coefficients, while the indicator with a higher value of the correlation coefficient will be assigned a higher weight in CLI. A calculation of different weights can be written as follows:

$$v_i = \frac{r_i}{\sum_{i=1}^n r_i} \quad (5.4)$$

where  $v_i$  is weight for  $i^{\text{th}}$  leading indicator,  $r_i$  is value of the correlation coefficient of  $i^{\text{th}}$  leading indicator in lead-time.

CLI construction itself. When creating a formula for CLI calculation, we use the sum of indicators multiplied by their weights<sup>1</sup>

## 26. Predictive ability of stock indices in the business cycle

### 6.1. Stock indices and the Czech business cycle

In a standard analysis of the Czech business cycle, among stock indices mainly Prague Stock Exchange 50 Index (PX Index) is being monitored. We have, however, decided to extend the analysis by other stock indices and market capitalization. After having calculated the cross-correlations, we got the results listed in Table 3.

Table 3 - Results of cross-correlation between GDP cyclical component and the cyclical components of selected indicators for the Czech Republic<sup>1</sup>

INDICATOR	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5
Prague Stock Exchange 50 Index	0.478	0.660	0.770	<u>0.836</u>	0.807	0.640	0.388	0.140	-0.032	-0.181	-0.269
DowJones STOXX 50 (Europe)	0.423	0.553	0.619	<u>0.636</u>	0.587	0.458	0.282	0.106	-0.029	-0.145	-0.219
DowJones STOXX Broad (Europe)	0.457	0.606	0.685	<u>0.711</u>	0.666	0.527	0.333	0.137	-0.013	-0.146	-0.232
DowJones EURO STOXX 50	0.384	0.533	0.619	<u>0.658</u>	0.625	0.504	0.330	0.156	0.026	-0.090	-0.168
DowJones EURO STOXX Broad	0.418	0.574	0.665	<u>0.704</u>	0.668	0.539	0.352	0.165	0.026	-0.099	-0.180
EURONEXT global index	0.503	0.693	0.805	<u>0.857</u>	0.833	0.696	0.482	0.260	0.092	-0.059	-0.162
Market capitalization, mld.eur	0.056	0.299	0.529	0.749	<u>0.851</u>	0.764	0.562	0.377	0.256	0.125	0.045

Source: Authors' own elaboration

From Table 3 we can see that *all the monitored stock indices in the case of the Czech Republic* show such a big lead time against the development of GDP cyclical component that they *can be included as leading indicators using the criteria we have selected*. All of them reach lead-time in time  $t-1$  and  $t-2$  and the second highest absolute value of the correlation coefficient was, for all of them, at least 0.55. It means that the selected stock indices definitely have the ability to predict the short-term development of GDP at high level of quality, where the total highest value of the cross-correlation was reached in the case of PX Index (0.836) and the lowest in the case of Dow Jones EURO STOXX 50 (0.658). The length of lead of the stock index development against the business cycle varied depending on the individual index and it is a lead of one or two quarters. Based on Table 3 we can already confirm Hypothesis 1, which states that the *Prague Stock Exchange 50 Index is a leading indicator in relation to the Czech business cycle*.

To test Hypothesis 3, i.e. its part relating to the Czech Republic, we had to compose the whole composite leading indicator for this country. The result was the following equation:

$$\text{Czech CLI} = 0.23594 * \text{Total Industrial Production} + 0.26433 * \text{PX 50 Index} + 0.26247 * \text{Turnover in Industry} + 0.23726 * \text{Exports of Goods and Services} \quad (6.1)$$

<sup>2</sup> We calculated the values of cross-correlations between the cyclical part of GDP in constant prices, reference year 2010, and cyclical components of stock indices from time series of quarterly data Q1 1997-Q4 2015 (Time serie for market capitalization Q1 1997-Q4 2012).

<sup>3</sup> We calculated the values of cross-correlations between the cyclical part of GDP in constant prices, reference year 2010, and cyclical components of stock indices from time series of quarterly data Q1 1997-Q4 2015 (Time serie for market capitalization Q1 1997-Q4 2012).



The equation for the calculation of the Czech CLI indicates that the selected stock index is of such quality that we could include it in the Czech CLI, and the weight assigned to it is approximately the same in all the CLI components and equals to 0.26433, which is more than 1/7, which is assigned to this index by OECD and 1/6 which is assigned to it by Eurostat. The given relation completely disproves the role of the index in predicting business cycles, which was calculated by ČSÚ. According to our results, PX Index belongs to high-quality leading indicators and its inclusion in the Czech CLI is justified. It cannot at all be considered a lagging indicator, as the work by S. Czesany from the year 2009 indicates. For the Czech Republic we, therefore, accept Hypothesis 3.

## 6.2 Stock indices and the Slovak business cycle

In Slovakia, the predictive abilities of stock indices have been studied the same way as in the case of the Czech Republic. Table 4 shows the values of cross-correlations in case of six stock indices and market capitalization.

Table 4 - Results of cross-correlation between GDP cyclical component and cyclical components of selected indicators for Slovakia<sup>1</sup>

4INDICATOR	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5
Slovak Share Index	0.246	0.262	0.254	0.296	<u>0.384</u>	0.375	0.297	0.274	0.222	0.110	-0.051
DowJones STOXX 50 (Europe)	0.342	0.413	0.433	<u>0.482</u>	0.351	0.206	0.048	-0.077	-0.160	-0.176	-0.148
DowJones STOXX Broad (Europe)	0.420	0.520	0.555	<u>0.568</u>	0.472	0.294	0.096	-0.057	-0.177	-0.238	-0.239
DowJones EURO STOXX 50	0.307	0.393	0.433	<u>0.462</u>	0.389	0.252	0.092	-0.033	-0.116	-0.132	-0.106
DowJones EURO STOXX Broad	0.358	0.463	0.515	<u>0.553</u>	0.474	0.311	0.124	-0.018	-0.124	-0.166	-0.156
EURONEXT global index	0.522	0.644	0.668	<u>0.700</u>	0.616	0.416	0.154	-0.037	-0.206	-0.324	-0.377
Market Capitalization, Billiards of euro	0.244	0.257	0.267	0.296	<u>0.385</u>	0.340	0.159	0.105	0.036	-0.124	-0.263

Source: Authors' own elaboration

Table 4 shows that the values of cross-correlations of stock indices and of reference series are significantly lower than in the case of the Czech Republic. Stock indices, such as Dow Jones STOXX 50 (Europe), 2010=100, Dow Jones EURO STOXX 50, 2010=100 and DowJones EURO STOXX Broad, 2010=100, did not even show sufficient values of cross-correlations to be included in the leading indicators. Remarkable was the finding that the Slovak Share Index (SAX), 2010=100, did not satisfy this condition, either, even though it is included in the basic cyclical leading indicators by Eurostat and OECD, which CLI for Slovakia comprises.

For detail analyse we also tried to do cross-correlations with shorter time series, it means for quarterly data of Q1 2000-Q4 2015 and Q1 2010-Q4 2015. We wanted to know predictable abilities of Slovak Share Index in these time periods. Results are in the Table 5.

Table 5 - Results of cross-correlation between GDP cyclical component and SAX cyclical component

Time period	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5
1997-2015	0.246	0.262	0.254	0.295	<u>0.384</u>	0.375	0.297	0.274	0.222	0.110	-0.051
2000-2015	0.211	0.220	0.229	0.290	<u>0.395</u>	<u>0.406</u>	0.325	0.306	0.253	0.139	-0.027
2010-2015	0.128	0.251	0.396	0.533	<u>0.631</u>	<u>0.730</u>	0.624	0.401	0.071	-0.246	-0.459

Source: Authors' own elaboration

Note: quarterly data

Table 5 shows us that relationship between cyclical components has changed in the time. During years 1997-2015 and 2000-2015 was correlation coefficient too weak but in the time of years 2010-2015 was coefficient 0,730 in time  $t$ . In means that in this time SAX was coincident indicator for Slovak business cycle and it can not predict this business cycle.

Based on the performed analysis, we have rejected Hypothesis 2, which says that the *Slovak Share Index (SAX) is a leading indicator in relation to the Slovak business cycle*.

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Based on the rejection of Hypothesis 2, we can claim that Hypothesis 3 will not be accepted for Slovakia, either, as the prerequisite for SAX to enter CLI is that it belongs to the leading indicators set, which it does not. Despite this fact, we have moved on to the construction of CLI for Slovakia and constructed the following formula:

$$\text{Slovak CLI} = 0.20467 * \text{Gross fixed capital formation} + 0.210526 * \text{Exports of goods and services} + 0.204678 * \text{Industrial production} + 0.19883 * \text{Turnover in industry} + 0.18128 * \text{Consumer confidence indicator} \quad (6.2)$$

Slovak CLI comprises five cyclical indicators, which SAX could not get into. There are just indicators from industry, consumer confidence indicator, gross fixed capital and indicator of export.

### 6.3. Comparison of predictive abilities of the Czech and Slovak stock indices

Based on the accessible data, we have documented the position of the basic Czech and Slovak stock indices in predicting the business cycle at international organizations, namely Eurostat and OECD and their position in the composition of CLI by national institutions such as Infostat and ČSÚ. Apart from that, we have made our own methodology for CLI calculation and hence we made our own conclusions in terms of the roles of these stock indices. The conclusions made this way have been summarized in Table 6.

Table 6 - Position of Czech and Slovak stock indices in relation to business cycles of these countries by the institution

Institution	Czech Republic (PX Index)			Slovak Republic (SAX Index)		
	Leading indicator	CLI component	Weight in CLI	Leading indicator	CLI component	Weight in CLI
Eurostat	yes	yes	1/6 <sup>b</sup>	Yes	Yes	1/6 <sup>b</sup>
OECD	yes	yes	1/7 <sup>c</sup>	Yes	Yes	1/5 <sup>c</sup>
Infostat <sup>a</sup>	-	-	-	Yes	No	-
ČSÚ	no	no	-	-	-	-
Own calculations	yes	yes	0.26433 <sup>c</sup>	No	No	-

Note: <sup>a</sup> Composite indicator composed by Infostat is considered a reference series <sup>b</sup> Other indicators in CLI have different weights. <sup>c</sup> Other indicators in CLI have the same weights.

Source: Own elaboration based on authors' calculations

Table 6 indicates the position of stock indices in relation to the development of the Czech and Slovak business cycles. This position, or the ability of the given indices to predict the development of the countries' business cycles, is monitored through three selected criteria, i.e. whether the given index is a leading indicator, whether its predictive abilities are so good that it has been included in the given country's CLI and what is the weight of the given index in country's CLI. The weight of the index indicates its position compared to the other CLI components.

According to the Eurostat methodology, both stock indices have the properties of leading indicators and, at the same time, these predictive abilities are of such quality that they enable the indices to be included in the Czech and Slovak CLIs. This demonstrates great significance of stock indices in predicting business cycles from Eurostat's point of view. The weight, which is assigned to these indicators in CLI, equals 1/6 for both countries.

OECD, just as Eurostat, lists PX Index and SAX as part of CLIs for the Czech Republic and Slovakia. The weights assigned to these indices, however, differ. In the Czech Republic it is 1/7 and in Slovakia 1/5, as only five indicators had been included in CLI for Slovakia.

The calculations made by Infostat show that SAX has properties of a leading indicator, but it is not a part of CLI. ČSÚ even considers PX index as a lagging, not leading, indicator, therefore it could not even be included in the construction of CLI.

Using this methodology, we have selected, we have found out that PX Index is a leading indicator of the Czech business cycle and its predictive abilities are so good that we can include it in the Czech CLI with a weight of 0.26433. On the contrary, SAX cannot be considered a leading indicator mainly due to low values of correlation coefficients at cross-correlation. Since it did not meet the criteria to be considered a leading indicator, it could not be included in the Slovak CLI, either. Overall, we can conclude that the Czech stock index has a more significant role in predicting the development of the Czech business cycle than the Slovak stock index.

In Table 6 we can also see that the individual institutions assign different importance to stock indices in prediction of the development of the Czech and Slovak business cycles. It is, however, important to think about the reasons why it is so as basically each institution this way expresses the relation of stock index to reference series which represents a business cycle. In our opinion, these significant differences are caused also by the differences

in methodologies used to calculate the leading indicators and the CLI itself. Each institution uses its own methodology, and we can define the basic areas where the approaches differ:

- Selection of approach to the business cycle (growth, cyclical),
- Selection of reference order which represents the business cycle,
- Way of selecting partial and cyclical indicators,
- Length of time series of cyclical indicators and reference series,
- Type of data (qualitative, quantitative data),
- Way of removing trend from time series,
- Way of determining the relationship between partial cyclical indicators and reference series,
- Conditions for including cyclical indicators in the group of leading indicators,
- Assigning weights for components entering CLI,
- Sequence of steps to construct CLI.

Every mentioned difference can lead to different conclusions as for the position and predictive ability of stock indices in the business cycle. It is, therefore, necessary to take into consideration all the available approaches and not to underestimate or overestimate the role of stock indices in predicting the Czech and Slovak business cycles.

## Conclusion

Nowadays, stock indices are used a great deal in predicting business cycles of world countries, including Slovakia and the Czech Republic. In these countries a stock index was included in the CLI in case of international organizations, namely OECD and Eurostat. Noteworthy is the fact that the domestic institutions, which engage in the construction of CLIs for the Czech Republic and Slovakia, i.e. Infostat and ČŠÚ, do not include in CLI any stock index, or even a financial market indicator. National institutions should take into consideration the specificities of the given country in a greater deal than Eurostat and OECD, therefore, it could seem that the results connected with the CLI composition should be more precise at the national level. Due to these discrepancies we have composed our own CLI for the Czech Republic and Slovakia and we have analysed the role of the selected stock indices in the prediction of Czech and Slovak business cycles using this composite leading indicator. The results of our analysis indicate that the selected stock indices in the case of the Czech Republic satisfy the conditions to be ranked among the leading indicators and that way they can predict the development of the country's business cycle. We consider the PX Index to be the best such indicator whose quality enables it to be ranked also among the leading indicators included in the Czech CLI, not only according to our calculations but also according to the calculations of OECD and Eurostat. In the case of Slovakia, we came to different conclusions. The monitored stock indices no longer showed the leading properties in all the cases, even the basic stock index for Slovakia, SAX, did not satisfy the conditions to be included in the group of leading indicators. This was the discrepancy between the results of our analysis and the analyses of OECD and Eurostat.

A prediction of a business cycle development, however, cannot be made only based on one area, i.e. for example the stock market development, but it is necessary to take into consideration the whole set of economic indicators, a combination of which can lead to the composition of a high-quality composite indicator which has a short-term predictive ability in terms of the country's business cycle.

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## Development of the Municipal Market of Land Plot Auctions for Housing Construction in Russia

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### Abstract:

*The article deals with relevant issues of the modern development of the Russian land market in the segment of municipal auction sales of land for housing construction. The article shows that municipalities play an important role in the Russian market of auction sales of land plots for housing construction. It presents statistics showing the current situation, characteristics and development trends of the land market for housing construction and its segment of auction sales at the level of the Russian Federation and the municipality of Penza. Elements of procedural modeling of the territorial land market for housing construction are shown, including a classification analysis of the structure of the auction sales segment of the market. Methodological proposals are formulated on modeling and forecasting growth functions of the starting auction price according to the theory of auctions in the context of the municipalities of the Russian Federation and Penza. Classification and analysis is given of key factors affecting the likelihood of sales of land plots for individual housing construction at municipal auctions in Penza, including economic and mathematical modeling. Conclusions and recommendations on the research subject are formulated.*

**Keywords:** land plots, municipal market of auction sales, land auctions, auction theory.

**JEL Classification:** D44, R52.

### 1. Introduction

At the present stage of development of the land market in Russia, land auctions are crucially important as a way of acquiring land for housing construction. Municipalities organize land auctions for housing construction to improve the housing conditions of individuals and to expand urban areas, as well as to additional revenue for state and municipal budgets.

In this regard, the study of the municipal market of auction sales of land for housing construction is of particular importance. With the proper functioning of the mechanism of land sales through auctions, budget revenues from land sales can significantly increase and the housing shortage problem that exists in Russia can be solved.

In this regard, the study of the municipal market of auction sales of land for housing construction is of particular importance. Without proper functioning of the mechanism of auction land sales, revenues from land sales of budgets of all levels can significantly shrink.

### 2. Methodology

The most important element of the land market of the Russian Federation is the municipal land market segment that has a significant impact on the Russian economy and especially on the housing construction trends (RF Government Resolution # 1050 of December 17, 2010). Therefore, finding out the characteristics and key trends of the market of auction sales of land for housing development (RF Government Resolution # 808 of November 11, 2002) is an important element of research into this segment of the land market (Vijay Krishna, 2010).

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<sup>2</sup> S units of domestic currency = 1 unit of foreign currency

The first trend at the federal level is the growth of the area of residential communities owned by municipalities (from 2006 to 2013 from 10.9K hectares to 408.7K hectares).

One of the features is that the distribution of area between urban and rural communities changed (Figure 1). In 2006, 34% of area of residential communities owned by municipalities was urban communities and 66% - rural communities. However, by 2013 the share of urban communities grew to 77% due to the expansion of city limits.

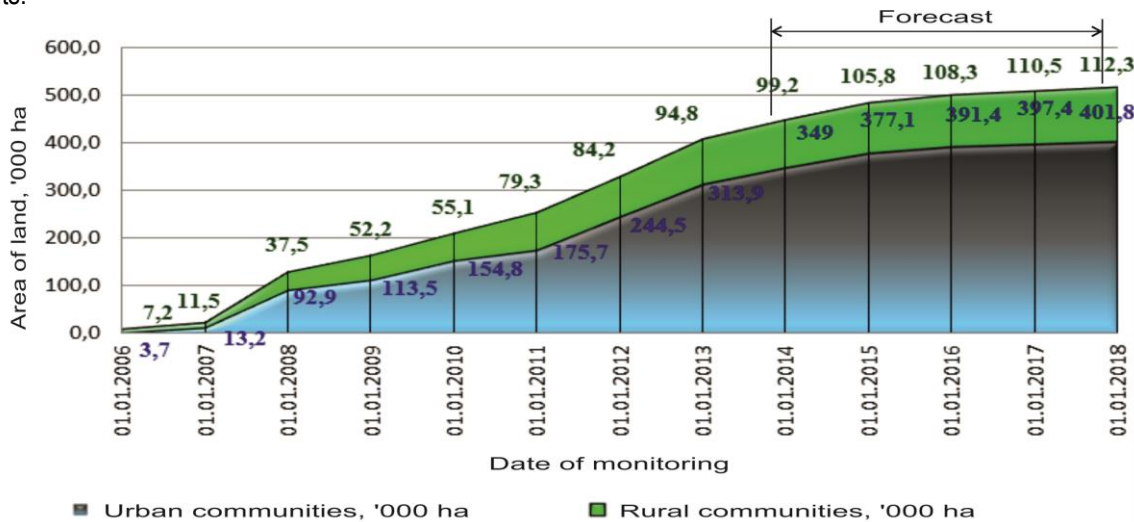


Figure 1 - Analysis and forecast of the distribution of residential areas in municipal ownership between urban and rural communities in 2006-2018

The second trend on the federal level is that in the entire area of land purchased from municipalities by individuals and legal entities the second place is held by land for individual housing construction (43% of all urban lands in private ownership in 2013), with the first place held by agricultural land (50%).

Another trend on the federal level is strong growth in the total number of land transactions closed at public auctions. As on 01.01.2006, the share of transactions with state and municipal lands in the total number of land transactions in the Russian Federation was 12.38%, while as on 01.01.2013, the share was 13.49%. In the considered time interval, we observe an increase in the number of transactions with land in state and municipal property closed at auctions (as on 01.01.2006, 4,644 transactions (3,774 ha), as on 01.01.2013, 34,706 transactions (86,918.26 ha), i.e., an increase by more than seven times in terms of the number of transactions).

The share of transactions with land sold at auctions in the total number of transactions with land in state and municipal property did not change smoothly (Baronin 2013). Since 01.01.2006 till 01.01.2011, there was recorded a significant increase of this indicator from 3.08% to 11.94%, and then it began to decline and on 01.01.2013 it was 9.26%. Increasing in the share of transactions with state and municipal land in the total number of transactions with land is due to the increase in the share of land plots allocated outside auctions (buying land under existing structures owned by individuals and legal entities; allocation of land without bidding to families with three and more children, etc.).

In the research conducted by the authors the municipal market of auction sales of land for housing construction was classified by four groups of criteria: legal, spatial, physical, auction criteria (Figure 2).

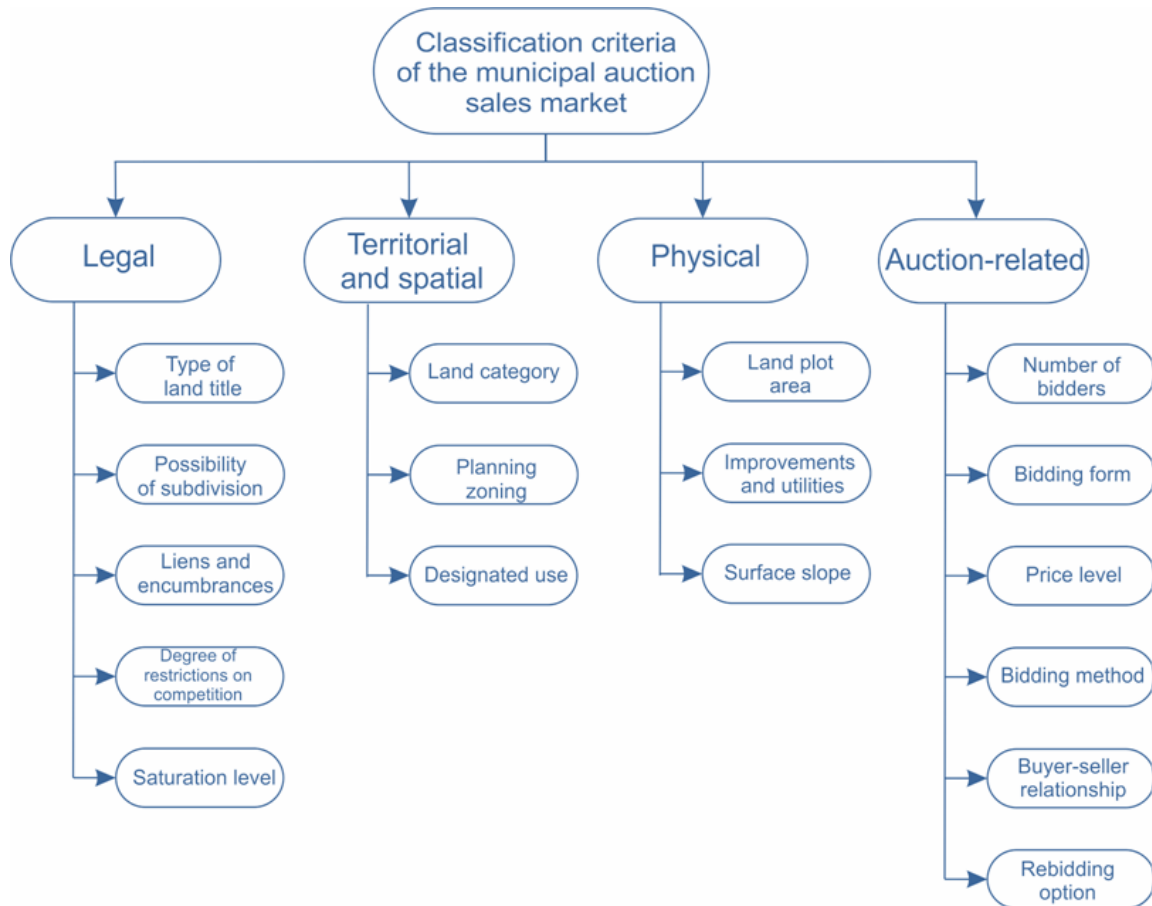


Figure 2 - Classification of the municipal market of land auction sales by groups of classification criteria

Classification analysis of the auction sales market of land for housing construction at the municipal level revealed the many ways the formation and registration of land rights, types of auctions, etc. Auction sales of land at the municipal level use the model of the English auction (ascending-price auction) discussed in the classification below (Menezes and Monteiro 2008, Milgrom 2010). In Russia in recent years, the Dutch auction (descending-price auction) has also been used, but only in economy class housing developments and it is not used by municipalities (Baronin *et al.* 2014, Baronin and Kulakov 2015).

Conducted research in the field of municipal administration of auction sales of land (Baronin *et al.* 2014), as well as of the auction theory of Milgrom (2010), allowed to carry out modeling and forecasting of functions controlling the starting auction price growth in the context of municipalities.

### 3. Findings

In the period since 01.01.2013 till 01.04.2014, according to the official public sales website of the Russian Federation [www.torgi.gov.ru](http://www.torgi.gov.ru) (Land Code of the Russian Federation of 25.10.2001 # 136-FZ), 3,650 public auctions for the sale of land were conducted, of which 1,520 (42%) failed due to lack of bidders, 1,406 failed due to participation of less than two bidders, 565 (15%) were successfully conducted, of which 30% registered no auction price gain compared to the starting price of the lot. (RF Government Resolution # 909 of September 10, 2012)

The research conducted allowed to carry out an economic and mathematical quantitative assessment of the likelihood of sales of land plots for individual housing construction at the auctions held by Penza municipality since 2010 (Report on the performance of the head of Penza municipal authority and of the municipal authority of the city of Penza in 2014, Report on the performance of the head of Penza municipal authority and of the municipal authority of the city of Penza in 2013, Baronin *et al.* 2014, Report on the performance of the head of Penza municipal authority and of the municipal authority of the city of Penza in 2011 and Report on the performance of the head of Penza municipal authority and of the municipal authority of the city of Penza in 2010) Whether the land plot has been properly prepared for the auction sale (Penza City Duma Decision #949-45/4 of April 25, 2008) determines how high the chances are that it will be sold at auction. For this purpose, first of all, the factors influencing the probability



of selling a land plot are identified. This will allow preparing and put land for sale in such a way as to maximize the likelihood of sale of all the prepared properties.

In further studies using expert assessment methods (involved 36 experts in the field of land development), an analysis of the affecting factors revealed 20 significant factors within the identified subsystems. Factors of subsystems F1 (spatial factors), F2 (physical factors), F3 (economic, political, and legal factors) are taken into account in the determination by an independent valuer of the market value of the land plot used to set the starting price of the auction. It is not taken into account that the property will be offered at auction and the probability of sale of land is also influenced by the factors of subsystem F4 (auction factors). Survey of experts made it possible to arrange the factors in a descending order of importance (Table 1).

Table 1 - The level of significance of factors affecting the likelihood of sale of land plots through municipal land auctions in the subsystem F4

#	FACTOR	Ranking
1.	Timing of the auction	1
2.	Number of previous auctions	2
3.	Whether there are lots with a similar location offered at the auction	3
4.	Amount of the deposit	4
5.	Auction step	5
6.	Reasons for the auction	6

The analysis of these factors and their significance identified as the most important of them the following factors: timing of the auction and the number of previous offers. The probability of sale of land at the current auction is calculated as the ratio of the number of sales of land at the current auction to the total number of lots offered at the current auction (Formula 3.1):

$$P(R)_{ta} = \frac{m_{ta}}{n_{ta}}, \tag{3.1}$$

where  $P(R)_{ta}$  is the probability of sale of land at the current auction,  $n_{ta}$  is the total number of lots offered at the current auction,  $m_{ta}$  is the number of sales of land at the current auction.

Calculation has been made of the average annual probability of sale at municipal auction of a land plot for individual housing construction, defined as the ratio of the annual total number of cases where at an auction there are one or more bidders for a single lot to the total number of auctions held for a single lot for during the year (Formula 3.2):

$$P(R)_y = \frac{\sum_{i=1}^k m_i}{\sum_{i=1}^k n_i}, \tag{3.2}$$

where  $P(R)_y$  is the average annual probability of sale of land,  $n_i$  is the number of auctions held for the single lot during the year,  $m_i$  is the total number of auctions held for the single lot during the year.

The average annual probability of sale of land at auction varied unevenly: 2010 – 0.3696, 2011 – 0.2750, 2012 – 0.1190, 2013 - 0.0735. (Penza City Duma Decision #922-39/5 of 22.05.2012, Penza City Duma Decision #1207-51/5 of 24.05, Penza City Duma Decision #320-18/5 of 27.05.2010, Penza City Duma Decision #606-28/5 of 27.05.2011)

The data presented make it possible to conclude that the likelihood of sale of land at auction decreases annually. For a detailed examination of these dynamics, average quarterly probability of sale of land was determined, which is defined the ratio of the quarterly number of cases where an auction with a single lot involved one or more bidders to the total number of auctions held for a single lot during the quarter (Formula 3.3):

$$P(R)_{sq} = \frac{\sum_{j=1}^l m_j}{\sum_{j=1}^l n_j} \tag{3.3}$$

where  $P(R)_{sq}$  is the average quarterly probability of sale of land,  $n_j$  is the number of auctions held for the single lot during the quarter,  $m_j$  is the total number of auctions held for the single lot during the quarter.

The following trend was observed in the average quarterly probability of sale in the period since 01.01.2010 till 01.01.2014: Q1 - 0.1613, Q2 - 0.3043, Q3 - 0.2411, Q4 - 0.2613. Through compilation of data on the average

quarterly probability of sale of land for individual housing construction, it is possible to determine the impact of seasonal factors of sales on the probability of sale of land sales by calculating the probability of sale of land by quarter.

According to the presented analysis, the probability of sale of land is the highest in Q2 and the lowest in Q1. This trend is due to the fact that individuals tend to buy land in the first half of the year to complete the maximum amount of construction work before the winter, but not in Q1, when the snow cover makes the land offered at auction unfit for inspection.

To model the probability of sale of land, depending on the number of previous exposures, we consider a group of land plots sold in the period from 01.01.2010 to 01.01.2014, consisting of 93 plots (the remaining 49 plots in the sample were not sold during the period, however were put up for auctions). Plots are grouped according to the number of previous exposures, and for each group the probability of sale of land at auction was calculated (Formula 3.4):

$$P(R)_{pv} = \frac{\sum_{i=1}^k m_i}{\sum_{i=1}^k n_i} \tag{3.4}$$

where  $P(R)_{pv}$  is the probability of sale of land based on previous exposures,  $n_i$  is the total amount of land plot in the sample,  $m_i$  is the number of land plots sold after the same number of exposures.

Based on these studies, we can conclude that the probability of sale of land for individual housing construction on municipal land auctions decreases with increasing number of previous exposures (Table 2).

Table 2 - Grouping of land plots for individual housing construction by the number of previous exposures

# of the auction	Number of previous auctions	Number of land plots sold in the group	Probability of sale of land at auction
1	0	52	0.5591
2	1	23	0.2473
3	2	5	0,0538
4	3	4	0,0430
5	4	6	0,0645
6	5	2	0,0215
7	6	1	0,0108
TOTAL		93	

In accordance with the addition theorem, the probability of sale at auction of land for individual housing construction can be calculated as follows (Formula 3.5):

$$P(R) = P(R)_{sq} + P(R)_{pv} \tag{3.5}$$

Based on the collected data, the probability of sale of land can be calculated, depending on the number of previous exposures and the time of the auction (Figure 3). Expert estimates of the probability of sale of land indicate that at  $P(R) \leq 0.5$  the process of auction sales can be considered satisfactory.

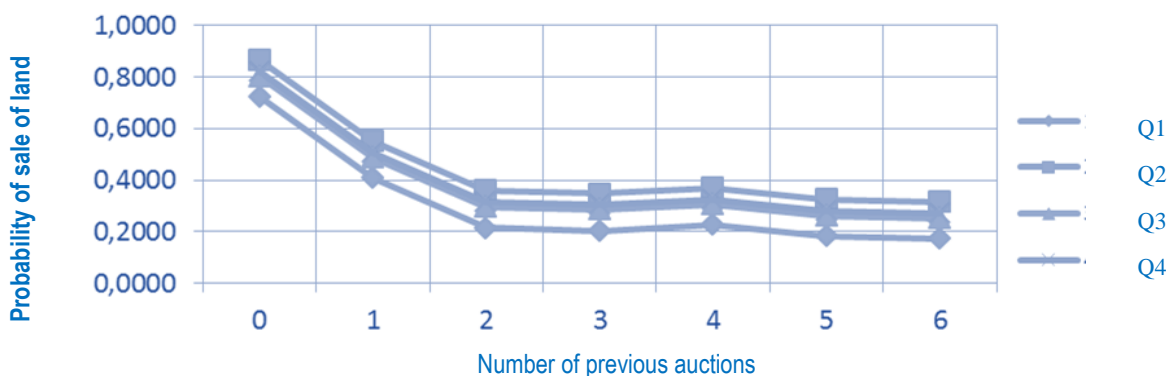


Figure 3 - Modeling the probability of sale of land, depending on the number of previous exposures and the time of the auction

Thus, to properly prepare a land plot for sale at auction it is advisable to model the probability of sale. Studies suggest that when municipal land is put on auction for individual housing construction purposes more than twice, it is recommended to publish a notice of the auction, taking into account seasonal factors.

Of 565 plots sold at auctions for the purposes of individual housing construction (land zoning category "individual housing construction" and "cluster housing construction"), 39% are land plots sold at auctions with 2 bidders, 26% - with 3 bidders, 17% - with 4 bidders, 11% - with 5-6 bidders, 7% - with 7 or more bidders.

Modeling of the starting auction price of land is possible only if bidders are equally interested in acquiring the lot. Therefore, of 565 plots, a sample of land plots was chosen that registered growth of the starting price. Final sample is 160 properties (40 properties in group 1 and 30 in the other groups) (Table 3).

Table 3 - Grouping of the final sample plots for individual housing construction sold at auctions

GROUP	Number of bidders	Group number
Group 1	2	1
Group 2	3	2
Group 3	4	3
Group 3	5-6	4
Group 5	more than 7	5

Dependence between the probability of sale of land at the auction and the date of the auction is considered below. For this purpose, the data from the Russian official public sales database [www.torgi.gov.ru](http://www.torgi.gov.ru) are used (Figure 4).

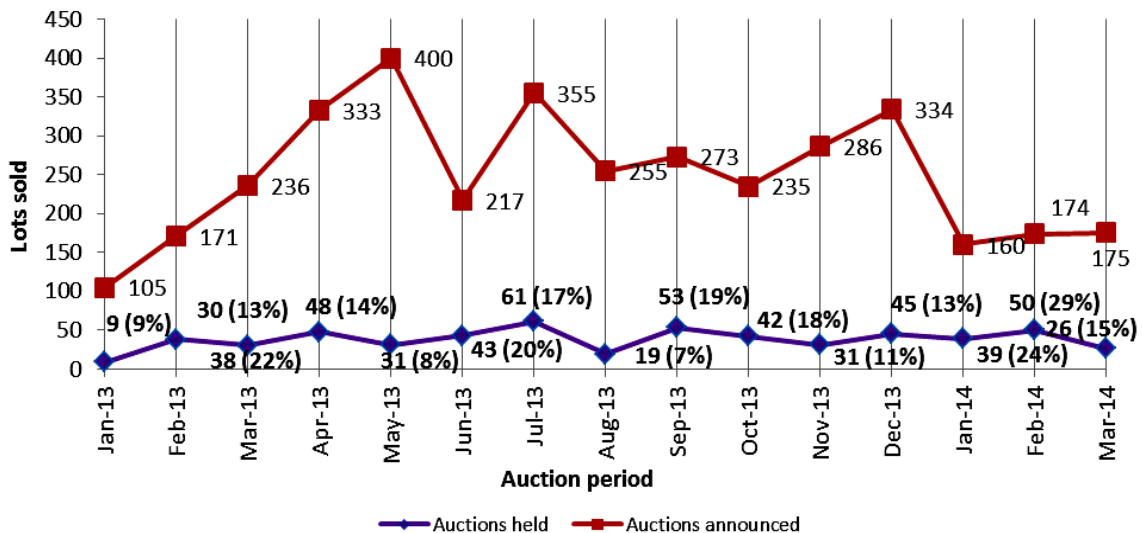


Figure 4 - Analysis of the dynamics of the sales of land for housing construction by date of sale at auction

The largest number of plots announced for sale was recorded in May, July and December 2013, however, the highest percentage of sold plots is observed consistently in Q1 (except for January 2013, when the said electronic resource was statutorily recognized as obligatory for publication of information about public sales and the involved parties were not yet familiar with how the database operates). At the same time, seasonality in the sales of land can be observed, also in the sample (Figure 4).

To the above sample of 160 properties, quarterly classification was applied by the date of auction sale of land for housing construction. The greatest number of transactions in the sample was closed in Q1 (39%), in Q2 there was a decrease to 23%, and in Q3 and Q4 - roughly 19% each (Figure 5).

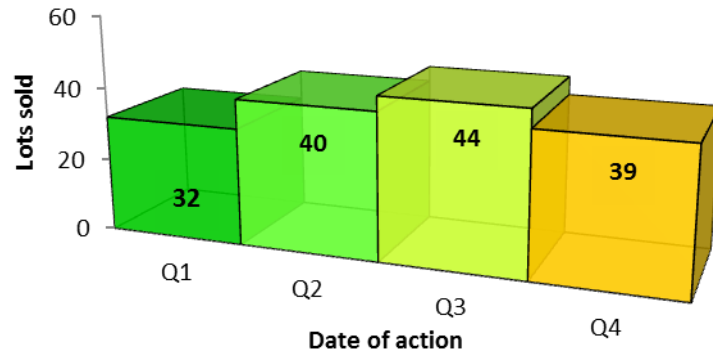
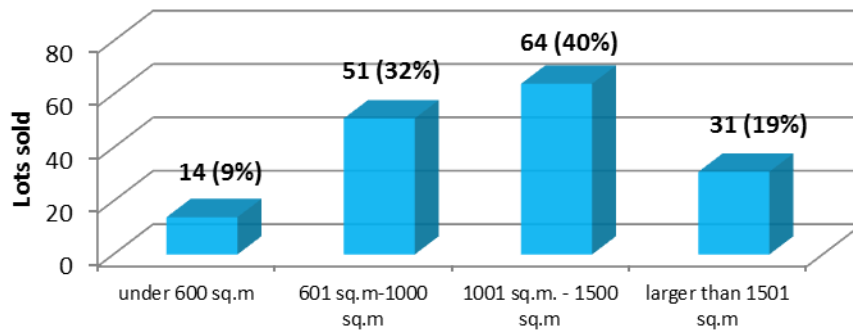
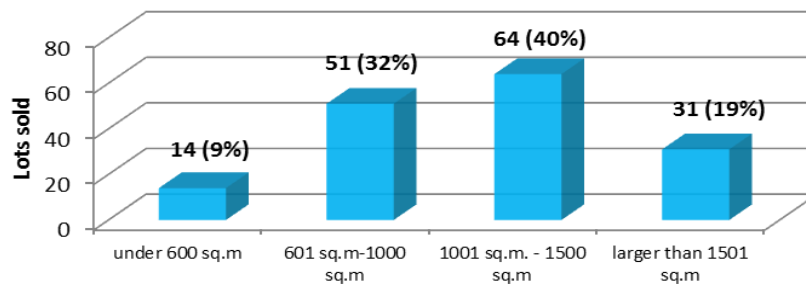


Figure 5 - Quarterly classification by date of the sale of land for housing construction at auction

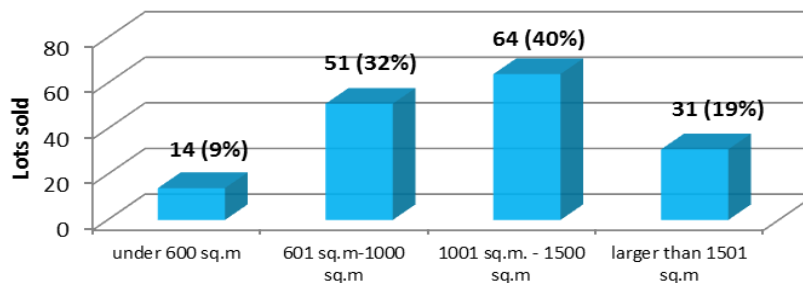
Land plots within the sample were grouped by the area of land sold. 4 groups of land plots were identified, with the highest number of sales in the group of properties with areas from 1,001 sq.m to 1,500 sq.m (40% of the total number of land plots sold) (Figure 6).



Lot group by area



Lot group by area



Lot group by area

Figure

Figure 6 - Analysis of the structure of land sales in terms of area

Most actively land for individual housing construction was sold in the range from 601 sq.m to 1,500 sq.m. When grouping properties within the sample by the number of auction steps, 6 groups of properties were identified.

The highest number of land plots is in the group with 1-3 steps (24% of the total). A more detailed presentation of the breakdown is given in a diagram (Figure 7).

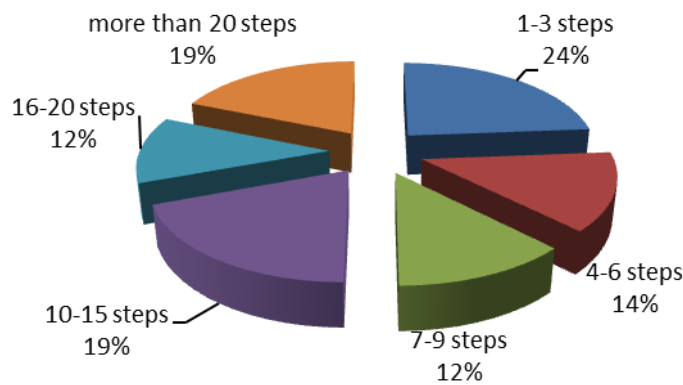
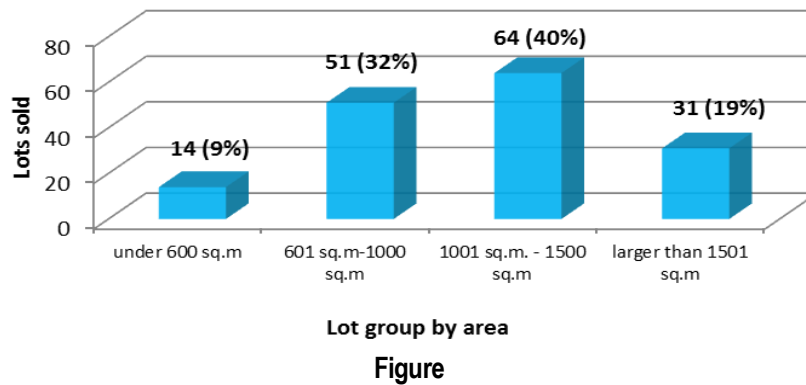


Figure 7 - Analysis of the structure of properties by the number of auction steps

Based on the grouping of land plots within the sample by the number of auction steps made, in each of the six groups the average number of bidders was found (Table 4). There is a clear pattern of distribution of the number of bidders by groups of land plots: the more bidders took part in the auction, the more steps were made. That dependence is described by the same yield theorem in the auction theory. (Vijay 2010)

Table 4 - Grouping of land plots within the sample by the number of auction steps made

Number of auction steps made	Number of land plots in the group	Weight of the group in the total number of land plots, %	Average number of bidders
1-3 steps	38	23,75%	2,21
4-6 steps	22	13,75%	3,50
7-9 steps	20	12,50%	3,65
10-15 steps	31	19,38%	4,81
16-20 steps	19	11,88%	5,79
more than 20 steps	30	18,75%	7,97

The most notable element of the effectiveness of the auctions is the increase of the starting auction price of the land plot. Increase of the starting auction price (Formula 3.6) of the land plot is the relationship of the difference between the auction price of the land and its starting price to the starting price of the land plot, expressed as a percentage.

$$R = \frac{AC-NC}{NC} \times 100\% \tag{3.6}$$

where: R is the increase in the starting auction price of land plot, %; AC is the auction price of the land plot (selling price of the land plot at the auction), RUB; NC is the starting price of the land plot, RUB.

#### 4. Discussion

According to the research conducted, the increase of the starting auction price grows with the number of bidders. To mathematically describe the relationship, the price growth factor was identified, which is a dimensionless value (Formula 4.1):

$$z=(1/e)e^x \quad (4.1)$$

where  $x$  is the serial number of the group, depending on the number of bidders,  $e$  is the mathematical constant.

Increase in the starting auction price (as a percentage) can be expressed by the following formula, which is a mathematical model of the starting auction price growth (Formula 4.2):

$$R=((ez(e+z)+(\ln(1+z)z)/100)*100\% \quad (4.2)$$

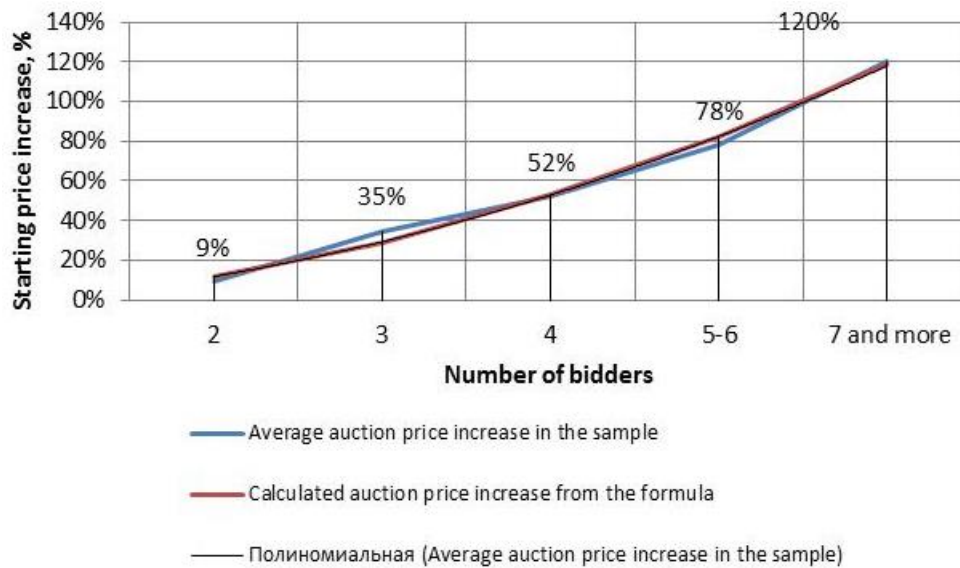


Figure 8 - Analysis of change in the auction price growth of land plots depending on the number of bidders

Based on the research findings, it can be concluded that measures to increase the number of bidders lead to an increase in the auction price growth, which will cause an increase in revenues of municipalities. To this end, a number of measures are proposed to increase the number of bidders: 1) active marketing policy on the part of municipal authorities to inform the public about the conduct of land auctions using mass media and the Internet; 2) study by municipal authorities of the demand for land to allocate for sale through land plots auctions in the territories where individuals are interested in buying them; 3) reducing the starting price when the lot is put on auction for the second time (provided that the previous auction failed due to lack of bidders); 4) simplifying the formation procedure of the land plot for sale by municipal authorities, reducing the time taken by the procedure; 5) where land is sold at auction in undeveloped areas, local infrastructure development is important (utilities, roads, social, recreational, and personal services, etc.); 6) increasing the period from the date of putting the land on auction to the bidding deadline so that as many individuals as possible can learn about the public offer; in addition, the extra time allows those who do not have sufficient funds who at the moment for the purchase of land to resort to credit.

#### Conclusion

Thus, the research contains an update on current situation of the research subject. It was found that the most problematic area of auction sales of land plots to individuals and legal entities is the sale of land plots that are part of residential areas zoned for housing construction, due to the high demand in Russia for affordable housing. The study covers the current situation, characteristics, and development trends of the land market for housing construction and its segment of auction sales at the level of the Russian Federation. The research findings was used by the authors to model the territorial market of land for housing construction, as well as to identify the classification criteria of the municipal market of auction sales and to propose a detailed classification of the auction sales market, leading to the conclusion about the diversity of the market. Methodological proposals were formulated on modeling and forecasting growth functions of the starting auction price according to the theory of auctions in the

context of the municipalities of the Russian Federation and Penza. Measures were proposed to increase the number of bidders in auctions, which will lead to a greater growth of the starting auction price and higher municipal revenues.

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## Market Structure and Banking Sector Performance

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### Abstract:

*The purpose of the paper is to analyse the relations between performance and structure in the banking market. The paper contains a theoretical definition and overview of approaches for competitive hypotheses testing. There have been used several methods to estimate the performance and concentration in the American banking market between 1966 and 2013. The results served as a basis for competitive hypotheses testing. The presence of the Structure-Conduct-Performance hypothesis and Efficient Structure hypothesis was verified by means of an estimate of regression models for panel data. Positive relations between the selected performance indicators and absolute concentration as well as between efficiency and market shares of the analysed banking sectors were estimated.*

**Keywords:** performance, concentration, competitive hypothesis, panel data, US banking sector.

**JEL Classification:** G21, C12, D40.

### 1. Introduction

In the economic system of the country that works in accordance with the principles of market mechanism, there are carry out economic activities of individual entities. One of the conditions for the effective functioning of this system is well functioning financial system. Significant changes that have affected the financial system in recent years have included changes in deregulation, markets globalization and innovation. Especially the process of globalization affects the structure of the financial and banking market, their performance and stability. Therefore, it is very important to focus on analysing the banks performance. The performance of banks must be examined not only as an isolated phenomenon, but it is important to focus on performance evaluation in the context of market structure. Therefore, the aim of this paper was to analyse the relations between the market structure and banking sector performance. The analysis was performed on data for the US banking market within the period 1966-2013. The access only to this type of data is not a limitation of our analytical work, whereas the paper may constitute a form of methodological and analytical process, which in the case of data availability can be applied also in the banking sector of other countries and continents.

To fulfil the objectives, the contribution is divided into two main parts. The content of the first part is the theoretical definition of the relationship between market structure and banking sector performance. In the second part, there is empirically estimated performance and concentration in the American banking market, followed by testing of competing hypothesis between selected variables. One of the benefits of this paper compared to other studies can be considered the simultaneous use of multiple methods for efficiency and concentration measurement and expansion of the group of independent variables. To measure the efficiency there are used two methods: the ratio method and the nonparametric method (Data Envelopment Analysis, DEA). The concentration is measured by using traditional indicator (Herfindahl-Hirschman Index) and also by Hall-Tideman index.

### 2. Literature review and methodology

The concentration of the banking market is widely examined and analysed primarily because of the close relation of competition and business performance of market economies. The basic principle of business activities assumes that conducting of enterprises is dependent on the market structure and market structure, in turn, will influence their conduction.

In the literature, there are two main theoretical approaches describing the relationship between structure and performance in the banking market. The structural approach used two basic hypotheses to define this relationship: Structure-Conduct-Performance (SCP) and Efficient structure (ES) hypothesis.

In the case of SCP hypothesis concentration is measured by indicators of absolute concentration (e.g. concentration indices of the relevant market). SCP hypothesis was for the first time introduced in the work of Mason (1939) and now forms one of the basic approaches for testing of competing hypotheses. This hypothesis is based on the idea that economic performance depends on the conduct of the manufacturers and buyers, while their conduct depends on the structure of the market. Market structure and conduction of the manufacturers and buyers are also influenced by the basic conditions (e.g. economic environment) within they operate. Mason (1939)



identified not only flows from the basic conditions to the structure, conduct and performance but found that there are feedbacks between the parts of the model.

The shift in the SCP theory brought Bain (1959), which allowed empirical test the hypothesis through regression analysis. Since the conduct of producers is difficult to measure, Bain (1959) focused directly on the relationship between performance (of producers) and structure (market concentration). It concludes that fewer firms in the market (more concentrated structure of market supply) leads to less competitive behaviour (in terms of higher prices and restricted output), and less competitive outcome (higher ratio of prices to costs and higher profits at the expense of lower consumer welfare). According to Bain (1959), effective companies in most sectors are consistent with their low or medium market share, while as an indicator of effective behaviour is considered profit.

Second, efficient structure (ES) hypothesis argues that performance of enterprises increases with their size. This means that an increasing market share of enterprises and growing ability to achieve higher profits are linked to the growth of concentration in the relevant market. According to the ES hypothesis, the higher concentration is the logical result of market forces. Therefore, in case of this hypothesis concentration is measured by indicators of relative concentration (e.g. market share of individual firms).

Concentration and hence competition in the banking market is an important factor affecting the effectiveness of provided services, quality of offered products and degree of innovation in the banking sector. Claessens and Leaven (2004) reported that the level of competition in the banking sector also affects the access of businesses and households to financial products and services, what ultimately affects overall economic growth. As well as in other sectors of the economy, an increase in competition should also cause an increase of efficiency and maximize the welfare of the whole economy.

The relatively high concentration of assets in the banking market, in the hands of a small number of banks in most countries, raises the question of whether the banking market is effective, and whether its performance does not just result in revenues achieved at the expense of clients due to monopoly prices. Due to a high concentration in the banking market, banks have undoubtedly favourable conditions, which enable them to establish and maintain a higher interest margin; there occur the allocation of credit as banks have a strong negotiating position. The higher concentration gives an additional incentive for the banks to act in a concerted fashion which can lead to higher margins and higher profits.

The importance of measuring concentration and performance are separately described in works of several authors. Individual authors in their papers used to measure the performance of the banking market by traditional methods or modern methods based on the use of mathematical models, or based on the use of information technologies (e.g. parametric and nonparametric methods) or the Balanced Scorecard method (e.g. Gavurová 2011). On the other hand, market concentration is most frequently measured by the Concentration ratio or Herfindahl-Hirschman index, while the majority of authors use these two indexes simultaneously. Only a small number of authors use other concentration indices (e.g. Hall-Tideman index, Rosenbluth index, or Entropy index).

Only a small amount of works analyses the relationship between these two variables. Analysis of the relationship between concentration and performance in the banking market is driven by an examination of one of the main aims, namely creation of an efficient banking market, which minimizes the probability of bankruptcy. Table 1 provides an overview of the works of selected authors who have focused on examining the relationship between concentration and performance on a local or global banking market. Most of the papers study this topic within a single-country setup. Berger (1995), Kosmidou *et al.* (2005), Athanasoglou *et al.* (2008), Rumler and Waschiczek (2012), Ahamed (2013), Řepková and Stavárek (2013) and Kočíšová (2014) focused their analyses on single countries. On the other hand, the studies of Smirlock (1985), Goldberg and Rai (1996), Grigorian and Manole (2002), Tregenna (2009), Zouhaier (2015) investigated panel data set.

As can be seen, results of these authors led to different conclusions. While in the case Smirlock (1985), Goldberg and Rai (1996), Grigorian and Manole (2006), Kočíšová (2014), the ES hypothesis was confirmed, in the papers prepared by Goldberg and Rai (1996), Kosmidou *et al.* (2005), Tregenna (2009), Rumler and Waschiczek (2012), Ahamed (2013) the SCP hypothesis was confirmed. In the case of Řepková and Stavárek (2013), results are in line with the Quiet Life Hypothesis and the suggestions that the increase of the competition will contribute to efficiency (performance). In the case of Athanasoglou *et al.* (2008) the SCP hypothesis wasn't verified, as the effect of industry concentration on banks' profitability was found insignificant. The empirical results of these studies vary, given the differences in their datasets, time periods, investigated environments, and countries. However, there was found some mutual elements.

Table 1 – Literature review

Author(s)	Sample characteristics	Performance	Concentration	Results of testing
Smirlock (1985)	US banking sector; 1973-1978	ROA, ROE	CR3, MS	ES Hypothesis
Goldberg and Rai (1996)	EU banking sector; 1989-1991	ROE, NIM, CE	HHI, MS	ES Hyp. (ROE, NIM) SCP Hypothesis (CE)
Kosmidou <i>et al.</i> (2005)	Banking sector in United Kingdom; 1995-2002	ROA, NIM	CR5	SCP Hypothesis
Grigorian and Manole (2006)	EU banking sector; 1995-1998	BCC	MS	ES Hypothesis
Athanasoglou <i>et al.</i> (2008)	Greek banking sector; 1985-2001	ROA, ROE	HHI	Rejection of SCP Hypothesis
Tregenna (2009)	US banking sector; 1994-2005	ROA, ROE	CR10, MS	SCP Hypothesis
Rumler and Waschiczek (2012)	Austrian banking sector; 1995-2009	ROA, ROE, NIE	HHI	SCP Hypothesis
Ahamed (2013)	Indian banking sector; 2004-2011	ROA, ROE	HHI, MS	SCP Hypothesis
Řepková and Stavárek (2013)	Czech banking sector; 2001-2010	BCC, CCR	Lerner index	Quiet Life Hypothesis
Kočišová (2014)	Slovak banking sector; 2000-2012	ROA, ROE	CR3, HHI, MS	ES Hypothesis

Notes: BCC/CCR - Pure/Overall technical efficiency measured by DEA model, CE - Cost efficiency measured by SFA model, CR3/5/10 - Concentration ratio for 3/5/10 biggest banks on the market, HHI - Herfindahl-Hirschman index, NIE - Net interest earnings over total assets, NIM - Net interest margin, ROA - Return on assets, ROE - Return on equity

Source: Prepared by author

In recent years, several authors concluded that the relationship between concentration and performance may be modified by specific conditions. Therefore, when examining competition hypothesis, the other variables are added in regression models. Among the most frequent variables used in the analysis belong characteristics of the banking sector and macroeconomic variables. In most studies they used as internal determinants of bank performance e.g. bank size, capital ratio, the cost to income ratio, loan to deposit ratio. The external determinants of bank performance include factors like as the inflation, GDP and interest rates.

In examining the relationship between performance and concentration we use a model presented in works of Smirlock (1985) and Lloyd-Williams *et al.* (1994). The proposed model (1) is used to test competing hypothesis to verify the presence of the SCP and ES hypotheses. Since the model contains a relatively high number of independent variables the linear regression is applied. The general form of proposed model can be expressed as follows:

$$\pi = \beta_0 + \beta_1 CR + \beta_2 MS + \sum_{j=1}^s \alpha_j X_j + \sum_{m=1}^r \sigma_m X_m + \mu \quad (1)$$

where  $\pi$  is an indicator of the banking sector performance,  $CR$  is an indicator of absolute concentration,  $MS$  is an indicator of relative concentration,  $X_j$  denotes banking sector specific variables,  $X_m$  denotes macroeconomic variables and  $\mu$  is an error term.

The positive and significant coefficient  $\beta_1$  confirms the SCP hypothesis. In the case of positive and significant coefficient  $\beta_2$ , the ES hypothesis is confirmed. Both competing hypotheses explain the positive relationship between performance and concentration. According to Rumler and Waschiczek (2012), based on the SCP hypothesis higher concentration reduces competition by fostering collusive behaviour among firms and whether higher concentrated market improves market performance as a whole. In a market with a high degree of concentration, firms have more market power which allows them to set prices above marginal costs and achieve higher profitability. The ES hypothesis also assumes the existence of a positive relationship between concentration and profitability. This is a result of the fact that more efficient firms achieve higher market shares at the expense of smaller and less efficient, which brings the growth of profitability with increasing concentration.

### 3. Empirical analysis

The aim of the paper is to estimate the relationship between concentration and performance in the US banking industry. The dataset used in this paper was obtained from the Federal Deposit Insurance Corporation (FDIC 2014), which publishes data on the development of the US banking market since 1966. From the set of all published data have been chosen adequately variables, development of which was followed by one in 50 US states, as well as summaries for the entire US banking market from 1966 to 2013. Data on the overall macroeconomic development in the USA have been drawn from the website of the Federal Reserve Bank of St. Louis (FRED 2014).

The performance of banking sector can be measured by different methods. The indicator of banking sector performance is represented by two alternative measures: the ratio of profits to cost, i.e. return on costs (ROC) and cost efficiency (CE) measured by the method of Data Enveloped Analysis (DEA). DEA can be used to measure pure and overall technical efficiency, or to measure allocative efficiency in the form of cost, revenue or profit efficiency. The methodology of efficiency measurement in our banking sector is described in works of Palečková (2015), Boďa and Zimková (2015). In our paper, we decide to use so-called intermediation approach to defining input and output variables. We consider three inputs, namely, total deposits, the number of employees and fixed assets. Each of these inputs generates costs, referred to total interest expenses, personnel expenses, and other operating expenses. Therefore, we can easily calculate prices for each input as a ratio of relevant cost to selected input. On the output side, we consider two types of outputs: total loans and other earnings assets, which refer to non-lending activities. The income generated by first output is interest income, so the output price is defined as the ratio of interest income to the value of loans. The second output generates other interest income; therefore, consider the price of this output as the ratio of other interest income to other earning assets.

As the aim of the paper is to estimate the relationship between concentration and performance in the US banking market, the other analysed variables were indicators of absolute concentration. As the indicators of absolute concentration, we used the Herfindahl-Hirschman index (*HHI*) and Hall-Tideman index (*HTI*). The above indicators were calculated and analysed on three sub-markets: the market of total assets (*TA*), loans (*TL*) and deposits (*TD*). Herfindahl-Hirschman index is a standard accepted methodology for evaluating the absolute concentration. As defined by US Department of Justice adjusted index values can be interpreted as follows (NBS 2013): the value of *HHI* below 1000 shows a very low concentration, in the range 1000–1800 shows a moderate concentration, value of *HHI* above 1800 shows a very high concentration of the banking system, whereas the index value equals to 10000 shows a full concentration. Hall and Tideman (1967) bring forward a number of properties which concentration indices should satisfy. They emphasize the need to include the number of banks in the calculation of a concentration index because it reflects some extent the conditions of entry into a particular industry. In their work was suggested the so-called Hall-Tideman index which ranges between zero and unity, being close to zero far an infinite number of equal-sized banks, and reaching unity in the case of monopoly. The lower value of the *HTI* thus indicates a lower market concentration which creates a more competitive environment in the market. On the other hand, growth in the *HTI* value indicates a higher concentration which reduces the competitive environment in the market.

To examine the ES hypothesis, we use the market share (*MS*) of banking sectors in the US banking market as the next independent variable in the model. The market share, as the indicator of relative concentration, was calculated and analysed on three sub-markets: the market of total assets, loans, and deposits.

The next variables in regression model represent banking sector specific variables and macroeconomic variables. After the literature review, we decide to use following banking sector specific variables: size, capitalisation, quality of assets, liquidity, stability, profitability and operational efficiency. The following macroeconomic variables were used: economic growth, inflation and interest rate spread. Table 2 lists the variables used in this study and they expected effect on the banking sector performance.

The size of the banking sector was measured by the logarithm of total assets because it was necessary to eliminate size effects. Generally, the effect of growing size on performance has been proved to be positive. For example, Tregenna (2009), Ahamed (2013), Raphael (2013) spoke about the positive relationship. According to them, larger banks have a better diversification of products and services compared to small banks, allowing them to achieve benefits in terms of economies of scale.

To measure capitalisation of banking sector there was used the ratio of equity to assets. In general, we assume that banking sectors with higher capital ratio are safer. To determine a relationship in case of this variable is not entirely clear. One point of view is that capital ratio is expected to have a positive sign since it is assumed that banks are predicted to be rewarded with additional revenues for holding the optimal amount of capital. The second point of view says that capital ratio is expected to have a negative sign since it is assumed that banks which

hold higher value of capital cannot provide these funds in the form of loans and this way reduce the value of potential interest income.

The third explanatory variable is the share of non-performing loans on total loans. According to Berger (1995), we expected the negative relationship to banking sector performance which confirms so-called bad management hypothesis. According to this hypothesis, bad managers don't control adequately operating expenses and poorly manage loan portfolio, so this can cause low performance and a greater amount of problematic loans.

The next variables involved in analysis are indicators of short-term and long-term liquidity. In the case of long-term liquidity, we expect a negative impact on banking sector performance, in the case of short-term liquidity we expect a positive impact on banking sector performance.

As the indicator of stability was used the ratio of total loans to total deposits. Loan to deposit ratio captures the credit creation by banking sectors. Loans of banks are expected to generate profit and to be the main source of income; therefore, we expected a positive impact on banking sector performance.

The last independent variable describing banking sector was an indicator of operating efficiency measured by so-called cost to income ratio. The cost to income ratio represents the share of operating costs to operating income. This indicator tells us what percentage of the operating income the banks use for its operation. The decreasing value of this indicator suggests that banks use their resources rationally and effectively, therefore we expect a negative relationship between the performance and the cost-to-income ratio.

In addition to the banking sector, specific variables the analysis included a set of macroeconomic variables. GDP growth rate reflects the conditions of the economy. We assume that the growing economy will provide a growing demand for banking services and lower risk; therefore, it is expected positive relation with banking sector performance. The effect of inflation on the banking sector performance depends on whether wages and other operating expenses increase at a faster rate than the inflation. If inflation is not anticipated and banks don't adjust their interest rates correctly, there is the possibility that costs may increase faster than revenues and hence affect bank profitability negatively. Therefore, it is not possible to identify the expected effect on banking sector performance. Also in the case of the interest rate spread the expected effect wasn't defined.

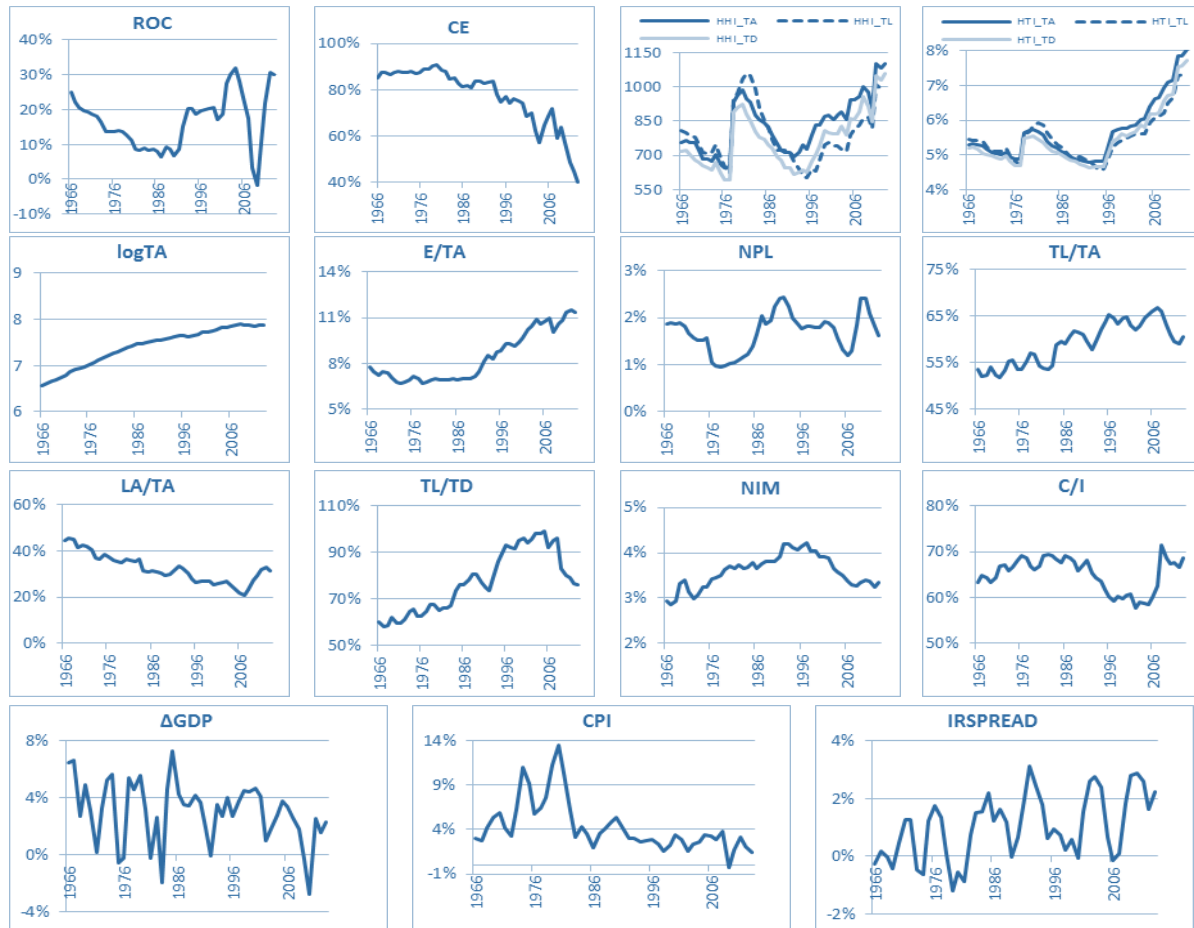
Table 2 – Definitions, notation and the expected effect of the explanatory variables of model (1) on banking sector performance

VARIABLE	MEASURE	NOTATION	Expected Effect
Dependent variable Performance	Return on costs Cost efficiency	ROC CE	
Concentration Absolute concentration	Herfindahl-Hirschman index	HHI	?
Relative concentration	Hall-Tideman index Market share	HTI MS	? ?
Banking sector specific variables Size	Total assets in logs	logTA	Positive
Capitalisation	Equity/assets	E/TA	?
Quality of assets	Non-performing loans/total loans	NPL	Negative
Long-term liquidity	Total loans/total assets	TL/TA	Negative
Short-term liquidity	Liquid assets/total assets	LA/TA	Positive
Stability	Total loans/total deposits	TL/TD	Positive
Profitability	Net interest margin	NIM	Positive
Operational efficiency	Cost to income ratio	C/I	Negative
Macroeconomic variables Economic growth	Growth rate of GDP	$\Delta$ GDP	Positive
Inflation	Rate of inflation	CPI	?
Interest rate spread	Spread between long-term and short-term interest rate	IRSPREAD	?

Source: Prepared by author

Figure 1 displays the development of analysed variables during the selected period. The graphic development of performance shows that at the beginning of the analysed period the both indicators had the same tendency. ROC of the US banking sector was positive through the whole period, except in 2009. As we know achieving losses in the US banking market in 2009 was a consequence of the crisis, which gradually began to affect

banking sector since 2004. Since that year (2004) the *ROC* was also affected by this trend as proved by a sharp decline in the average values. Declining performance and ultimately unprofitability of banking market was probably influenced by the need to create adjustments to previously issued loans, which due to rising interest rates became more expensive and led to a growing inability their repayment. Provisioning, but also a shortfall in interest income reflected a decline of profit making in the US banking market. When we look at cost efficiency we can see, that the value of *CE* decreased over the whole period. While at the beginning the *CE* reached its maximum, at the end of the analysed period reached its minimum.



Source: Prepared by author

Figure 1 – Development of the variables of model (1) in US banking sector

Based on the classification of HHI the market of assets, loans, and deposits could be during the analysed period considered as low concentrated. Only at the end of the analysed period (and also on the loan market between the years 1980-1982) the *HHI* exceeded the 1000 points, indicating that the banking market could be considered as the moderate concentrated. At the beginning of the analysed period, the development can be regarded as relatively stable until 1978 when there was a significant growth of values. Between the years 1980-1995 can be seen improvement in the competitive environment and consequently increase concentration from 1995 until the end of the analysed period which indicates a decline in the quality of the competitive environment.

According to the graphic representation of the US banking sector characteristics, we can see that during the analysed period the size of banking sector increased. In term of capitalisation can be seen a relatively stable development at the beginning, which was followed by growth since 1990. The quality of assets indicates great volatility. When we compare the value of *NPL* at the beginning and at the end of analysed period we would find that the difference between the values is only 0.22 percentage points. However, during the period, the quality of assets changed significantly. The minimum value of *NPL* signalling the highest quality of assets was recorded in 1978, the maximum value signalling the worst quality in 1992, which represents a decline in the quality of assets by 158%. Indicators of long-term and short-term liquidity signalise a gradual decline in liquidity, with a significant fall in case of short-term liquidity. Stability of the US banking sector increased gradually since 1966, where the growth

was interrupted by a significant decline in 2009. Development of profitability indicators and operational efficiency can be regarded as stable, signalling deterioration in the banking sector during the crisis.

The macroeconomic development signals the cyclical development of the economy. High GDP growth rates were followed by a slowdown. In crisis years, the growth rate even reached a negative value. Also, inflation rate indicates the minimum value in 2009. The development of interest rate spread can be considered as cyclic.

A key feature of the time series is stationarity tested through Maddal-Wu unit root test for panel data (theoretical definition, see Baltagi (2005). According to Výrost *et al.* (2013), nonstationary time series could indicate some problems in the processing of data and can lead to false regression. The results of Maddal-Wu test on the 0.05 level of significance pointed to no stationarity in the case of *HHI* on assets and deposit market and in the case of *HTI* on assets and loan market. As there is a high correlation between the absolute concentration indicators, we decide to exclude variables for which the assumption of stationarity wasn't followed.

The present study uses a standard methodology for panel data. According to Želinský (2013), the model must be tested whether there are individual of time effects (Lagrange Multiplier Test), cross-sectional dependence (Pesaran test), serial correlation (Breusch-Godfrey test), autocorrelation (Durbin-Watson test for panel data) and heteroscedasticity (Breusch-Pagan test). According to the results of Chow test we decide to use the structure of panel data. Then we choose a model with fixed effects in accordance with Hausman test results. All calculations were made in the R software (R Core Team 2012).

Table 3 reports the empirical results of the estimation of the model (1) using *ROC* or *CE* as the performance variables. According to the Adjusted  $R^2$ , we could see that the models as a whole are statistically significant and explain 56.71%-64.24% of the variability. As the best model can be considered the model with explanatory variables *HTI* and *MS* on the deposit market.

Results also indicate that the models have violated a number of assumptions (cross-sectional dependence, serial correlation, and heteroscedasticity). Therefore, the interpretation of the regression coefficients is based on the results of the robust variance-covariance matrix (shown at the right of each column).

The results showed that the variable describes the absolute concentration on the American banking market was identified as significant in three models, but regression coefficient reached positive value only in *ROC.2* model. The coefficient of the *HTI\_TD* was positive and statistically significant confirming the validity of the SCP hypothesis. A more concentrated market can lead to lower costs in the collusive behaviour among firms, which can reflect in higher profits for all participants on US banking market. Rising profits at lower costs reflected in the rising of *ROC*. Models *CE.1* and *CE.2* didn't confirm the presence of SCP hypothesis. The regression coefficients were identified as statistically significant, but their values were negative, which is contrary to the SCP hypothesis. In these models, higher cost efficiency was associated with lower concentration which indicates a better competitive environment in the US banking market.

The variable market share on the deposit and loan market was identified as significant in all models. The values of regression coefficients were positive, confirming the ES hypothesis. With the increasing market share of banking sector also increased its *ROC* and cost efficiency.

In the model *ROC.1*, *ROC.2* and *CE.1* estimated through robust variance-covariance matrix the significant impact of banking sector size was confirmed. The coefficient was negative suggesting that with the increasing size of banking sector its performance declined. This finding is contrary to the findings of other authors (e.g. Tregenna 2009, Ahamed 2013, Raphael 2013) who spoke about the positive relationship. According to them, larger banks have a better diversification of products and services compared to small banks, allowing them to achieve benefits in terms of economies of scale.

The estimated coefficients on operational efficiency and quality of assets were significant and negative in all models. When the value of *NPL* decreased, the quality of assets increased, which was followed by the growth of the *ROC* and *CE*. This confirmed so-called "bad management" hypothesis. Bad management hypothesis states that non-performing loans increase due to poor management practices in the form of poor loan underwriting, monitoring, and control, and thereby banks become inefficient. The negative impact of assets' quality on bank performance can be also seen in works of Athanasoglou *et al.* (2008) and Ahamed (2013). The variable *C/I* describing operational efficiency had a negative impact on banking sector performance. The lower ratio was related to lower costs (higher operational efficiency) which had a positive impact on performance measured by *ROC* and *CE*.

Table 3 – Regression models

	Model ROC.1		Model ROC.2		Model CE.1		Model CE.2	
HHI_TL	2.37e-5*** (1.31e-5)	(1.91e-5)			-0.0002*** (0.0001)	*** (0.0001)		
HTI_TD			2.3063*** (0.2624)	*** (0.5300)			-9.4584*** (0.4150)	*** (0.9037)
MS_TL	0.505*** (0.0865)	** (0.240)			2.1191*** (0.1455)	*** (0.5413)		
MS_TD			0.6913*** (0.0910)	*** (0.2288)			2.0360*** (0.1439)	*** (0.5073)
logTA	-0.0251*** (0.0057)	** (0.0107)	-0.0467*** (0.0056)	*** (0.0109)	-0.0470*** (0.0093)	* (0.0274)	0.0012 (0.0089)	(0.0298)
E/TA	1.9440*** (0.0929)	*** (0.408)	1.4592*** (0.1062)	*** (0.4588)	-3.2738*** (0.1564)	*** (0.3841)	-1.5041*** (0.1679)	*** (0.2924)
NPL	-3.6149*** (0.234)	*** (0.471)	-3.4195*** (0.2273)	*** (0.4506)	-1.2369*** (0.3951)	** (0.6169)	-1.1455*** (0.3595)	** (0.4940)
TL/TA	0.126*** (0.0445)		0.0641 (0.0451)		-1.1408*** (0.0748)	*** (0.2067)	-0.6942*** (0.0713)	*** (0.1758)
LA/TA	0.461*** (0.0478)	*** (0.116)	0.3768*** (0.0478)	*** (0.1129)	-0.1469* (0.0804)		0.2151*** (0.0757)	(0.1783)
TL/TD	0.0240*** (0.0083)		0.0238*** (0.0081)		0.1925*** (0.0139)	*** (0.0434)	0.1961*** (0.0129)	*** (0.0374)
NIM	0.341 (0.277)		1.1608*** (0.2853)	** (0.5404)	2.2064*** (0.4669)	** (1.0182)	-0.5938 (0.4512)	(1.1678)
C/I	-0.915*** (0.0238)	*** (0.0509)	-0.9542*** (0.0230)	*** (0.0516)	-0.3804*** (0.0400)	*** (0.1143)	-0.3293*** (0.0364)	** (0.1049)
ΔGDP	0.401*** (0.0781)	*** (0.0653)	0.5005*** (0.0767)	*** (0.0532)	-0.0765 (0.1314)		-0.3006** (0.1213)	*** (0.0875)
CPI	-0.215*** (0.0758)	* (0.111)	-0.2645*** (0.0724)	** (0.1214)	0.6972*** (0.1276)	*** (0.1532)	0.6040*** (0.1145)	*** (0.1700)
IRSPREAD	1.0102*** (0.191)	*** (0.197)	1.2087*** (0.1871)	*** (0.1761)	-1.8387*** (0.3227)	*** (0.2670)	-1.8875*** (0.2959)	*** (0.2369)
R <sup>2</sup>	0.6291		0.6424		0.5671		0.63112	
Adj. R <sup>2</sup>	0.61258		0.62554		0.5522		0.61455	
Sample size	n=50, T=48, N=2400		n=50, T=48, N=2400		n=50, T=48, N=2400		n=50, T=48, N=2400	
Individual effects	3.8989 (0.000)		3.7513 (0.000)		20.7211 (0.000)		24.0875 (0.000)	
Time effects	46.1758 (0.000)		42.5704 (0.000)		15.0175 (0.000)		8.0595 (0.000)	
Cross-sectional dependence	96.1866 (0.000)		100.1831 (0.000)		50.0124 (0.000)		38.9641 (0.000)	
Serial correlation	1284.765 (0.000)		1249.187 (0.000)		1572.833 (0.000)		1506.357 (0.000)	
Heteroscedasticity	302.7865 (0.000)		240.2521 (0.000)		441.7195 (0.000)		359.0925 (0.000)	
Autocorrelation	0.6917 (0.7604)		0.714 (0.7604)		0.4221 (0.7604)		0.4444 (0.7604)	

Note: Indication of significance levels: (\*) 0.1 (\*\*) 0.05 (\*\*\*) 0.01

Source: Prepared by author

In the case of capitalisation and short-term liquidity, the positive significant impact on return on cost was found out. The model ROC.2 (and also CE.1) confirmed the positive significant impact even at the profitability of the banking sector. The positive value of *E/TA* suggests that well-capitalised banking sectors were rewarded for holding the optimal amount of capital in the form of additional revenues, which was reflected in the growth of their profitability and, consequently, in the growth of their efficiency measured by *ROC*. It signals, that better-capitalised banking sectors were safer compared to those with lower capital ratios and might face lower costs of funding due to lower prospective bankruptcy costs. It is in line with works of Grigorian and Manole (2006), Kosmidou

*et al.* (2005), Athanasoglou *et al.* (2008) and Raphael (2013). In the case of cost efficiency, the variable  $E/TA$  had significant but negative impact on  $CE$ . This is in line with the study of Tregenna (2009) and Ahamed (2013), who suggested that higher equity capital restraint banks pursue risky investment ensuring lower profits.

The growing value of  $LA/TA$  signals the greater ability of the banking market to absorb liquidity shocks, assuming that market liquidity is the same for all participants on the analysed market. In the case of American banking market, the higher value of  $LA/TA$  was associated with the higher value of  $ROC$ .

The statistically significant variable in the models  $CE.1$  and  $CE.2$  was also variable describing the long-term liquidity ( $TL/TA$ ), with the negative impact on the cost efficiency. This indicator can be also used to measure the degree of specialisation in the banking sector. A higher value indicates that the banking sector invested more in the form of loans, it means it is more focused on transactions with clients. A higher degree of specialisation can be associated with higher liquidity risk, as the banks hold a greater part of their assets in the form of illiquid assets. The unexpected requirement to cover volatile liabilities may lead to a situation when a bank will be unable to meet its obligations, which may prove in the form of lower performance. A negative coefficient indicates that the banking markets with a lower share of loans in their portfolio achieved higher cost efficiency. The same findings of the negative impact of the share of loans to assets on the performance of banks can be seen in works of Goldberg and Rai (1996), Hassan and Bashir (2003), Rumler and Waschiczek (2012) and Ahamed (2013).

Statistically, significant variable with a positive impact on performance was the loan to deposit ratio, which can be used to analyse how the banking sector is able to finance the loans from the received deposits, namely from stable domestic sources. If the value of  $TL/TD$  increased, the banking sector was able to fund its loans from received deposits, which minimise the risk of dependence on unstable sources from abroad. This was reflected in the growth of cost efficiency.

If we look at a group of macroeconomic variables, we can see that in the case of GDP growth, the value of coefficient was positive and statistically significant in model  $ROC.1$  and  $ROC.2$ . A positive coefficient indicates that a higher rate of growth was reflected in a higher performance of banking market. The positive relationship between GDP growth and performance of banking market is also evident in the works of Hassan and Bashir (2003), Kosmidou *et al.* (2005), Prutean-Podpiera *et al.* (2007, 2008), and Rumler and Waschiczek (2012).

In the case of interest rate spread, the value of regression coefficient was positive and significant in models  $ROC.1$  and  $ROC.2$ , and negative and significant in models  $CE.1$  and  $CE.2$ . Rising interest rate spread was positively affected by the increase in long-term interest rates and keeping short-term interest rates at low levels. During the analysed period, the US banking sector primarily reduced the share of liquid assets to the detriment of long-term assets (mainly loans). Rising interest rate spread may thus be positively reflected in the growth of interest income resulting from long-term investment, which could have a positive impact on the overall profit of the banking market, as well as to return on costs. In the case of cost efficiency, the rising interest rate spread led to a decrease in cost efficiency. Due to changes in interest rates, there was created the space for achieving cost saving at an optimal combination of the use of inputs, outputs and taking into account their prices. In the case of inflation there was found out negative impact on return on costs, what is in line with the study of Prutean-Podpiera *et al.* (2007, 2008) realised on Czech banking market. The positive impact of inflation on cost efficiency is in line with the study of Kočišová (2014) realised on Slovak banking market. The positive value of the coefficient of inflation suggests that bank managers have been able to predict the evolution of inflation and take into account this information when adjusting interest rates, and these changes had a positive influence on the growth of cost efficiency.

The values of the estimated regression coefficients may also serve to assess the significance of the considered variables. The highest absolute value of the regression coefficient in model  $ROC.1$  and  $ROC.2$  was in the case of variable  $NPL$ . It means, that the increase of  $NPL$  by one percentage point led to a decrease in  $ROC$  of 3.6149 (respectively 3.4195) percentage points. The second variable with the highest value of regression coefficient was absolute concentration on deposit market measured by Hall-Tideman index. The increase of  $HTL\_TD$  by one percentage point led to an increase in  $ROC$  of 2.3063 percentage points. The third variable with the highest value of regression coefficient was capitalisation. The growth of  $E/TA$  by one percentage point led to an increase in  $ROC$  of 1.944 (respectively 1.4592) percentage points. On the other hand, the lowest absolute value of regression coefficient was found in the case of the size. The increase of  $logTA$  by one percentage point led to a decrease in  $ROC$  of 0.0251 (respectively 0.0467) percentage points. In models where the depended variable was cost efficiency, was the variable with the highest impact on  $CE$  identified capitalisation. The increase of  $E/TA$  by one percentage point led to a decrease in  $CE$  of 3.2738 (in model  $CE.1$ ) percentage points. The second variable with the highest value of regression coefficient was profitability. The growth of  $NIM$  by one percentage point led to an increase in  $CE$  of 2.2064 percentage points. As well as in  $ROC$  models, in  $CE.1$  model the lowest absolute value



of regression coefficient was assigned to size. Its ( $\log TA$ ) growth by a percentage point led to a decrease in  $CE$  of 0.047 percentage points.

View on the variability of the variables expressed by the standard deviation (and partly in Figure 1) indicates that the deviation from the average values is quite different. While for some variables the change by one percentage point is improbable, at other the probability of change is very high. Therefore, when assessing the impact of the variables in the linear model it is not necessary to assess not only its significance but also the practical impact of variables, taking into account their variability.

Based on the results of testing competing hypothesis we can see, that the higher concentration on the US banking market had a positive impact on the costs and on the profits of American banking market. Confirmation of SCP hypothesis in the case of return on costs, therefore, suggests that more concentrated banking market had a positive impact on the reduction of costs and increase of profits in the whole banking sector. Confirmation of ES hypothesis in the case of return on costs and cost efficiency could suggest that the increasing market share of the banking sector was linked to growth in profitability and decrease in costs of banking markets with the highest market shares.

## Conclusion

The aim of the paper was to estimate the relationship between concentration and performance in the US banking industry. By testing the competing hypotheses there was found a positive relationship between performance (ROC) and concentration, confirming the validity of SCP hypothesis in the American banking market. The positive relationship was also confirmed between the performance and market shares of banking sectors, confirming the validity of ES hypothesis. The higher concentration on the deposit market was linked to higher performance. Decreasing competition enable banks to maintain a stable position on the market. In the case of dominant players, the stable positions on the market allow them to influence the level of interest rates, which ultimately could lead to an increase in interest income, to a decrease in interest expenses and consequently to an increase in net profit of banks. Higher profit and lower costs were reflected in better return on costs, indicating better performance of banking market. On the other hand, we could say that the growing competition in the market increased the migration of clients, reducing the duration of the relationship between the bank and the client. Bank customers go to the competition, which is able to offer higher interest rates on deposit products, respectively lower interest rates for their credit products. It forced other banks in a competitive environment to adapt to these conditions by reducing interest rates on the asset side, and rising interest rates on the liabilities side, which in turn led to lower profits and to a decline in performance.

In contrast to the above findings are the results in the case of cost efficiency, where the results have shown the existence of the significant relationship, but the sign of the estimated coefficient signalled the existence of a negative relationship. This is in line with "quiet life hypothesis" presented by Hicks (1935). According to Hick's "quiet life hypothesis" firms with higher market power put less effort in pursuing cost efficiency: instead of taking advantage of their favourable position by cutting cost so as to gain higher profits, they prefer to enjoy a "quiet life". On the other hand, the competitive environment prevents managers to enjoy a "quiet life", forcing them to constantly look for opportunities to strengthen its market position, which reflects the growth of performance. The argument of a negative relationship between concentration and performance can be found in the work of Leibenstein (1966), who shown that the main factor for performance growth is the growth of competitive pressures leading to a decline in market concentration. Lower concentrations and thus higher competition lead managers to efforts to improve the performance of the company to prevent the crowding out from the market. The higher number of firms in the market allows for business owners to compare their performance with comparable market players. In the case that performance is not at the level required by the owners, it can lead to changes in management. It motivates managers to achieve increasingly better performance indicators in order to maintain a fixed position in the prosperous company. This finding is in line with work of Prutean-Podpier *et al.* (2007, 2008) suggesting a negative relationship between performance and concentration on the Czech banking market.

In recent years, several authors concluded that the relationship between concentration and performance may be modified by specific conditions. Therefore, when examining competition hypothesis, the other variables were added in regression models. The test results on the US banking market led to the conclusion that it is not possible to clearly identify the factors with a statistically significant positive or negative impact on banking sector performance. While in the case of ROC the variable capitalisation had a positive impact on performance, in the case of CE there was found a negative impact. A different impact was found out also in the case of macroeconomic variables. The exceptions are indicators of assets' quality, size, profitability, and operational efficiency of the banking sector, which show the same direction of impact in both performance indicators.

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## A Review of the State-of-the-Art Research on the Twin Deficit Hypothesis

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### Abstract:

*The aim of this paper is to find the most important patterns in published papers on the twin deficits. The research methodology includes text-mining analysis covering all the relevant Research Papers in Economics (RePEc) works. It turned out that Ricardian equivalence and the Mundell-Fleming approach dominate twin deficit research, especially in developed countries. The current account targeting hypothesis and bi-directional causality are confirmed mainly in developing countries. As regards the methodology, the most used are cointegration techniques and Granger causality testing. The percentage of papers proving Ricardian equivalence did not change during the analysed period, while the percentage of those confirming the Mundell-Fleming model decreased when using more recent data.*

**Keywords:** twin deficit, text mining, Granger causality, Ricardian equivalence, current account targeting, Mundell-Fleming model.

**JEL Classification:** E62, F41, H62.

### 1. Introduction

The instability of the world economic system is frequently discussed. The US financial and economic crisis touched the rest of the world; in particular, the national economies were exposed to persistent current account or public deficits. The idea explaining the co-existence of the two kinds of deficits is known as the twin deficit (TD) hypothesis. The first mention of the interdependence between the budget and the current account deficit appeared in the 1980s, but in recent decades, a considerable number of papers have provided evidence of various forms of the current account vs. budget deficit relation. However, the evidence often brings ambiguous and even contradictory results. Hence, our objective is to find and analyse the most important patterns (from the point of view of results, variables, methodology, etc.) in the chosen papers on twin deficits. For that purpose, text-mining analysis with clustering is performed. Subsequently, the research is complemented by the analysis of the content of 50 highly qualified papers. They are classified according to countries, variables included, methodology, periods and results achieved.

### 2. The theoretical approach to twin deficits

First, the existence of twin deficits is explained by traditional macroeconomic models: the Mundell-Fleming model (Fleming 1962, Mundell 1963) and Keynesian absorption theory. They both explain the causality running from the budget deficit to the current account deficit. Secondly, Barro-Ricardian equivalence (Barro 1989) states that a budget deficit increase has no effect on the current account deficit. Third, according to the current account targeting hypothesis - CATH (Summers 1988), although there is a positive mutual relation between the two deficits, the causality runs from the current account deficit to the budget deficit.

#### 2.1 The Mundell-Fleming model and the Keynesian theory of absorption

Traditionally, the short-run relationship between the two deficits is expressed by the Mundell-Fleming model (Fleming 1962, Mundell 1963), i.e. the so-called IS-LM-BP model. The model is defined by three log-linear equations (Hairault *et al.* 2000, Wickens 2010): the IS curve (the relation between the domestic product ( $y$ ) and the real interest rates ( $r$ ) that brings the market of goods and services to the equilibrium), the LM curve (the  $y - r$  curve, i.e. the money market equilibrium relations) and the BP curve (representing each combination of domestic product and interest rate that corresponds to the balance of payments equilibrium, i.e.  $f = 0$ ).

$$IS: \quad y = \alpha(s + p^* - p) - \beta R + \gamma g + \delta y^* \quad (2.1)$$

$$LM: \quad m = p + y - \lambda R \quad (2.2)$$

$$BP: f = \theta(s + p^* - p) - \varphi y + v y^* + \mu(R - R^* - \hat{s}) \quad (2.3)$$

where:  $y$  = domestic product (in logarithm);

$s$  = nominal exchange rate (in logarithm)<sup>2</sup>;

$p^*$  = foreign price level (in logarithm);

$p$  = domestic price level (in logarithm);

$R$  = domestic nominal interest rate ( $r = R$ , as inflation is supposed to be zero);

$g$  = exogenous government spending (in logarithm);

$y^*$  = world product (in logarithm);

$m$  = money supply (in logarithm);

$R^*$  = foreign nominal interest rate,

$\hat{s}$  = anticipated variation of nominal exchange rate (in logarithm);

$s + p^* - p$  = real exchange rate (in logarithm);

$\theta(s + p^* - p) - \varphi y + v y^*$  in BP equation determines the level of the current account;

$\mu(R - R^* - \hat{s})$  in BP equation determines the capital account;

$f$  = balance of payments;  $\alpha, \beta, \gamma, \delta, \lambda, \theta, \mu, \varphi$  and  $v$  are parameters, all strictly positive.

Here, an expansionary fiscal policy (an increase in  $g$  by  $\Delta g$ ), which raises the budget deficit, leads to a new equilibrium characterised by a higher domestic product ( $y_2 > y$ ) and higher interest rates ( $R_2 > R$ ). The real exchange rate is supposed to be constant at the moment.

$$IS: y_2 = \alpha(s + p^* - p) - \beta R_2 + \gamma(g + \Delta g) + \delta y^* \quad (2.4)$$

$$LM: m = p + y_2 - \lambda R_2 \quad (2.5)$$

$$BP: f = \theta(s + p^* - p) - \varphi y_2 + v y^* + \mu(R_2 - R^* - \hat{s}) \quad (2.6)$$

Consequently, a higher domestic product ( $y_2$ ) and a higher interest rate ( $R_2$ ) are followed by a change in the balance of payments ( $f$ ) (see the BP equation). Under the condition of high capital mobility, an increase in the domestic interest rates ( $R_2 > R$ ) induces an increase in the capital inflows and capital account surplus, i.e.  $\mu(R_2 - R^* - \hat{s}) > 0$  in the BP equation. This leads to a global balance of payments surplus ( $f > 0$ ). In the regime of flexible exchange rates, it consequently implies real exchange rate ( $s + p^* - p$ ) appreciation (i.e.  $s + p^* - p$  needs to be diminished in order to adjust the balance of payments to  $f = 0$ ).

The appreciated domestic currency decreases the competitiveness of domestic products on foreign markets, which deteriorates the current account balance ( $\theta(s + p^* - p) - \varphi y + v y^* < 0$ ) in the BP equation. Finally, a simultaneous budget deficit (induced by the increase in  $g$  by  $\Delta g$ , see the IS equation) and current account deficit ( $\theta(s + p^* - p) - \varphi y + v y^* < 0$ , see the BP equation) are observed; the causality runs from the budget deficit to the current account deficit (Salvatore 2006, Wickens 2010).

The Keynesian theory of absorption (Alexander 1952) states that an expansionary fiscal policy (i.e. a budget deficit increase) imposes a domestic demand increase. The higher domestic demand also includes imports that deteriorate the external balance. Then, the causality has the same direction as in the case of the Mundell-Fleming model.

## 2.2 Barro-Ricardian equivalence

Barro (1974; 1989) offers a completely different view on the relation between the budget and the current account deficit by explaining the so-called Ricardian equivalence theorem (Ricardo 1951). He states that an expansionary fiscal policy increasing the budget deficit will not affect the aggregate domestic demand. While government spending rises, consumers reflect the increasing public debt and higher future taxes in their expectations and consume less. Then, the decrease in the government savings is fully compensated for by a private savings increase. This insures that there is no effect on the current account balance as there is no need to borrow from abroad, which is why budget deficits are not linked with current account deficits.

### 2.3 The current account targeting hypothesis

According to the so-called current account targeting hypothesis (CATH), the causality between the budget deficit and the current account deficit is reverse in comparison with the Mundell-Fleming model and the Keynesian theory of absorption. Here, an increase in the current account deficit implies a decrease in economic growth. Consequently, lower economic growth leads to lower government revenues and budget deficit increases. This causality is apparent if the government aims to diminish the external imbalances using current account targeting (Summers 1988) through a budget deficit policy (Marinheiro 2008).

### 2.4 The intertemporal approach to twin deficits

The intertemporal approach to twin deficits is derived from the intertemporal approach to current accounts initially developed by Sachs (1981) and extended by Obstfeld and Rogoff (1995, 1996). Bussiere *et al.* (2004) further develop this model by including a fiscal balance and propose a dynamic model for current accounts, which allows the following way to account for the twin deficits:

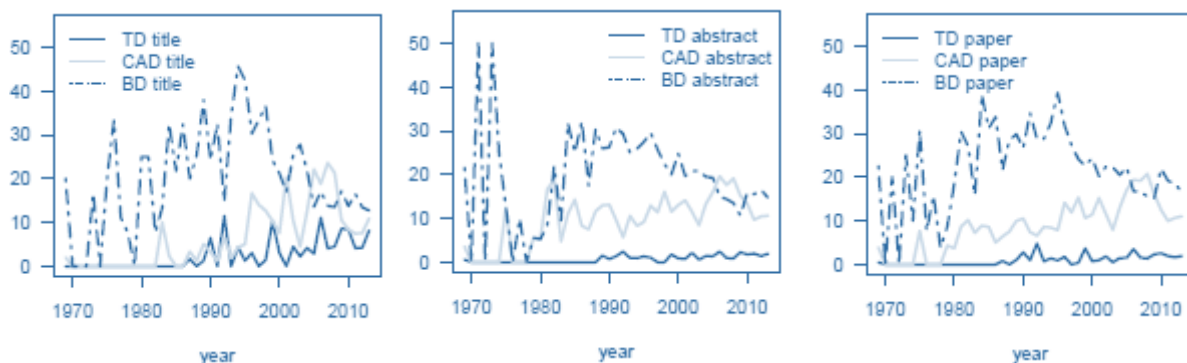
$$CA_t = (1-\lambda)\gamma CA_{t-1} + \lambda(T_t + rB_t^G - G_t) + \frac{\gamma(1-\lambda)}{1+r} \Delta NO_t + (1-\lambda)\left(1 - \frac{\gamma}{1+r}\right)(NO_t - E_t \tilde{NO}_t) \quad (2.7)$$

where: CA = the current account;  $T$  = taxes;  $rB_t^G$  = the return on net government assets;  $G_t$  = the government expenses, i.e.  $T_t + rB_t^G - G_t$  = the fiscal surplus;  $NO_t$  = the net output defined as  $NO_t = Y_t - I_t - G_t$ . Expression  $NO_t - E_t \tilde{NO}_t$  is a measure of the extent to which the actual net output  $NO_t$  exceeds its permanent level  $E_t \tilde{NO}_t$ .

According to Bussiere *et al.* (2004), if the output (investment or public spending) temporarily exceeds its permanent level, the net foreign asset position of the economy increases (decreases), which implies a current account surplus (deficit). They also pointed out that a fiscal surplus causes a current account surplus, if it decreases the disposable income of non-Ricardian agents (i.e. if it decreases the aggregate consumption; thus, the aggregate savings increase).

### 3. Text-mining analysis of scientific papers

The development of the world economy after the Second World War was characterized by its continuing internalization and the increasing role of the public sector. This led to the growth of the economy's vulnerability, based on the limitations of the domestic financial resources in covering the contemporary current account and public deficits. If the deficits became permanent, the country had run into a crisis, spreading its consequences through the main country partners. That was apparent mainly at the time of the various currency and debt crises that occurred in the last decades and is the reason why the deficit topic became one of the main topics discussed in economics research in the last decades. Here, we analyse the role of the twin deficit within the scientific discussion. As the extent of the scientific discussion is quite large, we decided to combine the text mining of the whole available texts database with the traditional analysis of the contents of the most relevant scientific papers. The evolution of the relative occurrences of papers in the Research Papers in Economics (RePEc) database containing the terms twin deficit(s), current account deficit(s) and budget deficit(s) in the time period 1969-2013 is displayed in Figure 1.



Note: Evolution of the relative frequency of papers on twin deficits (TDs) and current account and budget deficits (CADs, BDs), both without mentioning the twin deficit term. The occurrence of the keywords twin deficit, current account deficit and budget deficit is analysed (i) in the papers' title, (ii) in the abstracts and (iii) in the whole papers. The relative frequency is calculated as a share of the papers mentioning the corresponding terms over the papers containing the word "deficit". The analysis uses the RePEc database papers and covers the time period from 1969 to 2013.

Figure 1 - Evolution of the frequency of papers on twin deficits and current account and budget deficits

Here, we can conclude the following. Budget deficits have been discussed since 1969 and their importance prevailed up to 1995, when the relative number of papers analysing budget deficits without mentioning twin deficits began to diminish. Twin deficits started to be analysed in 1989 and the number of papers on twin deficits gently increased up to 2013. We assume that the budget deficit problem ceased to be analysed independently and started to be connected with the twin deficit phenomenon in the 1990s. However, the topic of current account deficits without using the term twin deficit has been expanding during the whole analysed period. This can be explained by the presence of currency crises, i.e. balance-of-payments crises (Mexico in 1994, Asia in 1997, Russia in 1998) as a current account deficit, i.e. a country's foreign indebtedness plays a potential role in this type of crisis (Corsetti *et al.* 1999). Moreover, current account imbalances in terms of global imbalances have become a highly discussed topic in recent years.

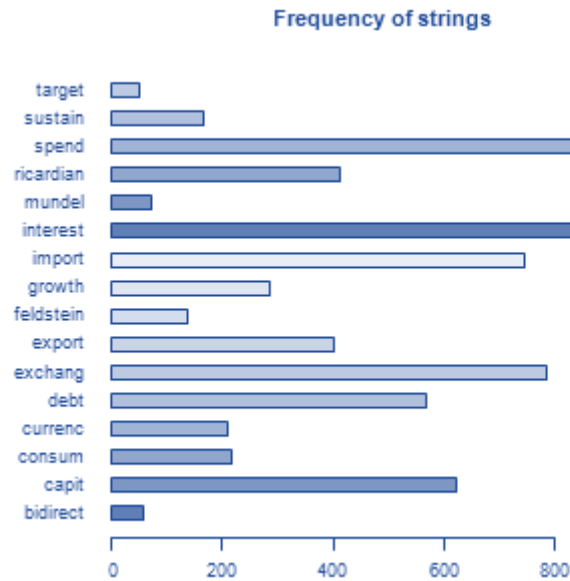
As mentioned before, a large number of scientific papers deal with the coexistence of a budget deficit and a current account deficit. According to the RePEc database, there are 67 journal articles and 101 discussion papers (December 2013) that contain the "twin deficit" string in their title. Here, the presented approach differs considerably according to the methods, time period and economic regions used in the research. That may explain why the results and empirical evaluation of the theory become rather ambiguous or even contradictory. Here, by conducting a text-mining analysis of the available texts<sup>3</sup>, we aim to find the most frequently discussed economic categories (words, text substrings) associated with the twin deficits. Thereafter, we identify some significant relations among them signalling the existence of general patterns prevailing in the papers.

For the analysis, we use the following 16 keywords (strings): *ricardian*, *mundel*, *target*, *bidirect* (all identifying the TD theory modifications), *debt*, *feldstein*, *interest*, *import*, *export*, *currenc*, *exchang*, *growth*, *spend*, *consum*, *capit* and *sustain* (identifying the categories used within the particular theories)<sup>4</sup>.

The occurrences of the selected string terms within the researched documents are depicted in Figure 2. Here, *interest*, *spend*, *exchang*, *import* and *capit* dominate. These terms form the basis of the Mundell-Fleming theory. On the other hand, the term *debt* is also frequently mentioned, which evokes the discussion of the Ricardian equivalence. If comparing the frequencies of the TD theory identifiers *ricardian*, *mundel*, *target* and *bidirect*, Ricardian equivalence seems to be the most discussed theory and the Mundell-Fleming model ranks in second place, albeit significantly lagging.

<sup>3</sup> Here, we excluded working papers that have been later published as journal articles.

<sup>4</sup> In order to apply the text-mining techniques and to unify the keywords, we perform "preprocessing" of the papers by replacing the term CATH with *target*. Further, in the keyword searching phase, we use the following word roots strings): *target* = current account targeting hypothesis; *mundel* = Mundell-Fleming; *bidirect* = bidirectional causality; *currenc* = currency, currencies; *interest* = interest rates; *exchang* = exchange rate; *spend* = spending; *consum* = consumption; *capit* = capital; and *sustain* = sustainability.



Source: Authors' calculations.

Figure 2 – Terms / strings' frequency in the investigated papers

However, Figure 2 does not enable us to specify the associations among the studied terms, which are necessary to identify the theories dominating the research. Accordingly, we expect that the occurrences of the term mundel will be correlated with the terms spend, interest, exchang, import and currenc, as these terms enter the Mundell-Fleming model as explanatory variables. Similar associations are expected in the case of Ricardian equivalence, in which we expect association with the term debt. The empirical correlations of the researched terms are given in Table 1.

Table 1 - Association between the occurrences of the terms ricardian, mundel, target, bidirect and others

	RICARDIAN	MUNDEL	TARGET	BIDIRECT
debt	0.55*			
consum	0.52*			
capit	0.33*	0.34*		
feldstein	0.29			
interest	0.21	0.47*		
import	0.17	0.34*		
bidirect	0.13		0.11	
target	0.12			0.11
currenc	0.10	0.43*		
growth	0.10			
spend		0.20		
export		0.14		
exchang		0.36*		
ricardian			0.12	0.13
sustain				0.22

Note: only correlations higher than 0.1 are displayed; \* denotes correlations higher than 0.3.

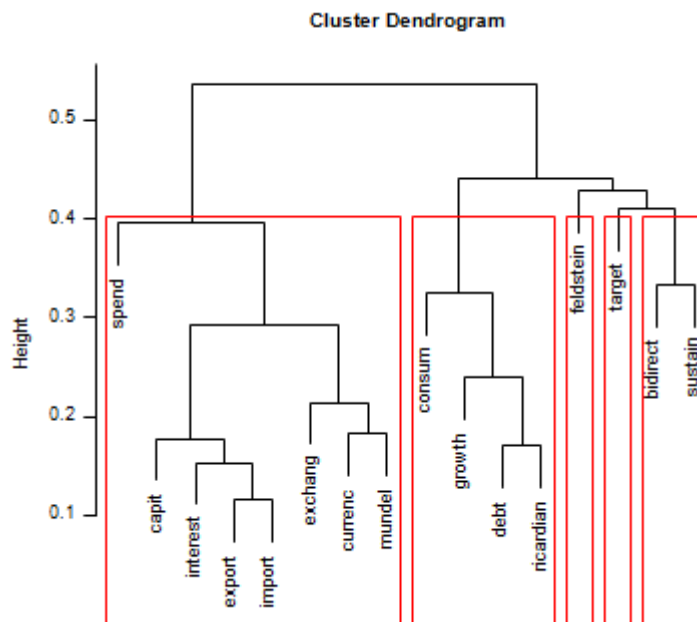
Source: Authors' calculations

Further, we consider moderate correlations ( $> 0.30$ , rule defined by Dancey and Reidy 2004) between the text strings' occurrences in the researched documents. As expected, the term mundel is correlated with interest (0.47), currenc (0.43), exchang (0.36), capit (0.34) and import (0.34) and the term ricardian is correlated with the terms debt (0.55) and consum (0.52). The statistically significant relation between the terms ricardian and capit is quite surprising and can be explained by the discussion of the Feldstein-Horioka (1980) puzzle in the context of



Ricardian equivalence (see the nearly significant association between the term ricardian and the term feldstein). The terms target and bidirect are not significantly correlated with any of the selected terms. However, these terms do not occur with such a high frequency as the terms ricardian and mundel (see Figure 2).

The complex view can be provided by clustering based on the frequency of the terms used in the researched papers. Here, we use the hierarchical clustering with Euclidean distances and the Ward linkage method of cluster identification. The result is given in a dendrogram in Figure 3. We identify five clusters, of which two big clusters corresponding to the Mundell-Fleming model and Ricardian equivalence dominate (compare with Figure 2). The first cluster consists of the terms mundel, currenc, exchang, interest, import, export, capit and spend and is associated with the Mundell-Fleming model. The second cluster consists of the terms ricardian, debt, growth and consum, which are undoubtedly linked with Ricardian equivalence. As explained before, mainly debt, having the smallest distance to the term ricardian, is associated with the invalidity of the twin deficit hypothesis, as Ricardian equivalence holds.



Source: Authors' calculations.

Figure 3 - Dendrogram - distances between terms and clustering

The remaining two theories, the current account targeting hypothesis, i.e. the term target, and bi-directional causality between two deficits, i.e. the term bidirect, are linked to the terms sustain and feldstein. Thus, the terms target and bidirect are connected, too. That is not surprising as many papers dealing with bi-directional causality between two deficits regard the possibility of reverse causality in terms of the CATH. Then, bi-directional causality is connected with the Feldstein-Horioka hypothesis. Marinheiro (2008) explains that "according to Feldstein and Horioka (1980), in a world of perfect capital mobility, the financing of domestic investment is not related to (nor constrained by) the amount of domestic saving. If in fact savings and investments are not correlated, reflecting high capital mobility, and Ricardian equivalence does not hold, government saving and the trade balance move together, originating a twin deficit." Furthermore, Misztal (2012) states that "in accordance with the hypothesis of Feldstein-Horioka (1980) the budget deficit and the current account balance interact mutually."

#### 4. Analysis of the content and classification of the papers

In this section, we analyse 50 selected papers (Table 2) from the point of view of methodology, regions researched, variables included, period analysed and results (see Table 4 in Appendix). All researched papers are high-quality papers covered by the Web of Science and Scopus citation databases (published by Elsevier, Wiley Online Library, Springer, Jstor, Taylor-Francis, etc.) or published within the research papers series of the European Central Bank (ECB). The selection includes the papers that are cited many times, what underlines their importance (number of citations of each selected paper is given in Table 2).

Table 2 - Author, year and analysed period classification

	AUTHOR	YEAR	CITED	PUBLISHER	ANALYSED PERIOD
1	Darrat	1988	171	Jstor	1960Q1-1984Q4
2	Bernheim	1988	73	NBER	1960-1984 (A)
3	Miller and Russek	1989	108	Wiley Online Library	1946Q1-1987Q3
4	Abell	1990	142	Elsevier	1980s
5	Enders and Lee	1990	152	Jstor	1947Q3-1987Q1
6	Dewald and Ulan	1990	65	Cato Institute	1954-1987 (A)
7	Bahmani-Oskooee	1992	38	Jstor	1971Q1-1989Q4
8	Rosensweig and Tallman	1993	84	Wiley Online Library	1961Q1-1989Q4
9	Bahmani-Oskooee	1995	30	Jstor	1971Q1-1989Q4
10	Dibooglu	1997	24	Taylor-Francis	1957Q1-1992Q4
11	Anoruo and Ramchander	1998	67	Elsevier	1957-1993 (A)
12	Islam	1998	77	Springer	1973Q1-1991Q4
13	Khalid and Guan	1999	85	Springer	1950-1994 (A)
14	Normandin	1999	115	Elsevier	1950Q1-1992Q3
15	Vamvoukas	1999	90	Taylor-Francis	1948-1994 (A)
16	Piersanti	2000	87	Elsevier	1970-1997 (A)
17	Kaufmann <i>et al.</i>	2002	43	Springer	1976Q1-1998Q4
18	Leachman and Francis	2002	80	Taylor-Francis	1948Q1-1992Q4
19	Chinn and Prasad	2003	618	Elsevier	1971-1995 (A)
20	Fidrmuc	2003	44	Springer	1970-2001 (Q)
21	Kouassi <i>et al.</i>	2004	48	Springer	1969-2008 (A)
22	Bussiere <i>et al.</i>	2004	122	ECB	1995-2002 (A)
23	Salvatore	2006	53	Elsevier	1973-2005
24	Funke and Nickel	2006	13	ECB	1970-2002 (A)
25	Corsetti and Müller	2006	176	Wiley Online Library	1979Q1-2005Q3
26	Kim and Kim	2006	16	Taylor-Francis	1970-2003 (A)
27	Baharumshah <i>et al.</i>	2006	39	Taylor-Francis	1976Q1-2000Q4
28	Jobert and Zeyneloglu	2006	0	Economie Internationale	1988Q1-2000Q4
29	Muller	2008	49	Elsevier	1973Q1-2005Q3
30	Kim and Roubini	2008	256	Elsevier	1973Q1-2004Q1
31	Afonso and Rault	2008	25	ECB	1970-2007 (A)
32	Nickel and Vansteenkiste	2008	36	ECB	1981-2005 (A)
33	Beetsma <i>et al.</i>	2008	115	Wiley Online Library	1970-2004 (A)
34	Marinheiro	2008	45	Elsevier	1977-2003
35	Daly and Siddiki	2009	18	Taylor-Francis	1960-2000
36	Rault and Afonso	2009	4	Economics Bulletin	1970-2007 (A)
37	Grier and Ye	2009	16	Wiley Online Library	1948Q1-2005Q1
38	Katircioglu <i>et al.</i>	2009	8	Taylor-Francis	1970-2004
39	Bussiere <i>et al.</i>	2010	28	Elsevier	1960-2003 (A)
40	Holmes	2011	11	Elsevier	1947Q1-2009Q4
41	Altintas and Taban	2011	2	Eurojournals, Inc.	1974-2010 (A)
42	Kalou and Paleologou	2012	6	Elsevier	1960-2007 (A)
43	Makin and Narayan	2013	2	Springer	1983Q1-2009Q1
44	Trachanas, Katrakilidis	2013	5	Elsevier	1971-2009 (A)
45	Algieri	2013	0	Elsevier	1980Q2-2012Q2
46	Nickel and Tudyka	2013	10	ECB	1970-2010 (A)
47	Chihi and Normandin	2013	1	Elsevier	1960-2005 (A)
48	Sobrinho	2013	0	Elsevier	1990Q3-2012Q1
49	Forte and Magazzino	2013	0	Springer	1970-2010 (A)
50	Mirdala	2013	1	ASERS Publishing	2000Q1-2012Q4

Note: Year = of the publication, A = annual data, Q = quarterly data, cited = number of citations of the paper.

Source: Authors' classification

Twin deficits first appeared in the United States in the 1980s. These years were marked by large trade deficits and federal budget deficits, as the trade deficit increased from \$25 bill. in 1980 to \$124 bill. in 1985 and the budget deficit rose from \$74 bill. in 1980 to \$212 bill. in 1985 (Darrat 1988). As stated by several authors (Gordon

1986, Darrat 1988, Miller and Russek 1989), the conventional view of this period claimed that high US budget deficits were a principal cause of large US trade deficits. Thus, many authors attempted to explain this phenomenon, tried to find the factors explaining rising deficits and finally aimed to determine the relation between fiscal and trade (current account) deficits in the United States (such as Laney 1984, Gordon 1986, Darrat 1988, Miller and Russek 1989, Abell 1990, Dewald and Ulan 1990, Bahmani-Oskooee 1992, 1995, Rosensweig and Tallman 1993, Dibooglu 1997, Leachman and Francis 2002) and later also in other countries (Bernheim 1988, Roubini and Sachs 1989, Islam 1998, Khalid and Guan 1999, Normandin 1999, Vamvoukas 1999, Piersanti 2000).

Generally, there are two different ways to test twin deficits. Some authors (such as Miller and Russek 1989, Khalid and Guan 1999, Normandin 1999, Piersanti 2000, Kouassi *et al.* 2004, Marinheiro 2008, Holmes 2011) research the direct relation between the budget balance on one side and the current account (or trade balance) on the other side, both without including other variables. Others reveal that the number of other macroeconomic variables significantly causes changes in both deficits (Darrat 1988) through the transmission mechanisms of interest rates and exchange rates (Abell 1990, Baharumshah *et al.* 2006, Kalou and Paleologou 2012). Rosensweig and Tallman (1993) conclude that the growing US government deficit appreciates the US dollar and therefore the government deficits contribute to the trade deficits. Some authors (e.g. Kim and Kim 2006, Afonso and Rault 2008, Rault and Afonso 2009) take into account the role of the exchange rates in their twin deficit studies. Others (e.g. Daly and Siddiki 2009, Grier 2009) use the interest rates here. Dibooglu (1997) confirms that both the budget deficit increase and the real interest rate increase are associated with the increase in the current account deficit. In our research, the interest rates and exchange rates are the most considered macroeconomic variables. This is also confirmed by our text-mining analysis (see Figure 2, frequencies of the strings interest and exchange).

Many authors use classical vector autoregression (VAR) or cointegration techniques. However, some of them make various modifications, e.g. structural VAR (Corsetti and Muller 2006), VAR with structural breaks (Kim and Kim 2006) or VECM with structural breaks (Daly and Siddiki 2009). The inclusion of the structural breaks is of special interest, as Daly and Siddiki (2009) confirm the validity of the twin deficits and state that "the number of countries with apparent long-run relationships is dramatically reduced, when regime shifts are not permitted. This suggests that earlier studies, which did not allow for structural breaks may have been methodologically biased in favour of supporting the REH perspective". Furthermore, Holmes (2011) estimates the threshold vector error correction model and reveals that the Keynesian viewpoint of the twin deficits would only prevail after the internal balance has reached a given threshold. Nickel and Vansteenkiste (2008) use the dynamic panel threshold model with the threshold variable government debt-to-GDP ratio. They conclude that in the case of the countries with debt-to-GDP ratios up to 80-90%, any increase in the fiscal deficit leads to a current account deficit increase, whereas Ricardian equivalence is confirmed when the debt-to-GDP ratio is over 80-90%. Nickel and Tudyka (2013) reveal that if this ratio is less than 110%, the Mundell-Fleming model is confirmed, and if the debt-to-GDP ratio is more than 110%, Ricardian behaviour and twin divergence are observed. Trachanas and Katrakilidis (2013) apply the asymmetric cointegration methodology with structural breaks and test whether positive and negative components are cointegrated. They uncover asymmetric linkages between the twin deficits in the long run, i.e. fiscal deficit decreases have a greater impact on the current account deficit than the opposite. Bussiere *et al.* (2004) use a panel data dynamic model and confirm the intertemporal approach to twin deficits, i.e. the fiscal balance, relative income and relative investment determine the current account in the medium term and the fiscal balance is positively related to the current account.

#### 4.1 Papers' classifications

We aim to classify and analyse the selected papers (see Table 2) on twin deficits. Here, 42 papers analyse twin deficits in developed countries and 12 papers concern developing countries. As far as the variables included in the econometric models are concerned, 11 papers study the direct relation between two variables (budget balance and current account/trade balance) and 39 papers add other macroeconomic variables. The classification of studied papers is given by Table 3.

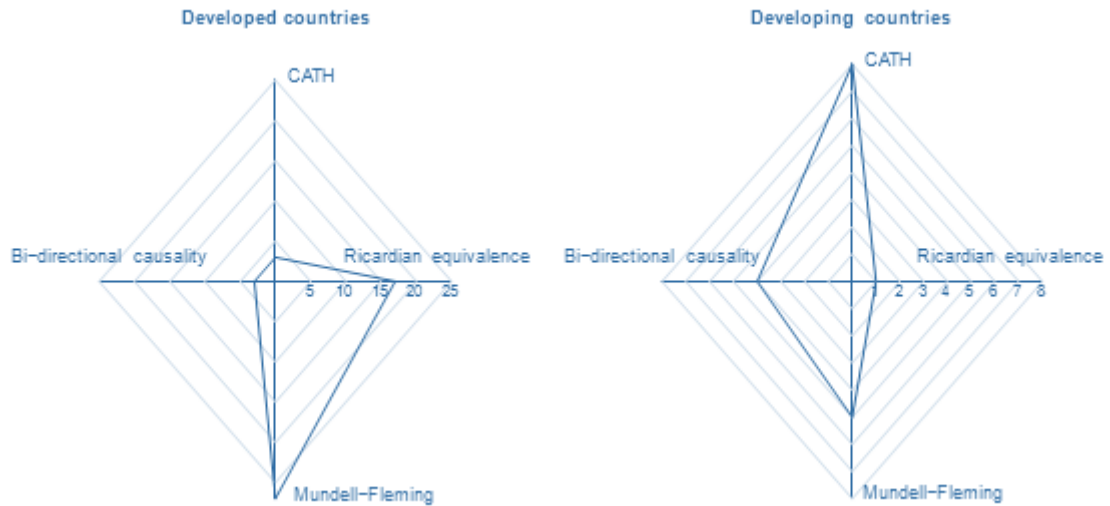
Table 3 - Papers' classification

		Ricardian equivalence	Keynesian view: Mundell-Fleming model	Current Account Targeting Hypothesis	Bi-directional causality
COUNTRIES	Developed countries	2, 3, 6, 13, 14, 17, 21, 25, 28, 29, 30, 31, 32, 37, 45, 46, 49	2, 4, 5, 7, 8, 9, 10, 13, 14, 15, 16, 18, 19, 22, 23, 24, 32, 33, 35, 36, 37, 39, 40, 43, 44, 46, 49	36, 42, 49	1, 41, 49
	Developing countries	21	13, 19, 21, 27, 47	11, 13, 21, 26, 27, 34, 38, 48	11, 12, 21, 27
VARIABLES	2 variables: BB, CA / TB	3, 13, 14, 21	5, 13, 14, 16, 21, 40, 44	13, 21, 34, 38	21
	BB, CA / TB + other variables	2, 6, 17, 25, 28, 29, 30, 31, 32, 37, 45, 46, 49	2, 4, 7, 8, 9, 10, 15, 18, 19, 22, 23, 24, 27, 32, 33, 35, 36, 37, 39, 43, 46, 47, 49	11, 26, 27, 36, 42, 48, 49	1, 11, 12, 27, 41, 49
METHODS	Simple regression	2, 6	2, 23		
	Panel data regression	32	19, 22, 32, 36, 39, 49	36, 38	
	VAR	25, 29, 30, 37	4, 5, 8, 37, 47	11, 26	11
	Panel VAR	46	33, 46		
	Cointegration	3, 13, 14, 17, 28	7, 9, 10, 13, 14, 15, 18, 27, 35, 40, 43, 44	13, 27, 34, 42, 48	27
	Panel cointegration	31	24		
	ARDL				41
	Granger causality	13, 14, 21, 28, 45, 49	4, 10, 13, 14, 15, 16, 21, 27, 36, 49	11, 13, 21, 27, 34, 36, 38, 43, 48, 49	1, 11, 12, 21, 27, 49
	Other causality	28	16	26	41
PERIOD	Up to 1984	2	2		1
	Up to 1985-1989	3, 6	4, 5, 7, 8, 9		
	Up to 1990-1999	13, 14, 17	10, 13, 14, 15, 16, 18, 19	11, 13	11, 12
	Up to 2000-2008	21, 25, 28, 29, 30, 31, 32, 37	21, 22, 23, 24, 27, 32, 33, 35, 36, 37, 39, 47	21, 26, 27, 34, 36, 38, 42	21, 27
	Up to 2009-2013	45, 46, 49	40, 43, 44, 46, 49	48, 49	41, 49

Note: Papers' classification according to analysed countries, variables included, period analysed, methods and results; the numbers correspond to the papers in Table 2; CA = current account, BB = budget balance, TB = trade balance; some papers analyse more countries, i.e. one paper may confirm both Ricardian equivalence and the Mundell-Fleming model: this paper is classified into both theories, e.g. see paper number 2.

Source: Authors' classification

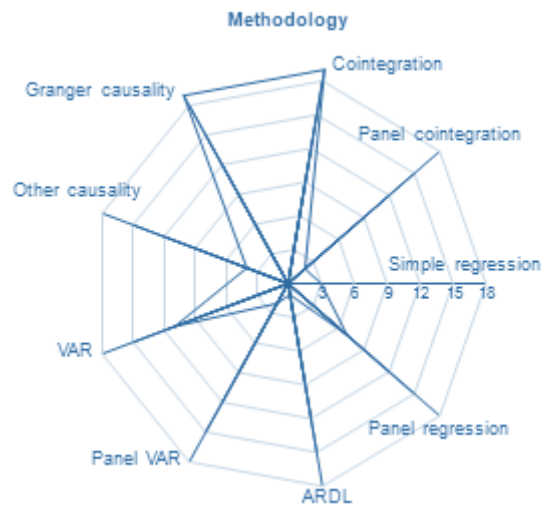
On the basis of the papers' classification in Table 3, we display spider graphs capturing and comparing the frequencies of papers according to the chosen criteria. Figure 4 analyses the results obtained in papers testing twin deficits in developed countries compared with those in developing countries. Here, there is a visible difference between developed and developing countries, as the quadrangles are positioned almost inversely. This implies that papers dealing with developed countries confirm the existence of twin deficits mainly by the Mundell-Fleming model (i.e. 27 papers) or confirm Ricardian equivalence (17 papers), though the papers using data on developing countries mostly confirm the current account targeting hypothesis (i.e. 8 papers).



Note: Developed vs. developing countries and the number of papers according to the results, e.g. Developed countries-Ricardian equivalence corresponds to the number of papers confirming Ricardian equivalence in developed countries.

Figure 4 - Developed vs. developing countries and the number of papers

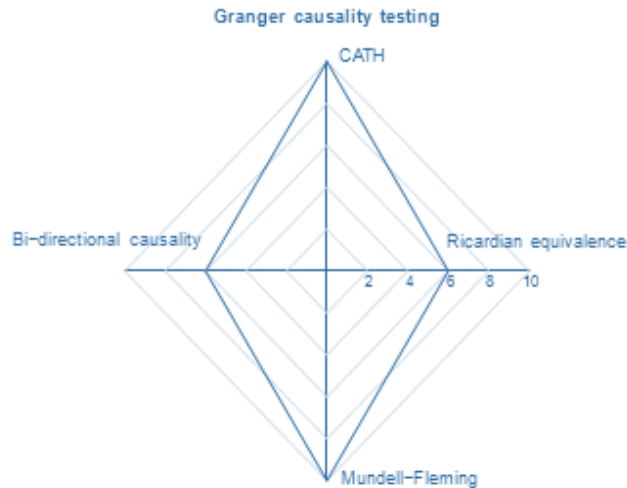
As far as the methodology used for testing twin deficits is concerned (see Figure 5), most papers use cointegration techniques (21 papers) and/or test Granger causality (19 papers).



Note: The overview also includes the papers applying more than one of the considered methodological approaches.

Figure 5 -The number of papers according to the methodology used to test twin deficits

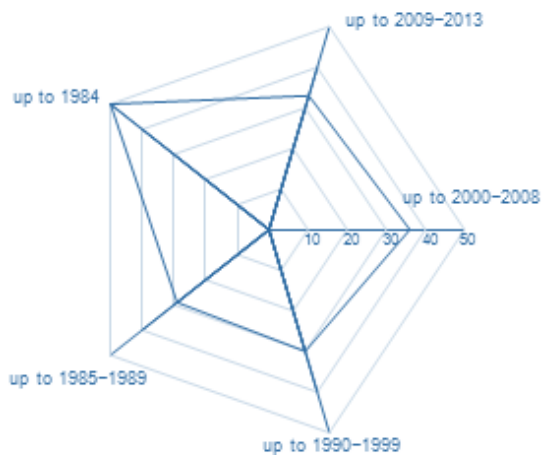
Granger causality testing (Figure 6) does not give uniform results, as each approach is confirmed: the current account targeting hypothesis CATH (10 papers), the Mundell-Fleming model (10 papers), bi-directional causality (8 papers) and Ricardian equivalence (8 papers).



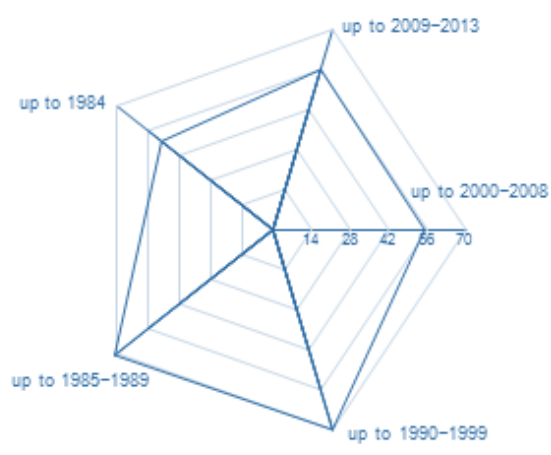
Note: The overview also includes the papers in which Granger causality tests confirm more than one of the four approaches to twin deficits.

Figure 6 - The number of papers according to the results of Granger causality testing

i) Ricardian equivalence confirmation (%)



ii) Mundell-Fleming model confirmation (%)



Note: (i) Ricardian equivalence and (ii) the Mundell-Fleming model. The confirmation of the hypotheses changes with the time period researched (the pictures offer the categorisation of the papers researching the time series ending in different periods, i.e. up to 1984, 1985-1989, 1990-1999, 2000-2008 and 2009-2013).

Figure 7 - The share of the papers confirming Ricardian equivalence and the Mundell-Fleming model

Figure 7 reveals that 70% of the papers using data up to 1985-1989 and those using data up to 1990-1999 confirm the Mundell-Fleming model to explain twin deficits, whereas 30% of these papers prove Ricardian equivalence. For the papers using data up to 2000-2008 and up to 2009-2013, Mundell-Fleming is confirmed by 56% and Ricardian equivalence by 35% of the papers analysing these periods of time. The percentage of papers confirming Ricardian equivalence did not change significantly during the whole analysed period (except the period up to 1984). However, the percentage of papers that confirm the Mundell-Fleming model decreased when using more recent data.

## Conclusion

Nowadays, a considerable number of papers are concerned with twin deficits. According to the RePEc database, 67 journal articles and 101 discussion papers (December 2013) contain the term “twin deficit/s” in their title. The papers differ according to the methods used, variables included, regions researched, results achieved and time period.

Firstly, our objective was to find the most frequently discussed economic categories associated with twin deficits, to identify the relations among them and to find some patterns prevailing in the papers. For that purpose, text-mining analysis and consequently clustering analysis were performed. The text-mining analysis reveals that Ricardian equivalence and the Mundell-Fleming approach dominate the twin deficit research. The analysis of the papers’ content and classification confirms that this is true mainly in developed countries. The clustering of the frequency of terms used in the papers confirms that these two theories form two important clusters and are properly linked to the corresponding macroeconomic variables. The current account targeting hypothesis and bi-directional causality are evident primarily for developing countries.

Secondly, we aimed to classify the 50 most relevant papers into four possible categories according to the countries analysed, methodology, variables included and period analysed, i.e. approaches explaining twin deficit theories by (i) Ricardian equivalence; (ii) the Mundell-Fleming model; (iii) the current account targeting hypothesis; and (iv) bi-directional causality.

As regards the applied methods, the most commonly used are cointegration techniques and Granger causality testing, although the Granger causality test does not offer uniform results. The majority of papers do not test the direct relation between two deficits, but also use some additional macroeconomic variables. The text-mining analysis (i.e. analysis of terms’ frequency) and the analysis of the content of the papers reveal that the interest rate, exchange rate, government spending and debt represent the factors that are used relatively often. Finally, the percentage of scientific papers proving Ricardian equivalence did not change significantly during the analysed period. Nevertheless, the percentage of papers confirming the Mundell-Fleming model decreased when testing twin deficits with more recent data.

## Acknowledgement

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## APPENDIX

Table 4 - Research in twin deficits: a review of selected 50 papers

	COUNTRIES	VARIABLES	METHODOLO	RESULTS: twin deficits causality
1	United States	BB, TB (% of GNP) + monetary base, real output, inflation, labour cost, ER, IR, foreign real income	Multivariate Granger causality	Bi-directional causality between budget and trade deficit; in addition, number of other macroeconomic variables significantly cause changes in both deficits.
2	US, Mexico Canada, UK, Japan, Germany	CA, BB (% of GDP), real GDP growth	Simple linear regressions of CA	Budget deficit raises current account deficit, Japan: no fiscal effects.
3	United States	BB, TB	Cointegration analysis	Positive relationship between the twin deficits exists only under flexible exchange rates. Ricardian equivalence: no long-run equilibrium relationship between the twin deficits (no cointegration).
4	United States	BB, TB + IR and ER	VAR, causality testing, impulse response functions	Mundell-Fleming model confirmed: Budget deficit causes trade deficit, but indirectly rather than directly; twin deficits are connected through the transmission mechanisms of interest rates and exchange rates.
5	United States	government spending, CA	VAR	Mundell-Fleming model confirmed: government spending increases current account deficits.
6	United States	general government deficit, CA (% of GDP) + gross nominal /real private domestic investment	Simple linear regressions	Ricardian equivalence: using the data adjusted for inflation and market-value changes: no significant link between fiscal and current account balance.
7	United States	TB, CA, BB, M1, M2, REER, NEER, terms of trade, IR	Cointegration analysis	Mundell-Fleming model confirmed: Budget deficit causes trade/current account deficit.
8	United States	TB, BB, government purchases (% of GNP), real IR, ER	VAR	Mundell-Fleming model confirmed: growing government deficit appreciates the dollar and government deficits contribute to trade deficits.
9	United States	TB, CA, BB, M1, M2, real GNP, REER, NEER, terms of trade, IR	Multivariate cointegration	Mundell-Fleming model confirmed: Budget deficit causes trade/current account deficit
10	United States	CA, BB, government spending, productivity, domestic and foreign income, real long term IR, terms of trade	VECM, Granger causality, impulse response, variance decomposition	Mundell-Fleming model confirmed: budget deficit and real interest rate increase are associated with current account deficit.
11	India, Korea, Indonesia, Malaysia, the Philippines	BB, TB (% of GDP) + short-term government IR, trade-weighted ER, GDP, inflation	VAR, Granger causality, impulse response	CATH: trade deficits cause fiscal deficits, Malaysia: bi-directional causality.
12	Brazil	BB, TB	Granger causality	Bi-directional causality between budget and trade deficit.

13	5 developed: US, UK, FR, CAN, AUS; 5 developing: India, Egypt, Mexico, Indonesia, Pakistan,	BB, CA	Cointegration, Granger causality	Developed countries: Ricardian equivalence - no long-run relationship between the two deficits; however in US, Canada, France: causality running from budget deficit to current account deficit; developing countries: long-run relationship exists: CATH, i.e. current account deficit causes budget deficits (Indonesia, Pakistan) or Mundell-Fleming model: budget deficit causes current account deficit (Egypt, Mexico).
14	United States, Canada	CA, BB (including the service of the debt)	GMM, cointegration, Granger causality	Positive relationship between current account and budget deficit only in Canada that is not confirmed in United States.
15	Greece	BB, TB, real output, inflation	Cointegration, Granger causality	Mundell-Fleming model confirmed: causality from budget deficit to trade deficit in the long and short run.
16	OECD countries	BB, CA (% of GDP)	Optimizing general equilibrium model, Granger/Sims causality	Positive impact of budget balance on trade balance (twin deficits confirmed if future expectations of budget deficits are taken into account).
17	Austria	BB, CA + real GDP, index of German industrial production, government spending, long-term real IR, labour productivity, terms of trade	VECM, variance decomposition, impulse response	Ricardian equivalence: budget balance has no significant impact on current account balance
18	United States	BB, TB, government spending, government revenue, export, import	Cointegration and multicointegration	Mundell-Fleming model confirmed: causality running from fiscal to trade deficits (years 1974 - 1992)
19	18 industrial, 71 developing countries	CA, BB + other indicators (e.g. GDP growth, openness, M2)	Cross-section regressions, panel regressions	Budget balances positively influence current account balances (but no causality was tested)
20	10 OECD, 2 emerging, 6 EU transition	CA, BB, investment (% of GDP)	Cointegration	Twin deficits (positive long-run cointegration relation) are confirmed for 3 OECD countries (France, US, UK) and 2 transition economies (Hungary, Poland)
21	10 developed, 10 developing	BB, CA	Granger causality	Ricardian equivalence in developed countries: budget deficit and current account deficit are independent. Developing countries: mixed results - Mundell-Fleming model (BD causes CA): Israel, CATH (CA causes BD): Korea, bi-directional causality: Thailand, RE: other developing countries.
22	33 OECD and EU accession	CA, BB, net output, real income, investment ratio, public spending ratio, real ER	panel data dynamic model	Intertemporal approach confirmed: fiscal balance, relative income and relative investment determine current account in the medium term; fiscal balance positively related to current account.
23	G-7 countries	CA, BB (% of GNP), real GNP growth, real GNP growth in rest of the world	Regression analysis with lagged variables	Mundell-Fleming model confirmed: budget deficits lead to current account deficits by one or more years.

24	G-7 countries	exports/imports of goods and services, real government expenditures, world income, real GDP, real private consumption and investment, CPI, world CPI, export prices, ER	Panel cointegration	Mundell-Fleming model: increase of government expenditure leads to trade balance deterioration
25	US, UK, Canada, Australia	BB, TB, GDP, inflation, terms of trade, long-term IR, investment, consumption / savings	Structural VAR (SVAR), impulse response	Ricardian equivalence: limited impact of budget shocks on trade balances (in US, Australia which are relatively less open than Canada and UK).
26	Korea	BB, CA, ER	VAR (structural breaks), Modified Wald causality	CATH: causality running from current account deficit to budget deficit.
27	ASEAN-4: Indonesia, Malaysia, the Philippines, Thailand	CA, BB (% of GDP), nominal ER, short-term IR	Cointegration, Granger causality, variance decomposition, impulse response	Mundell-Fleming model: indirect causality running from budget deficit (through interest rates, currency appreciation) to current account: all ASEAN-4 except for the Philippines; direct causality running from budget deficit to current account deficit: Thailand, CATH: Indonesia, bi-directional causality: Malaysia, the Philippines.
28	Turkey	BB, CA/TB, REER, GDP growth	VECM, Granger and Instantaneous causality	Ricardian equivalence: budget deficit is not associated with trade deficit.
29	United States	TB, government/private spending, nominal ER, terms of trade, prices, investment, consumption	VAR	Twin divergence: after exogenous increase of government spending, trade balance improves (moves into surplus).
30	United States	real GDP, BB, CA (% of GDP), real IR, real ER	VAR, impulse response	Ricardian equivalence: twin divergence as government deficit shocks improve current account - partial Ricardian behaviour.
31	5 groupings of EU, OECD countries	CA, BB, REER	Bootstrap panel cointegration, SUR	Ricardian Equivalence: no clear evidence of direct and close relationship between budgetary and current account balances.
32	22 industrialised + 11 largest EA countries	BB (including interest payments on government debt), CA + terms of trade, income relative to US, output gap, investment, openness, REER, productivity, dependency	Dynamic panel threshold model (threshold variable: government debt/GDP)	Model for 22 countries: countries with debt ratios up to 90% of GDP: Mundell-Fleming model confirmed - increase in fiscal deficit leads to current account deficit increase; high debt countries: Ricardian equivalence; model for 11 euro area countries - threshold is debt up to 80% of GDP.
33	14 European Union countries	public spending, exports, imports, output, REER, net taxes	Panel VAR	Mundell-Fleming model confirmed: increase in public spending deteriorates trade balance (i.e. increases imports, reduces exports)
34	Egypt	BB, CA (% of GDP)	VECM, Granger causality	CATH: Granger-causality running from current account deficit to budget deficit

35	23 OECD countries	BB, CA, real IR	VECM (with structural breaks)	Keynesian perspective confirmed for 13 from 23 countries: long-term cointegration exists (number of countries is reduced when regime shifts are not permitted): studies without structural breaks may have been methodologically biased in favour of supporting the Ricardian equivalence perspective.
36	EU and OECD country groupings	CA, BB, REER	Panel-data approach based on SUR, bootstrap panel Granger-causality	Mundell-Fleming model: causality running from budget deficit to current account deficit (majority of EU countries - Bulgaria, Czech Republic, Estonia, Finland, France, Italy, Hungary, Lithuania, Poland, Slovakia); CATH: causality running from current account deficit to budget deficit (7 EU - Austria, Belgium, Ireland, Spain, Czech Republic, Estonia, Italy and 5 non-EU countries - Australia, Canada)
37	United States	BB, CA, real IR	VAR-GARCH, impulse response, variance decomposition	Ricardian equivalence in long-run: no connection between the current account balance and budget balance; Mundell-Fleming model confirmed in short-run: positive effect of budget shocks on the current account
38	24 small islands	BB, CA (% of GDP)	Panel data, bivariate/ pairwise Granger causality	CATH: causality running from current account balance to budget balance
39	21 OECD countries	CA, BB, productivity, government consumption, private investment	Panel regressions	Mundell-Fleming model confirmed: budget deficits are an important determinant of current accounts (because fraction of households are non-Ricardian households)
40	United States	CA, BB (% of GDP)	Threshold cointegration	Mundell-Fleming model confirmed: however, this theory would only prevail after the internal balance has reached given threshold.
41	Turkey	BB, CA, investment (% of GDP)	ARDL, Toda and Yamamoto causality	Positive long-run relationship between two deficits, bi-directional causality between budget and current account balance
42	Greece	BB, CA, short-term IR, NEER	VECM (with structural breaks), Granger causality	CATH: positive relation between two deficits; causality running from current account deficit (through interest rate and exchange rate) to budget deficit.
43	Australia	foreign borrowing, BB, real ER	Cointegration analysis	Mundell-Fleming model confirmed: increase in budget deficits leads to a rise in foreign borrowing and crowds out net exports (i.e. current account deficit)
44	5 EU: Portugal, Ireland, Italy, Greece, Spain	primary BB, CA (% of GDP)	Asymmetric cointegration of positive/ negative components (with structural breaks)	Twin deficit hypothesis confirmed for: Portugal, Ireland, Greece, Spain; asymmetric linkages between the twin deficits in the long-run : fiscal deficit decreases have a greater impact on the current account deficit than the opposite.
45	5 GIIPS: Greece, Ireland, Italy, Portugal, Spain	BB, CA, TB	Granger causality, Toda-Yamamoto test	Ricardian equivalence: no clear relation between budget-current account balances and budget-trade balances.
46	17 EU countries: with debt at least 70% of GDP	real government consumption, real GDP, real private investment, debt/GDP, TB (% of GDP)	Panel-VAR, impulse response	If debt-to-GDP ratio less than 110%: Mundell-Fleming model confirmed: increase in government spending deteriorates trade balance, if debt-to-GDP ratio more than 110% : Ricardian behaviour and twin divergence

47	12 developing countries	external deficit, BB + IR, terms of trade, ER, output, taxes and other shocks	VAR, impulse response, decompositions of empirical/predicted covariances	Mundell-Fleming model: positive co-movement between the external and budget deficits explained mainly by shocks associated with the internal conditions (domestic resources and fiscal policies)
48	Peru	CA, BB, fiscal spending, real GDP	VECM, Granger causality, impulse response, variance decomposition	CATH: Causality running from current account balance to budget balance; fiscal policy has no effect on the current account
49	33 European countries	CA, net lending / net borrowing of general government, REER, government expenditures, total factor productivity, real GDP per capita growth	Panel data: Generalized Least Squares-Fixed Effects; GMM dynamic model, Granger causality	Panel data: chronic and robust budget deficit generates a trade deficit; Granger causality: Mundell-Fleming model (6 countries), bi-directional causality (3 countries), CATH (7 countries), Ricardian equivalence (17 countries)
50	European transition economies	event study: CA, primary BB, real output, private / public saving-investment balances; VAR: CA, primary BB, real output, short-term IR, real ER	event study, VAR, impulse response	Positive relationship between current account and cyclically adjusted primary balance; crisis period reduced exposure of external imbalances to primary balance.

Note 1: The serial number of the paper corresponds to papers numbering displayed in Table 2 giving additional information about the author(s), publication year, analysed period, etc.

Note 2: CA = current account, TB = trade balance, BB = budget balance, IR = interest rates, ER = exchange rate

## Outsourcing: The Improvement of Accounting System

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### Abstract:

*The article is devoted to the issues of formulation and solving the problems of accountancy, expenditures, when we use outsourcing. The article marks the necessity to organize such accountancy, when pricing groupings are formed according to the events and changes that take place in business. The article underlines the necessity of accountancy for all expenditures that can be achieved by using the ABC - method (Activity Based Costing), when we calculate. Moreover, the article underlines the importance and necessity to define the fractions of assets to form the product cost of the certain forms or areas of activity. The article indicates the structural factors that influence the formation of full cost. These factors form tacit or transactional expenses. When we use outsourcing, we must manage by expenditures maintaining economic unity. The article splits off connections between the strategic components when we use outsourcing. At the end of the article, the authors present the conclusions due to the results of study.*

**Keywords:** outsourcing, expenditures, pricing groupings, ABC-method, economic unity.

**JEL Classification:** M41.

### 1. Introduction

Further, in modern sources of information there is no scientific evidence of outsourcing companies. In the accounting information sources choice between “make” or “buy” is limited to the comparison of alternative costs by cost apportionment. As Horngren notes some strategic objectives remain forgotten (Hall 2004, 255-260). The choice of the “right” service provider has a decisive influence on the effectiveness of outsourcing. “Confidence in well-done work outweighs any price saving, which the customer can receive by referring to another performer.” (Morse, Davis, and Graves 2003, 43)

It is common knowledge, the foundation of any accounting system – chart of accounts. Chart of accounts by types of financial and economic activity includes the accounts used in management accounting. In accounting area information on expenses, changes in accounting procedures related to costs, as it requires multiple ways records and disclosure. With such a record, it is possible to obtain valuable information about competitors of the company. However, this may incur additional charges on accounting and analysis, expanding the scope of accounting, as well as on information on current costs.

### 2. Methodology

This research is based on theoretical (philosophical) method, applied approach, predictive analysis and special methods.

Applied methods of dialectical logic are effective means of cognition determining costs that help to take into account the share of assets in value creation of products in certain types or fields of activity. There is an influence discovered by means of system analysis of structural factors affecting the creation of full cost, which form the implicit, called transaction costs. When outsourcing there is a necessity to control costs while respecting the principle of economic unity. The relation between the components of the strategy is pointed by means of structural-functional analysis when outsourcing.

The laws of materialist dialectics such as transformation of quantity into quality, mutual penetration of polar opposites and their transformation into one another, development through contradiction or negation of the negation determines dialectical contradictions in the object of cognition that is outsourcing.

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Applied research method of system analysis helps to identify uncertainties for each option and comparing options on certain criteria. In this study, we use various methods of qualitative and quantitative study of reality: deterministic and probabilistic.

### 3. Results

Cost accounting system helps management staff to make decisions related to the purchase, production, distribution and sales, with the focus on added value. Added value unit of goods and services can be both industrial, purely commercial, banking and even the activities of public authority (Porter 1985, 48).

Cost accounting system provides information on the cost of production: financial statements (income statement and financial situation) and information for the purposes of management, planning, monitoring in production and marketing.

At present the role and significance of items expenses grouping is increasing. Traditional role of cost calculation is product price determination for the purposes of preparing the financial statements. When we use services of external organization-outsources the role of cost calculation is to provide relevant information for management decision-making (Figure 1).



Figure 1 - Cost accounting role in outsourcing and in making managerial decisions

Figure 1 shows the correlation between items expenses grouping and the business world changes and events. For the purposes of planning and expense control, it is necessary to use different quantitative models and tools of accounting. In particular, such researchers as Kaplan and Cooper (1998) suggest using ABC-method (Activity Based Costing) within value chain in making decisions about outsourcing.

At first, the company should define its value chain. You can create the chain in its general terms, that is, each generic category can be divided into a number of discrete areas of activity. When defining relevant activities in the value chain it is necessary to define spheres with discrete technologies and behavior of costs. Such functions as production and management are divided into different types of activities. The right degree of analysis of the processes in the chain depends on the behavior of costs of a particular activity. The basic principle of dividing into spheres is different behavior of costs. Using outsourcing, the processes should be detailed before and after outsourcing. This level of detailing is necessary to understand how outsourcing has affected the dynamics of the value chain.

Secondly, when you define the scope of activities in the chain, you allocate assets and operating costs. The necessity of identifying assets proportion in value of certain activity types reflects the fact that assets utilization efficiency determines the amount of assets. Operating costs should be allocated to activities in the period they are incurred while the assets should be allocated to the sphere of activity they are used and controlled. M. Porter (Report of the accounts of the company for a job costing system in the company 2012, 66) focuses on the use of ABC-method in cost accounting, as this method is the specific technique of cost allocating in responsibility centers.

The third step of an assessment of outturn costs helps to identify the structural factors that explain cost differentials in comparison with competitors. It is important to understand costs vary in economies of scale, externalities of education and treatment links in the value chain and as a result costs depend not only on the behavior of costs. Such scientists as J. Shank and V. Govindarajan (1992) show how important it is to pay attention to the outside of the chain costs for the decision making. (Shank and Govindarajan 1992, 179 -197)

For example, in the context of outsourcing, contracting of specific activities in the internal chain can generate additional costs in the later period of production, owned by one of the company's customers. Therefore, clients can request price reduction for products if company has preferred outsourcing.

To diagnose the strategic advantages is to know the strengths and weaknesses of cost analysis within economic unity. Thus, this analysis allows us to study the decision-making process and to assess the factors and elements connected with functional operations of all subsystems of economic unity (Figure 2), allowing to establish links between input and output. (Atheer 2007, 64)

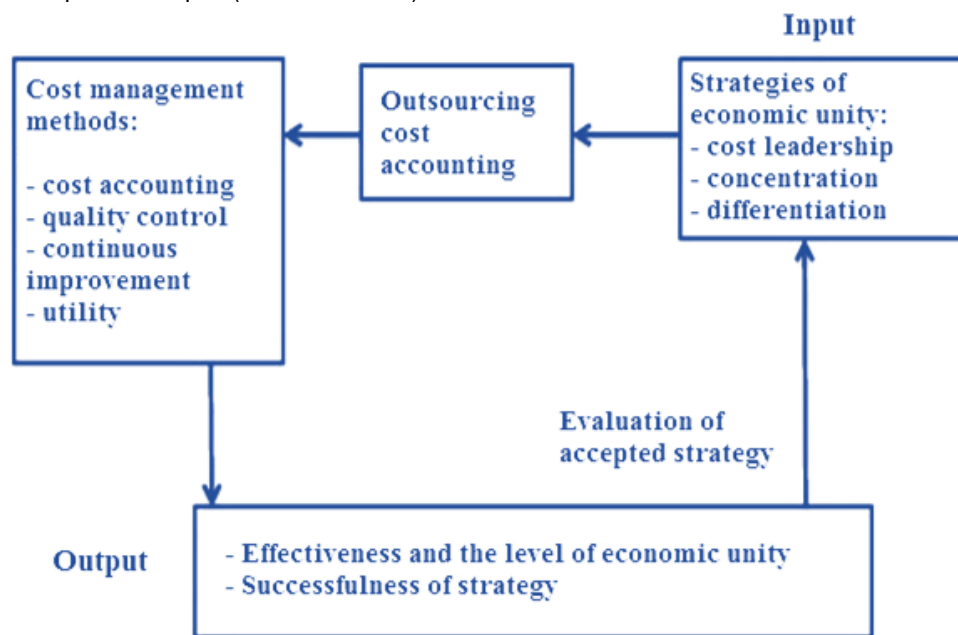


Figure 2 - Cost management and economic unity using outsourcing

Figure 2 illustrates the system of cost management when there is outsourcing that is one of the necessary information systems and reduces business costs. Management is supported by standards that reduce the cost of information production and characterized by the following features:

- using the principle of consistency that means the unified procedure of formation of the sub-accounts and analytical accounts and showing the relevant economic indicators across the vertical chart of accounts;
- using the principle of analyticity means that chart of accounts provides information with such details and generalization, which meets the needs of the relevant levels of management with the available information systems.

Management accounting system contains fewer items, but more detailed in accordance with the specific goals. There is a variety of activities, levels of analysis and total activity. In addition, there are multiple copies of documents, types of data that can be demanded so there is a necessity in harmonization goals and objectives, types of reports, types of required measurements and the preparation of balanced factors. These items must be prepared and organized in accordance with the established rules.

Researchers believe that the obtained information about costs according to the rules has positive impact on the elements of accounting systems. At the same time, these systems may change as private and common goals of the organization change. Making managerial decision is based on the analysis that cannot be conducted immediately. Outsourcing management accounting system should reduce the gap between accounting and strategic researches. (Arab Society of Certified Public Accountants, Management Accounting 2001)

#### 4. Discussion

The analysis of accounting systems elements is essential for effective and rational use for searching methods to manage expenses for the following reasons:

- a variety of organizations forms helps to give specific measurements and various reports for each organization;
- the company size is determined by the costs of market coordination that are compared with the costs of internal components. (Ronald Coase, <http://baguzin.ru/wp/?p=5116>);
- a centralized or decentralized organization structure is connected with costs. Accounting system depends on a decentralized structure, which reports on amendments in accounting system;
- the main company opportunities require the analysis of other companies' possibilities and research;

- financial reporting system requires an extended amount of data for automatization or historical data analysis.

Report preparation is important for accounting system in the service and industry sectors while in management accounting system it must contain current information about financial results and information about the quality and efficiency reports (Horngren *et al.* 2005, 14). The accounting methodology in accordance with its specification requires additional elements of accounting, the necessity of which is caused by different reasons.

Firstly, the diversity of activities, the level of analysis, the level of accounting systems varies according to the special goals of each of the accounting systems. In the systems of financial reporting and accounts, the analysis is held due to the measurement of financial results in terms of clients, geographic regions, quality of work, etc. Account and use of costs by type of activity helps to reveal financial results in the context of specific activities.

Various types of analysis in accounting systems for the purposes of cost management and traditional expenses look as follows (Ahrens and Chapman 2007, Michael 1992).

Revenue cycle is the process of relations between the seller and the customer for the supply of products or services including conclusion the sale and purchase agreement, goods delivery, aftersales service; billings, debtors' management, crediting money resources to an account. For planning production schedule, it is necessary to know costs of production, used materials, etc. Costs for planning do not increase the cost of production, but the calculation of production costs is important to evaluate the effectiveness of the economic unity.

Accounting system includes different operations, for example, the preparation of documents. Documents confirm primary data and include the forecasting documents: lists, reports or bills. Documentation is regarded as one of the tools in the system of internal control (Shank and Govindarajan 1992, 124).

James A. Hall divides three types of documents (Marshall and Steinbart 2004, 51). The first type is the original documents that describe external events affecting business processes of economic events, such as ordering and sales. The second type of documents is for describing the operations and activities regarding the purchase and storage. The third type of documents is notification (correspondence) that is sent to the customer at the company's expense and submitted into the company tracking system of all customer relationships (Moscov *et al.* 1989, 347).

There are different types of reports using for cost control (Bouquin 2006, Briciu 2008, Horngren *et al.* 2005). For example, cost reports show actual costs, unit costs and can serve as life cycle cost reports. (Briciu *et al.* 2010, Hall 2004, Michael *et al.* 1988, Mikhailov 2006) Figure 3 shows the relationship between the components of the strategy by means of outsourcing, depending on the scheme, Robert & David (Coase, <http://baguzin.ru/wp/?p=5116>).



Figure 3 - Correlation between strategy components using outsourcing

Actually, technical analytic account "Expenses on elements" is used when outsourcing. These costs are collected on the sub-account of the first order "Other material costs", which represent expenses for industrial works and services provided by outside organizations or companies.

Due to the multiplicity of processes by which the product reaches full readiness and is designed for offtake in the production phase, the accounting system must include cost accounting for all products taking into account the following important points (Kaplan and Norton 1990):

- using the detailed information provided by the system;
- using information system in planning budgets preparation, monitoring performance of operations;
- the correlation between the cost of the product and the total cost method (in this case, all direct costs are considered as distributed according to centers of production).

## Conclusion

To summarize, we can draw the following conclusions:

- Outsourcing some types of activities helps to achieve such goals as cost saving, flexibility in operations and quick response to client requests. Outsourcing is an important element of maintaining the competitive position of the organization on the market. In addition, the main point of outsourcing is redesign, the aim of which is to improve the quality of work in accordance with customer's requirements.
- Cost accounting system is essential; it allows forming the information base for making effective managerial decisions. Outsourcing accounting allows you to target the rational use of funds intended for the execution of the order in accordance with the pricing groups.
- Considering cost accounting, it is possible to use ABC method because of the division of company infrastructure, processes and activities, unrelated directly to the company but having a significant role for economic and financial indicators. The cost of outsourcing contracts has a decisive influence on purchase, operation, distribution and sales decisions. At the same time, outsourcing is connected with some risks that should be considered not only in relation to a particular field or function, but also in the diversity of risks or their combination. The main criteria of making decisions are to ensure business continuity.
- It is necessary to take into account planning and company strategy in the process of cost-benefit analysis and making decisions of outsourcing contracts to determine the strengths and weaknesses of the company, the effectiveness of environmental opportunities and threats and the adoption of a systemic and strategic plans.
- Costs and separate cost accounting, the process of management accounting at the enterprises should be based on Uniform corporate automated control system of finances and resources and can be used with accounting outsourcing. The recommended system can improve the quality of accounting information and help to make the correct managerial decisions by all authorities.

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## Creating Methodological Instruments for Innovation Project Assessment under Uncertainty Conditions

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### Abstract:

*The research evidences that there is no uniform approach to the assessment of an innovation project. To form an unbiased assessment of an investment project, its separate features have been studied and the authors' definition has been given; the difference between an innovation and an innovation investment project has been found, criteria for the classification of innovation projects have been studied, methodological approaches to the assessment of an innovation project from the point of view of efficiency, competitiveness, innovativeness, uncertainty and risks, as well as risks management have been systemized. Among numerous methodological approaches to innovation project assessment it was reasoned that under uncertainty the most preferable is the innovation stability of a project. As a result, methodological instruments have been created for the assessment of an innovation project comprising the following stages: 1) study of innovation project functioning via identification of risk types and uncertainty; 2) finding universal autonomy coefficient (financial stability) of an entity in funding of innovation activities characterizing both the success of a project and innovation situation risk; 3) implementation of comparative efficiency theory in the assessment of an innovation project; 4) assessment of the uncertainty of a project via finding its stability; 5) formulation of motivated conclusion on the condition of an innovation project by innovation activity-related staff.*

**Keywords:** project, innovation, innovation stability, innovation uncertainty, innovation risk, real options, improvement project.

**JEL Classification:** O31, O22.

### 1. Introduction

As the practice shows, few national organizations implement innovation projects and certainly are able to assess them.

For the assessment of an innovation project it is important to identify the notion of an innovation project. Despite the fact that innovation project assessment issues are long-developed, so far at the Russian and international levels there has been no uniform approach to the notion of an innovation project. The national law (Federal Act No. 127-FZ of 23.08.1996 on science and state scientific and technical policy, Zavlin 2000, Korobeinikov, Korshunov and Trifilova 2002) characterize an innovation project as a set of steps in innovative activity in various modifications which create it together. Baiburtyan, Mamiy (2011) and Sklyarova (2011) define constructive features of an innovation project in the course of innovation activity. Novikov (2010) studies it via a system of interrelated innovation programs. Vertakova and Simonenko (2008), Yevgrafova and Krasnikova (2011), Yesengalieva and Mutanov (2012), Fatkhutdinov (2013) integrate the interpretations via a set of steps, target

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management, set of documents. Sometimes, the notions of an investment innovation project and innovation project are identified.

Meantime, there are a lot of criteria for the classification of innovation project types. Different definition of the essence and content of an innovation project greatly complicates the preparation of instruments for its assessment.

Regarding the implementation of methodological approaches of an innovation project, pluralism is noted. Vertakova, Simonenko (2008) offer to identify the assessment of an investment project and an innovation project, while Krylov, Vlasov, Ovodenko (2003), on the contrary, have the opposite opinion; the basis of various assessment methodologies consists of efficiency, competitiveness, innovativeness, uncertainty, risk and other criteria. The national legislator does not provide for a uniform methodology for the assessment of an innovation project in the federal statistical instruments for monitoring innovative activity.

All the above causes to develop a set of instruments for innovation project assessment much accounting for the requirements of the federal statistical instruments for monitoring innovative activity and the conditions of innovation project realizability which evidences the rationale of this research.

The purpose of this research is to develop a methodological set of instruments for the assessment of the notion of an innovation project accounting for the uncertainty of project environment and realization. The objectives of this research are: from theoretical and methodological positions to describe the points of view on the notion of an innovation project and to express the authors' position on that matter; to study and classify the types of innovation projects; to assess the applicability of many methodological approaches under uncertainty and risk; to develop methodological instruments to innovation project assessment aimed to find the stability of a project under uncertainty upon approbation in the practice of a commercial entity.

The theoretical and methodological basis of this research consists of the works of national and international economy scholars. The methodological basis of this research is the scientific and logical approach to the study of the essence, content, methodologies of innovation project assessment. Using synthesis, detailization and generalization, grouping, formalization, abstract logical, analytical, comparative, economic statistical, expert assessment methods, the essence and content of the notion of an innovation project were identified, the authors' position was rationalized on the classification of its types, and methodological set of instruments for its assessment was made and tested.

Working hypothesis of this research is based on a conceptual assumption that methodological instruments for innovation project assessment should be oriented at the assessment of its innovative stability. That suggests the following: specification of the essential and substantial characteristic of an innovation project; systemizing its types; differentiation of investment innovation projects and innovation projects; systemizing methodological approaches to innovation project assessment admitting their independence regarding its assessment; development of methodological instruments for its assessment under uncertainty. Theoretical and methodological significance of this research is as follows: the notion of an innovation project was formed, the authors' position on the classification of its types was reasoned; preferable instruments for innovation project assessment were rationalized and realized.

The practical significance of this research is the development and application of an approach to innovation project assessment oriented both to find its innovative stability and break-even analysis of the entity realizing it.

## 2. Literature review

### 2.1. Study of innovation project notion content; interrelation of investment innovation project and innovation project; criteria for the classification of innovation projects

The most acceptable form of innovative activity is the innovation project reflecting technical and economic, legal and organizational rationalizing of the final innovative activity. Innovation project is a project form of innovations having all of its key features (Manuylenko 2015). The study (Table 1) shows that its definition may be interpreted as follows: set of steps in innovative activity in various modifications which create it together; set of steps, form of target management, set of documents; constructive features of an innovation project in the course of innovation activity; system of interrelated innovation programs. Regarding the objective of this research the authors opine that an innovation project is a discrete collection of innovative resources, innovations and certain practical steps, the key objective of which is successful realization of innovative activity.

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Table 1 - Study of the notions of an innovation project and innovation project risk

SOURCE	FEATURE
<b>INNOVATION PROJECT</b>	
<ul style="list-style-type: none"> <li>▪ A set of steps in innovative activity in various modifications which create innovation project together</li> </ul>	
Federal Act No. 127-FZ of August 23, 1996 <i>On science and state scientific and technical policy</i>	<ul style="list-style-type: none"> <li>▪ a set of steps aimed at the achievement of economic effect from innovations, including commercialization of scientific and/or scientific engineering results.</li> </ul>
O.P. Korobeinikov, I.A. Korshunov, A.A. Trifilova (2002)	<ul style="list-style-type: none"> <li>▪ a set of interrelated steps aimed at making and distribution of new kind of products/technologies.</li> </ul>
P.N. Zavlin (2000)	<ul style="list-style-type: none"> <li>▪ a set of interrelated objectives, tasks manifested via a system of scientific research and development, operational, organizational, financial, commercial and other steps harmonized by sources, terms and parties approved by project documents and contributing to the solution of some scientific and engineering tasks.</li> </ul>
<ul style="list-style-type: none"> <li>▪ Integration of interpretation via a set of steps, form of target management, set of documents</li> </ul>	
Yu.V. Vertakova, Ye.S. Simonenko (2008); I.Yu. Yevgrafova, Ye.O. Krasnikova (2011); Zh.S. Yesengalieva, G.M. Mutanov (2012); R.A. Fatkhutdinov (2013).	<ul style="list-style-type: none"> <li>▪ a form of target management of innovative activity (comprehensive system of measures) harmonized by resources, time and parties, oriented at the achievement of final objectives in some directions of science and technology development); innovations implementation process (set of successively implemented scientific, technological, production, organizational, financial and commercial steps finalized in an innovative product);</li> <li>▪ a set of documents with aggregate of scientifically reasoned objectives and steps on fulfillment of tasks and organization of business processes accounting for time and space; research and development aimed at fulfillment of present theoretical and practical tasks of sociocultural, commercial and political nature.</li> </ul>
<ul style="list-style-type: none"> <li>▪ Constructive features of an innovation project in the course of innovation activity</li> </ul>	
M.A. Baiburtyan, Ye.A. Mamiy (2011)	<ul style="list-style-type: none"> <li>▪ investments project on making a new product.</li> </ul>
V.V. Sklyarova (2011)	<ul style="list-style-type: none"> <li>▪ investments in making, implementation and production of results of fundamental and applied research for receipt of profit (social benefit).</li> </ul>
<ul style="list-style-type: none"> <li>▪ System of interrelated innovation programs</li> </ul>	
V.S. Novikov (2010)	<ul style="list-style-type: none"> <li>▪ a system of interrelated formalized programs contributing to successful achievement of individual innovative objectives within certain resources/terms/parties.</li> </ul>
<ul style="list-style-type: none"> <li>▪ Investment innovation project</li> </ul>	
O.V. Stepanova (2009)	<ul style="list-style-type: none"> <li>▪ scientific research and development, operational, organizational, commercial and other procedures provided with certain investments and harmonized by time and parties, interrelated by objectives.</li> </ul>
<ul style="list-style-type: none"> <li>▪ Innovation project risk</li> </ul>	
Yu.V. Vertakova, Ye.S. Simonenko (2008)	<ul style="list-style-type: none"> <li>▪ aggregate of risks specific for this innovation project implemented in the environment of a certain economic subject and risks typical for traditional business processes.</li> </ul>
G.Ya. Goldshtein (2004), S.A. Koshechkin (2001)	<ul style="list-style-type: none"> <li>▪ set of factors expressed via system of risks, personal for each individual project party in quality and quantity.</li> </ul>
N.P. Denisenko (2008)	<ul style="list-style-type: none"> <li>▪ degree of uncertainty in expected level of profitability in the course of realization.</li> </ul>



SOURCE	FEATURE
Ye.A. Mamiy, M.A. Baiburtyan (2011) <i>(investment project risk in connection with investments in innovative activity)</i>	probability of unfavorable financial results in the form of full or partial loss of expected income from innovation project implementation under uncertainty.
O.N. Ryzhikova (2009)	cumulative level of accounting for all risks: project-specific within a certain economic subject and standard risks in respective business area.
V.V. Sklyarova (2011)	potential probability of negative event causing significant damage in the course of project implementation.

As evidenced by the research, sometimes the term investment innovation project is used. Innovation project and investments innovation project are differing by the following core criteria: level of novelty and required financial investments. In other words, on the one hand an innovation project adapted for investments requirements may be called an investment innovation project while on the other hand any innovation project to some extent includes the level of innovativeness; in case of positive development any innovation project transforms into an investment innovation project and then into an investment project (Figure 1).

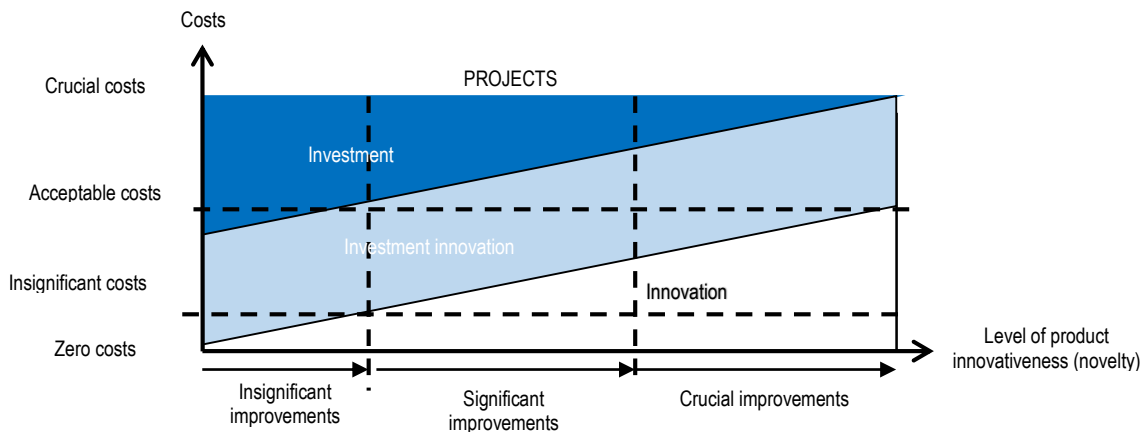


Figure 1 - Interrelation of investment innovation project and innovation project

Innovation projects ensure the long-term strategic advantages of an organization (return on investments exceeds the discount rate required by investors) which strategically enables an organization to improve growth rates and further returns. Investments in innovation projects are an important part of corporate investments strategy related to strategic investments. The integration of innovation and investment activity is an area to ensure availability of resources for innovation projects implementation.

Innovation projects may be classified by the following criteria: decision making level – federal, presidential, regional, sectoral; specific – related to project objectives; final – related to results; intermediary – related to achievement of intermediary results in the course of comprehensive issues solution; oriented at existing needs and creation of new needs; volume of tasks solved: monoprojects – implemented by a single organization/division following expressly set task within time and financial limits, project coordinator/organizer is required; multiprojects – comprehensive programs synthesizing a few monoprojects aimed at the achievement of a comprehensive objective, coordination structures are required; megaprojects – multipurpose comprehensive programs synthesizing a few monoprojects and multiprojects related to each other, created and implemented via the consolidated efforts of a few countries, regions, kinds of economic activity, financial and industrial groups and corporations, centralized financing and governance from coordination center is required; length: short-term – 1-2 years; middle-term – up to 5 years, long-term – over 5 years. Each entity taking into account innovation project implementation objective and target, as we opine, may apply own classification of innovation projects compliant with its tasks.

### 3. Method

#### 3.1. Review of methodological approaches to innovation project assessment

Opinions of economy scholars on innovation project assessment methods are reduced to two points of view: a) innovation project assessment parameters are used; b) independent assessment. The common thing is accounting for inflation, uncertainty and risk factors related to project realizability; comparing results and costs with the required rate of return achievement; assessment: efficiency of innovation and investment projects accounting for modeling flows of products, resources, funds, effect of project implementation on the financial performance and environment of an organization.

As opined by Vertakova, Simonenko (2008), the efficiency of innovations is found based on their ability to save some labor, time, resources and money per unit of common required and planned productive results in products, technical systems and organizational structures. The effect of innovative activity is multi-aspect manifested in the following values: product-related (quality improvement and expansion of commodity line), technological (productivity growth and labor improvement), functional (management efficiency improvement), social (life quality enhancement due to innovations). The economic efficiency of innovations is the result of investments of various resources in a new product/technology in two aspects: production and implementation of innovations; purchase of innovations to achieve a certain productive result. Taking into account that an innovation project is the subject of investments they suggest that the economic efficiency of an innovation project is directly comparable with the assessment of capital investments efficiency, equalizing final assessment of investments in innovations and specifying discount-related and standard assessment methods, reduced costs methods, absolute efficiency, finalizing the economic efficiency from production and implementation of an innovation/investment.

Krylov, Vlasov, Ovodenko (2003), on the contrary, opine that the information on absolute change of the cost-price of a product is not enough for assessment of investment and innovation projects as in the course of the implementation of investment innovation projects the unit costs on products are decreasing and absolute production costs are increasing due to output growth. Therefore, it is reasonable to find the cost-price using both available and new technologies for comparable output provided for in the investment innovation project.

Krylov, Vlasov, Ovodenko (2003) rationalize the inability to apply the methods of innovation project efficiency assessment for respective assessment of an innovation project specifying the differences between existing assessment methods and further specify economic efficiency assessment of projects (Table 2).

Table 2 - Comparison of assessment methods for innovation project and investment projects

Comparison criteria	Innovation project	Investment project	Differences
Project parties	Investors, R&D organizations, manufacturers of new products and end-users	Investors and organizations engaged in implementation	Compared to an investment project, an innovation project concentrates a wider number of parties.
Basic theory	Comparative efficiency.	Absolute efficiency.	Comparative efficiency theory suggests the choice of the best variant from many possible among different projects during the assessment of the impact of project implementation/non-implementation on the financial performance of an organization and further finding of assessment parameters of absolute efficiency (combining absolute and comparative efficiency).
Term	Long	Less long	Creating, producing and managing innovation projects exceed respective parameter on investment projects.
Periods	Project introduction, initial upon completion of standard term of innovation project development, its	None	

Comparison criteria	Innovation project	Investment project	Differences
	productive use including initial and final.		
Economic effect on each step of productive use	Further comparison of performance coefficients with real economic business processes using discounting, compounding, annuity methods.	Result undistributed by years for the whole term of productive use, as prospective costs/results are discounted to the present period.	For investment project, assessment of performance parameters in the near future is excluded
Product price	To be acknowledged by consumers.	Already accepted by market.	
Final result achievement	More uncertain and risky.	Less uncertain and risky.	
Final objective	To obtain the best results compared to analogs.	Excludes the best variant choice.	The issue is not reflected as applied to investment project assessment.
Parties in project assessment process	Seeking the interests of state, budget, developers, producers, consumers.	Seeking the interests of investors within their limits.	Innovation project efficiency is assessed in a diversified way.
Project efficiency assessment nature	Coefficients of aggregate effect from development, making and use and contribution of each party in that efficiency.	Performance results of an implementing party	Innovation project efficiency is assessed in a comprehensive way.
Rate of return	Discounting nonrecurring costs to base year; matching the interests of investors and innovation producers.	Uniform rate of return	
Economic nature of project efficiency parameters	Total value added (net product) less deterioration; comparing total earning power of an innovation project implementation enables to assess its feasibility looking at the structure of financial sources	To a greater extent the needs of investors are characterized, showing only discounted income but not real.	Innovation project efficiency assessment parameters are aimed at finding the funds at the disposal of an organization for payment of wages, development of social sphere, taxes, finally showing the result of innovation project implementation. Meantime, total taxes in budget from the implementation of an innovation project account for state needs including tax authorities via tax preferences, getting organizations interested in projects implementation and enhancement of the national scientific and engineering progress.

Based on the provisions of Table 2, Krylov, Vlasov, Ovodenko (2003), Ilienikova *et al.* (2007) introduce a set of assessment parameters for efficiency of an innovation project characterizing the implementation results and comparison of results/costs in connection with its creating, making and using specifying commercial (integral) parameters – results of innovation project implementation in general for economy; its aggregate result by budgets, creators, makers, consumers; production (operational), financial, investment activity – results of innovation project implementation by each party; budget – financial results of innovation project implementation for federal/regional/local budgets; commercial efficiency, finally reasoning the advantages of commercial, production efficiency over economic efficiency of investment projects. Meantime, the aggregate of comparative and analytical

efficiency parameters for innovation projects is divided into 3 groups: parameters for the analysis of innovation projects implementation on the efficiency of the production (financial, investment) activity of an organization – parameters of economic efficiency of scientific and technical actions. In general, the methods of assessment of generalizing and specific parameters of innovation projects efficiency are integrated into two groups by Krylov, Vlasov, Ovodenko (2003): 1) growth (comparative indexes) specifying quality and quantity factors affecting the efficiency; 2) comparing projects by absolute values: financial result, value added, costs on 1 ruble for similar products, new technology, etc.

Masloboev (2008) took preliminary assessment of the investment component of the business plan of an innovation project as the basis for efficiency assessment of the innovative business structure implementing the project specifying the following modified dynamic methods for economic assessment of innovation projects: net present value, profitability factor, internal rate of return, payback period, which, as he opines, do not take into account the components like transactional costs on business project related operations, risks of innovation process stages taken separately, costs of operational resources. Meantime, he developed the method of combined creation and assessment of efficiency of innovation-oriented business structures ensuring the choice of the most efficient business structures for a particular business idea and making investment forecast in innovation projects on imitation basis.

Speaking on innovation projects specifics, we relieve that uncertainty of the environment, dependency on macrofactors caused by long-term realization, Buimov (2010) does not apply the traditional methods of assessment of investment projects. Rogova and Yarygin (2011) specifying the particular features of innovation projects, underlying that long-term realization, high uncertainty of results/costs also deny the ability to assess them using traditional methods with discounting cash flow. As from cash flow assessment position most of innovation projects are inconsistent, it is feasible to apply the methods accounting for strategic importance of innovation projects – special instruments based on real options.

Filin (2004), noting on the need to divide methods of assessment of innovation and investment projects prefers to assess innovation projects on the basis of scenario analysis with expertise and sensitivity analysis.

In the West, the value of traditional methods for assessment of investments in new technologies is limited. So, the high level of uncertainty and risk in connection with results/costs in a quickly changing environment makes it impossible to assess innovation projects using traditional investment methods being static and not accounting for synergy.

Taking into account the specifics of innovation projects, Novikov (2010) recommends combine the traditional methods of correlation, financial and investment analysis and situational stochastic modeling methods, results of research forecast and project viability evaluation.

Ryazanov (2011) from corporate positions specifies economic efficiency of innovations while commercial efficiency is expressed via the ratio of the result from R&D (cutting cost-price, increasing profit, etc.) and costs on scientific and technical products in the context of the following factors: target market assess and strengthening consumer appeal; intellectual property protection; resource and funds endowment; reasonability of commercialization strategy. The following assessments of innovations activity are specified: commercial, research, investment, the basis of methodology is three-stage assessment from the origin of a new idea to market realization of an innovation.

Twiss (1992) pays much attention to social and ecological importance of innovation projects specifying the following criteria: related to objectives, strategies, policies and values of a corporation, market, scientific and technical, financial, operational, external and economic.

Innovation relations, as opined by Mutanov, Yesengalieva (2012), are born by competitiveness enabling to consider it as a function of innovations –  $K = f(I)$ . As innovation projects are the objects of two interacting segments – science and business, the graphical model of the quality assessment of an innovation project is formalized as bi-dimensional: innovativeness (I), competitiveness (K), by each criterion, average values of expert assessments are found in three stages: choice of optimal criteria, setting weight coefficients, making project matrix. Finally, expert assessments enable to find weight coefficients for positioning innovation projects in the matrix.

It is innovativeness which brings an element of uncertainty in the project affecting its cost, and the higher the innovativeness level, the higher uncertainty in costs. Uncertainty of innovation activity suggests that neither acts nor results may be estimated while risk actions are not determined and the result may be predicted in case of a certain set of actions. So, the risk is more subjective: the result of the realizability of a project unfavorable for some parties may be favorable for others. Risk is the uncertainty caused by the probability of occurrence of negative conditions/outcomes in the course of project implementation. Knight (2003) associates business income with

innovations and risk opining that any risk causing profit is a unique uncertainty originating from exercising responsibility function in the last resort.

Respectively, the assessment of risk and uncertainty parameters is the key component in innovation project assessment. As an innovation project is totally non-linear, the interaction of high risk and high opportunities is accounted for in terms of quantity and quality, as opined by Zakiyeva (2012), during investment in innovations, acquiring information, considering innovation project assessment via a set of opportunities.

The study of innovation project risk term (Table 1), which, as the authors opine, from the assessment methodology position, is reasonable to be considered as the result of the impact of factors causing risks on macro/meso/micro-levels being individual for each innovation project.

Some scholars offer innovation project risk assessment guidelines. Vertakova, Simonenko (2008) divide innovation risk assessment methods into quantity-related – statistical, analog, expert (personalistic probability), analogy method and quality-related – rating. Davtyan (2010) systemizes project risks assessment methods into the following groups: analytical (riskless equivalent, discount rate adjustment, expert assessment); statistical (dispersion, variation, correlation, CAPM, etc.); stress-testing (sensitivity analysis, scenario analysis, decision tree); imitation Monte Carlo methods; non-traditional innovation methods (fuzzy sets, artificial neural networks). Under uncertainty of the nature of factors and reasons for risks the nonlinearity of a neural network is important for the assessment of innovation projects risks. Sklyarova (2011) specifies the following criteria for risk identification: source of information about risks, method of receiving information about them, object, while innovations assessment methods are considered traditional financial parameters, statistical, heuristic, expert assessment methods suggesting to do expert assessment of an innovation project by the following factors: demand, novelty of economic activity type, its external environment uncertainty.

It is logical that innovation risks assessment is finalized with the study of their management, as fairly noted by Fatkhutdinov (2013), minimizing innovation risks via economic methods increases the preciseness of risk factors via improvement of communication in the course of management. The most widespread methods of innovation risks management are; insurance, diversification, distribution between project parties, providing for reserves to cover unexpected costs.

Thus, a comprehensive assessment of an innovation project was formed including its assessment from the position of efficiency, competitiveness, innovativeness, uncertainty and riskiness; assessment of respective risks management. As there is no existing uniform methodology for the assessment of an innovation project, corporate management may use the guidelines considered based on personal professional opinion accounting for the operating environment which predetermines the next stage of our research.

### 3.2. Description of methodological instruments development stages for innovation project assessment

As the object of this research, OOO Anda Technology was chosen – the official representative of industrial and investment group Anda Group Pte Ltd with headquarters in Singapore, design centers and production sites in Singapore, China, Korea and Japan; participating in business incubator zone in Zelenograd, Russia.

Innovative activities within the basic type of economic activity are the development and implementation of semiconductor materials processing (silicon) and sapphire for making innovative products in microelectronics, optoelectronics, solar power, nanotechnologies; making innovational, extra bright light emitting diodes, hybrid electric mopeds; innovational methods of semiconductor materials processing; types of innovations: technological, organizational, process, ecological.

Average life cycle of an innovation project is 5 years. Despite the fact that the federal statistical instruments for monitoring innovative activity – form 4 – innovation Information on the innovation activity of the organization is continuously reviewed by the Center for statistics and monitoring of science and innovations as per updated international standards, it does not contain any uniform methodology for the assessment of the realizability of an innovation project. Such an assessment is feasible to be made on the basis of the federal statistical instruments for monitoring innovative activity – Annex A, Tables A.1 - A.3. Regarding the information on implementation of innovation projects there are some difficulties in connection with replies; missing factor (form 4 is based on expert assessment method); joint projects on research and development participated in by the organization are implemented in Russia within the cooperation on particular project basis.

In OOO Anda Technology the core goal is the development of comprehensive science-based projects with elements of innovations. OOO Anda Technology is engaged in joint projects only cooperating within the framework of a particular project. Joining the business incubator by OOO Anda Technology in 2009-2011 facilitated it with the best opportunity regarding innovation projects implementation, services of qualified consultants from other

organizations of the incubator, contacting various suppliers and consumers of science-intensive products and technologies, etc.

The methodological instruments for innovation project assessment are feasible to be divided into the following stages.

Stage 1. Study of the environment of an innovation project, as the success of an innovation project depends on both the state of an organization where it is implemented and its internal characteristics. Innovations should manifest the current situation and their future state which is of special importance for higher level of uncertainty of the national economic, financial and institutional environment compared to developed countries. Therefore, under uncertainty conditions the organizations implementing innovation projects may either lose from any incorrect investment decision or get ahead competitors by gaining a special competitive advantage.

Uncertainty, as mentioned before, is the key characteristic of an innovation project increasing its cost. Accounting for negative impact of particular factors on the innovation activity of OOO Anda Technology seen in form 4 – innovation, rankings of the 1st and 2nd position (Annex A, Table A.4) the following types and kinds of uncertainties are identified (Table 3).

Table 3 - Classification of types and kinds of uncertainty and its factors in OOO Anda Technology

Types/kinds	FACTORS	Yes, no (+, -)
<b>INTERNAL UNCERTAINTY</b>		
Financial	Deficiency of own funds	+
	Insufficiency of own funds negatively affecting innovation products reproduction	-
	Low innovation potential	+
Infrastructural	Underdeveloped innovation infrastructure	+
Intellectual	Missing continuous economic benefit from intellectual property use	+
Information	Lack of information on new technologies	+
	Lack of information on markets	+
	Failure to use all internal information sources	-
	Failure to use all market information sources	-
	Failure to use all institutional information sources	-
	Failure to use all other information sources	+
Project	Delay of innovation projects implementation terms	-
	No innovation projects	-
	Underdeveloped cooperative communications	+
Legal (microlevel)	Insufficiency of laws/regulations governing and stimulating innovation activity	+
HR	Lack of highly qualified HR	-
Intangible	Lack of owned intangibles, patents	+
<b>EXTERNAL UNCERTAINTY</b> caused by negative impact of risk factors in the implementation of the national innovations policy		
Economic	Insufficiency of state funding	-
	Cyclic demand on innovative products/goods/services by respective kind of economic activity	-
	Price-related, caused by high cost on novelties, creating higher risks for investors; inflation	+
	High economic risk	+
	Foreign economic, created by specifics of economic activity development	-
Market		+
Legal (macrolevel)		+

For OOO Anda Technology, on the internal level financial, infrastructural, intellectual, information, project uncertainties are inherent; on the external level those are market and legal.

Skilled choice of projects financing strategy affects the stability of an organization and overall success of an innovation which stresses the importance of the optimal scheme for financing innovation projects for organizations engaged in innovations. The ability to fund innovation projects in some or other form is determined based on the innovation potential of an organization.

The infrastructure of innovations should suggest the development of methods for financial support of innovation projects at all the stages of implementation and evolution. As the key criterion of the viability of a modern

organization is creating values for stakeholders (owners and interested parties), it may be assumed that innovation projects and related divisions should be able to generate value.

Uncertainty on continuous economic benefit from intellectual property use greatly complicates the implementation of strategic innovation activity of an organization.

Limited and/or incorrect information on the terms and conditions of a project, missing reliable information on the future transformed into the distribution of probabilities of various outcomes causes informational uncertainty. Creating good quality database by organizations of various kinds of economic activity and innovation projects is a comprehensive task due to a number of their specific features, the desire of an organization to protect significant information. In that connection, growth of data volume in the process is important, enabling to assess both a particular project and its analogs and improve assessment methods.

Introduction of real options in a project ensures possible adaptation of a project to the changing environment decreasing negative effect of uncertainty to project results. Thus, the process of innovation projects assessment accounts for designed flexibility via the following options – Table 4.

Table 4 - Kinds of real options for OOO Anda Technology

Kinds of options	Characteristic	Yes, no (+,-)
Option created by external uncertainty		+
Option created by internal uncertainty		+
Cut-down option	Opportunity to cut down output not closing the project in case of negative market situation (oil price downturn)	-
Demand uncertainty option	Opportunity to make an operational decision on regulating demand on the innovation market	-
Project commencement delay option	Opportunity to postpone investments in innovations until new information to make a balanced decision	+
Project implementation term option	Opportunity to postpone investments until exact date in the future when investments will start	+
Capital value adjustment option	Opportunity to make an operational decision on the change of project funding strategy	+
Resources change option under constant final product	Opportunity to use alternative resources to obtain final result	+

Growing uncertainty causes the risk of the failure of innovations. Respectively, managing the innovation risks of an organization suggests the assessment of each innovation project planned for implementation accounting for uncertainty factors. So, the uncertainty is transformed into a risk manifested in the probability of unfavorable outcomes occurrence while also admitting a probability of success.

It is obvious that it is possible to identify, assess and control innovation risks on the basis of their correct classification, the core criterion of being innovation activity factors, as mentioned above by the authors (Table 5).

Table 5 - Classification of innovation risks in OOO Anda Technology

Kinds of risks	Characteristic	Yes, no (+,-)
Inflation loss	Inflation factor accounted for by respective adjustment of value parameters (real interest rate has great significance: nominal rate less estimated inflation; high discount rate caused by long implementation, high risks and inability to attract cheap finds into such projects do not contribute to their development); projects are compared from the point of view if insurance from inflation loss	+
Foreign economic	Caused by uncontrolled factors inactively affected by organization	-
Legal		+
Innovation situation risk		+
Effect of other factors of macro- and meso-environment		+
Commercial	Cyclic of demand on innovation products/services provided to organizations of respective economic type	-

Kinds of risks	Characteristic	Yes, no (+,-)
Price		-
Insufficient financing		+
Underfunded R&D	Slows down the development and implementation of technologies and introduction of new products in the market	-
Technological risks of R&D	Caused by technical condition of research, testing and experimental production equipment	-
Insufficient scientific qualification of HR		-
Insufficient patents		+
Long implementation period		-
Operational risks		+
Insufficient market discipline		+
Delayed project commercialization		-
Failure to sell results of innovation project		+

Introduction of such a classification is based upon authors' definition of an innovation risk. So, innovation project risk is of integrated nature, covering the risks typical for the innovation activity of an organization in general and special risks in connection with a particular innovation project. So, innovation project risk is a complex structure made of other risks elements, many-sided in its manifestations, its core characteristic is comprehensiveness. Innovation risk assessment is complicated by the time remoteness of implementation results.

Stage 2 – estimation of parameters taken for project implementation. As a parameter for innovation project success it is feasible to take the autonomy factor of an organization (financial stability index) in financing innovation activity (Annex B, Table B.1), it is also indirectly showing the risk caused by innovation situation which acknowledges its universal nature. The volatility of autonomy factor is shown in Annex B, Tables B.1, 6 (formulae B.1 – B.2).

Within some range of variation, the expected autonomy factor regarding innovation activity funding (73.7%) in OOO Anda Technology means high unacceptable risks. For OOO Anda Technology it is important to make operational decisions aimed at innovation activity financing strategy improvement and change of financial sources structure. Risk management methods may be loss probability minimizing, its coverage, localization of risk sources, control. Some macro/meso/micro-parameters recommended for accounting in the course of project implementation are shown in Annex B, Table B.2.

Stage 3 – implementation of the basic theory of comparative efficiency in the assessment of an innovation project (Table 6). The technical description of the project implemented by OOO Anda Technology on the development and introduction of silicon processing technologies for making innovative products in microelectronics, optoelectronics, solar power is in Annex B, Table B.3.

On the novelty level, the project on the development and introduction of silicon processing technologies for making innovative products in microelectronics, optoelectronics, solar power may be classified as an improving one with the following selection criteria: compliance with the priority directions of innovative development; positive total economic effect from the project within 5 years' term; ability to reproduce the project results on other sites of OOO Anda Technology.

Table 6 - Comparative parameters of innovation project assessment on development and implementation of silicon processing technologies

PARAMETERS	YEAR				CHANGES, %		
	2011	2012	2013	2014	2012 / 2011	2013 / 2011	2014 / 2011
1. Revenue from sale of silicon sheeting, thousand rubles, including	16,146	23,871	33,164	41,259	+ 47.8	+ 105.4	+ 155.5
– polished	16,146	17,293	14,297	10,343	+ 7.1	- 11.5	- 35.9
– lapped	-	6,578	18,867	30,916	-	-	-
2. Cost-price of silicon sheeting, thousand rubles, including	12,086	23,758	29,294	34,582	+ 96.6	+ 142.4	+ 186.1
– polished	12,086	11,497	11,551	9,035	- 4.9	- 4.4	- 25.2
– lapped	-	12,261	17,743	25,547	-	-	-



2.1. Semi-variable tangible costs	8,976	19,547	24,867	29,834	+ 117.8	+ 177.1	+ 232.4
2.2. Semi-variable costs on intellectual labor	295	416	416	553	+ 41.0	+ 41.0	+ 87.5
2.3. Other semi-variable costs	1,718	2,258	2,366	2,518	+ 31.4	+ 37.7	+ 46.6
2.4. Semi-fixed costs	1,097	1,537	1,645	1,677	+ 40.1	+ 50.0	+ 52.9
3. Marginal profit (line 1 – line 2.1 – line 2.2 – line 2.3), thousand rubles	+ 5,157	+ 1,650	+ 5,515	+ 8,354	– 68.0	+ 6.9	+ 62.0
4. Profit from sale of silicon sheeting (line 1 – line 2 or line 3 – line 2.4), thousand rubles	+ 4,060	+ 113	+ 3,870	+ 6,677	– 97.2	– 4.7	+ 64.5
5. Profit tax and other mandatory payments, thousand rubles	–	41	386	1,014	–	–	–
6. Net profit from sale of silicon sheeting (line 4 to 5), thousand rubles	+ 4,060	+ 72	+3,484	+ 5,663	– 98.2	– 14.2	+ 39.5

Comparative assessment of the improved product in 2012-2014 compared to 2011 until its implementation is exercised for the purpose to assess the impact of improving technology on the final result. The comparison shows that revenue from sales, cost of goods sold in 2012-2014 saw an increase as compared to 2011; marginal profit reached the effect in 2013-2014 while profit from sales and net profit – only in 2014. Revenue from silicon sheeting in 2012 comprises polished sheeting: 72.4 %: 27.6 %, in 2013-2014 – lapped – 56.9%: 43.1% and 74.9%: 25.1% respectively (Annex B, Table B.4). In 2012 compared to 2011 there was a decline in marginal profit, profit from sale of silicon sheeting, net profit from sales by 68%, 97.2%, 98.2%; in 2013 compared to 2011 marginal profit grew by 6.9%, while profit from sales of silicon sheeting, net profit from sales declined by 4.7% and 14.2% respectively; in 2014 compared to 2011 the above parameters grew by 62%, 64.5%, 39.5% respectively. Meantime, the parameters describing the financial performance of the project may be used for the assessment of innovation attractiveness of the project.

It is logical to assess the project uncertainty at the 4th stage via its stability. A project is stable if for any scenario it is successful and financially realizable while probable negative consequences are eliminated through the steps provided for the organizational and control mechanism of the project. The level of the stability of the project regarding possible changes of implementation conditions is marked by break-even point while hurdle rate and financial safety margin (risk level) (Annex B, tables B.4).

In 2012, hurdle rate of the innovation project 93.3% while the limiting level of 60% – 70% means insufficient stability of the project to products demand fluctuations at a respective stage; there is some probability of a risk to incur losses in the project. Failure to reach the break-even point means the outflow of the capital of an organization. In 2013-2014, the situation is changing the other way round, there is a significant gap between break-even point and revenue (both total and by each kind of project), hurdle rate does not exceed 30%, which features the stability of the project. Break-even point in 2012-2014 declined by 62.7%, including for polished silicon sheeting by 87.1%, while it grew for lapped sheeting by 1.1 % (Annex B, Table B. 4). High financial safety margin, namely 70.1% – 79.9% in 2013-2014 as compared to 6.7% in 2012 acknowledges that there is some reserve for revenue decrease while profitability remains.

The final assessment stage is formulation of motivated conclusion on innovation project situation by the employees taking part in innovation activity.

#### 4. Results and discussion

- In the theoretical field of research:
  - innovation project notion was interpreted as a discrete aggregate of innovation resources, innovations and particular practice the key objective of which is successful implementation of innovation activity;
  - difference between an innovation project and investment innovation project was formulated by the following key criteria: level of novelty and required financial investments reduced to the following: an innovation project adapted for investment requirements is an investment innovation project while an investment project to some extent may include an element of innovativeness; in the positive course of development an innovation project transforms into an investment innovation project and further into an investment project;
  - representations on the classification of innovation project kinds were generalized and developed under the following criteria: decision making level; specific; final; intermediary; oriented at existing needs and

- creation of new needs; volume of tasks solved; length and it was reasoned that each business entity may use own classification of an innovation project meeting its requirements;
- innovation project risk notion was interpreted which, from the standpoint of assessment methodology is feasible to be considered as a result of the impact of factors causing risks on macro/meso/micro-levels individual for each innovation project;
  - innovation project risk was proved to be of integrated nature, combining the risk typical for the innovation activity of an organization in general and special risks attributable to an innovation project only; innovation project risk is a complex structure of other risks' elements, many-sided in its manifestations, the core feature is comprehensiveness.
- In the analytical field of research:
    - using synthesis, detailization and generalization, grouping, formalization, abstract logical, expertise methods the types/kinds of uncertainties, risks and organizational risk factors were identified;
    - universal autonomy factor (financial stability) of an organization was introduced as the index of success of innovation projects together with risk parameter determined by the innovation situation via the realization of economic and statistical methods; the studied organization has high variation of 73.7%;
    - break-even analysis methods were developed in connection with project stability via estimation of hurdle rate and financial safety margin (risk level); in 2013-2014 hurdle rate is 29.9-20.1%, financial safety margin – 70.1-79.9% respectively.
  - In the methodological field of research:
    - it was reasoned that innovation project assessment methods should be independent while innovation project efficiency assessment methods are reasonable to be applied at the stage of transformation of an innovation project into an investment and innovation project and further into an investment project; assessment of investments in innovations is possible, including via various financial sources;
    - methodical approaches to innovation project assessment were systemized and described from the standpoint of efficiency, competitiveness, innovativeness, uncertainty and riskiness; respective risks management methods making its comprehensive assessment;
    - methodological instruments for assessment of an innovation project was developed comprising the following stages: 1) study of the environment of an innovation project, 2) estimation of parameters taken for project implementation, 3) implementation of the basic theory of comparative efficiency in the assessment of an innovation project, 4) assessment of project uncertainty via its stability, 5) formulation of motivated conclusion on innovation project situation by the employees taking part in innovation activity;
    - the approach based on the innovation stability of an innovation project was rationalized and implemented in practice of a commercial organization aimed at both stability assessment and break-even analysis of the implementing entity, which in absolute values in 2012-2014 declined by 62.7%, while by the relative parameter there was a decline by 78.5%; financial safety margin grew by 1,092.5% with sharp growth in the 2nd year of innovation project implementation.

Innovation project stability assessment results are shown in Table 7.

Table 7 - Parameters describing stability level of innovation project on development and implementation of silicon processing technologies

PARAMETERS	Year			CHANGE, %
	2012	2013	2014	
1. Break-even point, thousand rubles	22,276.0	9,910.0	8,302.0	- 62.7
– polished	16,128.0	4,271.0	2,084.0	- 87.1
– lapped	6,148.0	5,639.0	6,218.0	+ 1.1
2. Hurdle rate, %	93.3	29.9	20.1	- 78.5
3. Financial safety margin, %	6.7	70.1	79.9	+ 1,092.5

It should be noted that break-even point analysis connects pricing and production output tasks with the existing effective market demand. So the approach offered for innovation project assessment integrates expert, economic and statistical, financial analysis, real options, comparative efficiency, and the assessment of innovative sensibility.

Mamiy and Baiburtyan (2011) state that methods for innovation project risk assessment in connection with investments in innovation activity synthesize economic/statistical, expert methods (cost-volume-profit analysis, etc.). It should be noted that the analysis of cost-volume-profit chain allows assess an organization in general and an innovation project from the standpoint of stability via various modifications: generalized assessment of project stability in general, through its parties, through break-even point. The practical significance of a methodology assesses the following: 1) level of innovation project stability; 2) break-even point of an organization.

## Conclusion

So, the conducted research may be developed in the following: formulation of updated methodological instruments for assessment of innovation project under uncertainty and risk conditions; development of uniform national methodology of innovation project assessment; considering at the state level of the opportunity to include innovation project assessment in the federal statistical instruments for monitoring innovative activity; implementation of other approaches to innovation project assessment from the perspective of efficiency and competitiveness accounting for the specifics and environment of an organization.

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## Predicting Bankruptcy using Multi Discriminant Analysis in Sugar Industry

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### Abstract:

*The study is about examining and predicting the financial health of sugar industry using multi discriminant analysis. The study has taken a sample of 27 sugar companies and data for eleven years 2005-2015 is taken from the financial statements of the companies. It is found that out of 27 sample companies none are in safe zone, 6 companies are in grey zone and 21 companies are in the red zone or distress as far as financial health is concerned. This is the true reflection of the sugar industry today which is bogged down by plethora of problems like high cost of procurement and low realization towards final product which resulted in the companies into distress.*

**Keywords:** financial distress, multi discriminant analysis, bankruptcy, Altman Z score, sugar industry.

**JEL Classification:** G 33.

### 2. Introduction

India is an agrarian economy and is the second largest producer of sugar in the world contributing to 15% of the world's sugar production (2014-15). Brazil being the largest producer of sugar, contributes 22% to the total world sugar production. Indian sugar industry has a capital investment of about Rs. 12,500 million (US\$ 190 million), employs around 0.5 million skilled and semi skilled employees directly and supports about 50 million sugar cane growing farmers. The annual turnover of the industry is estimated to be around Rs. 410,000 million (US\$ 6,212 million) as of 2015. India produces about 300 to 350 million metric tons of sugarcane and produces 24 to 26 million metric tons of sugar. Maharashtra, Uttar Pradesh and Karnataka are three top sugar producing states in the country contributing to about 75% of the production.

Sugar cane is the raw material used in sugar industry in India. Sugar cane is perishable and cannot be transported over a long distance. Hence, most sugar producing factories are located close to the sugar cane growing areas. The industry suffers from some peculiar problems. In India the price of sugar cane procured from farmers are fixed by the government which the sugar companies are bound to pay. However, the sugar prices are market driven and determined by the international prices. Indian sugar companies find it extremely difficult to export sugar and compete in the international markets. This is because of increased supply of sugar by the world leader Brazil coupled with the falling Brazilian currency Real, which has brought down the international prices of sugar. The other problems which the industry faces are low yield of sugar cane (65-70 tons per hectare compared to 90 tons in Java), short crushing season of 4 to 7 months keeping the sugar mills idle for the rest of the year, fluctuating production trends, low rate of recovery (10% as against 14-16% in Australia), high cost of production, small and uneconomical size of mills with outdated machinery. These resulted in decreasing profitability and worsening working capital situation in the sugar industry. This gave the researchers impetus to do research on understanding the financial situation in sugar industry using multi discriminant analysis the Altman's Z score.

Bankruptcy prediction and understanding the company's financial situation is very useful from various perspectives. Early detection can help shareholders reduce losses by taking corrective steps, banks and financial institutions to assess and take better decisions in extending credit facilities and mitigate risk and most importantly companies in early detection to rectify their financial position.

### 3. Review of literature

Bankruptcy and bankruptcy prediction has been well researched by the researchers in the past and have developed many models like multi discriminant analysis, logit and neural networks. The review of literature shows a majority of bankruptcy prediction studies employed multi discriminant Analysis (Altman 1984, Charitou *et al.* 2004)

Altman (1968) was the first researcher to predict financial distress using multivariate discriminant analysis. The research employed 22 financial ratios to compare between 33 failed companies and 33 successful companies. Altman used multivariate discriminant analysis to develop a model to predict bankruptcy; namely, the Z-score model which predicts bankruptcy if the company's score fell within a certain range. The results showed that five ratios, namely, working capital to total assets, retained earnings to total assets, profit before interest and tax to total assets, market value of equity to book value of total debt and sales to total assets can predict financial failure up to 95% in the first year, and then the prediction rate decreases to 36% in the fifth year before the failure.

Altman (2002) re-examined Altman (1968) during the period 1969-1975, 1976-1995, and during the period 1997-1999. The study concluded that the accuracy of the discriminant model ranges from 82% to 94% in the first year before financial distress, while in the second year the accuracy of the model decreases to a range between 68% and 75%.

Hazem B Al Khatib and Alaa Al Hazane (2013) examine the role of financial ratios in predicting financial distress of publicly listed companies in Jordan. The researcher made a comparison between logistic regression model and discriminant analysis to predict financial distress. Their study concludes that both logistic regression and discriminant analysis are equally predictive in financial distress. As per their study Return on Investment and Return on Equity are the most important ratios which determine the financial health of a company and result in financial distress.

Mohammed Ahmed Al Saleh and Ahmed Mohammad Al Kandari (2012) in their study have predicted financial distress in banks in Kuwait using discriminant analysis and logistic regression. The relationship between financial ratios and distress of banks is calculated. The research predicted the banks in bad financial condition which have high probability of distress.

Khalid Alkhatib and Ahmed Equab Al Bzour (2011) examined the bankruptcy prediction to non-financial service and industrial companies using Altman Z score and Kida model. The results of the two models were compared by the researchers. The researchers found that the Altman model had an advantage over Kida model in predicting bankruptcy with 93.8% predictive ability of 5 years prior to liquidation compared with Kida model which had 69% predictability.

Ying Wang and Michael Campbell (2010) in their study test the accuracy of Altman Z score model in predicting bankruptcy. Altman's Z score was compared with the recalculated score given by Boritz *et al.* (2007) and Taffler (1983) using matched pair technique. The study finds that Taffler model is better in predictability than Altman's Z score and Altman's revisited model by Boritz.

Jim Langabeer (2006) used Altman Z Score a multi discriminant analysis tool to predict the bankruptcy of hospitals. The researcher found that the most important reason for bankruptcy is heavy debt financing used by companies which will eventually push them into bankruptcy in the long run.

#### 4. Methodology

For the purpose of this study 27 sample sugar companies are selected. The financial ratios data of 11 years starting 2005-2015 is taken from the financial statements of the companies. The sample is restricted to Indian sugar companies. The objective of the study is to examine the financial health of the sugar industry by using multi discriminant analysis given by Altman's Z score.

##### Altman's Z score

Z score model was developed in 1968 by Edward I. Altman a New York University Professor who was the first in predicting corporate bankruptcy by using financial ratios. This Z score model builds on the interrelationships of many different aspects, similar to that of a balanced scorecard, and calculates an index or score for each company based on the independent variables. Out of the 22 variables, five were selected for being the most useful in predicting corporate bankruptcy. The criteria for selecting the variables were:

- the amount of help that each independent variable is able to provide in the discrimination of the two groups
- the presence of relationships (correlation) between the variables
- the accuracy of the predictions by different combinations of variables

The final discriminant function is as follows:

$$Z = 0.012X_1 + 0.014X_2 + 0.033X_3 + 0.006X_4 + 0.999X_5$$

where: X1 = Working capital/ total assets; X2 = retained earnings/ total assets; X3 = earnings before interests and taxes/ total assets; X4 = market value of equity/ book value of total debt; X5 = sales / total assets; Z = Z Score.

The criteria used to interpret Altman's z score are as follows:

- Z > 2.7 Safe zone (the firm is not at risk of financial distress)
- Z < 1.81 Distress zone (the firm will likely to go bankrupt)
- Z between 1.81 and 2.7 Grey zone (the firm is at risk of financial distress)

Altman's Z- score model, although initially was used as a bankruptcy predictor but later played a major role in the substantial recovery of businesses from near failure by predicting the bankruptcy early.

#### Data analysis and findings

A sample of 27 sugar companies is selected and Z score is calculated using each of the five ratios given by Altman.

Table 1- Table showing Working Capital / Total Assets of sample sugar companies (2005-2015)

S No.	List of Sample Companies	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	BalrampurChini Mills Ltd	0.23	0.06	0.08	0.17	0.09	0.41	0.41	0.36	0.35	0.28	0.35
2	Bajaj Hindustan	0.03	0.13	0.20	0.28	0.31	0.18	0.15	0.26	0.11	0.11	0.15
3	Renuka Sugar Mills Ltd	0.15	0.27	0.24	0.17	0.28	0.06	0.17	0.17	0.06	0.07	0.04
4	Eid Parry Ltd	0.13	0.15	0.21	0.27	0.25	0.29	0.27	0.28	0.25	0.21	0.24
5	Dhampur Sugar Ltd	0.27	0.18	0.05	0.21	0.11	0.18	0.18	0.21	0.30	0.16	0.23
6	Oudh Sugar Mills Ltd	0.40	0.27	0.12	0.25	0.13	0.25	0.21	0.29	0.27	0.30	0.24
7	DCM Shriram Industries Ltd.	0.27	0.20	0.22	0.26	0.23	0.23	0.24	0.25	0.29	0.18	0.28
8	Dalmia Bharat Sugar & Ind Ltd	0.06	0.04	-0.01	0.06	0.05	0.11	0.34	0.36	0.31	0.24	0.28
9	Dwarikesh Sugar Industries Ltd	0.08	0.10	0.04	0.16	0.07	0.10	0.16	0.21	0.09	0.30	0.30
10	Bannari Amman Sugar Ind. Ltd	0.26	0.24	0.25	0.35	0.25	0.13	0.34	0.38	0.41	0.49	0.50
11	Upper Ganges Sugar Ltd	0.38	0.25	0.14	0.23	0.14	0.22	0.26	0.27	0.26	0.30	0.23
12	Uttam Sugar Mills Ltd	0.10	0.20	0.03	0.06	0.28	0.28	0.29	0.27	0.30	0.28	*
13	Rana Sugars Ltd	0.41	0.32	0.09	0.14	0.33	0.33	0.30	0.33	0.34	0.39	0.37
14	Ugar Sugar Works Ltd	0.43	0.39	0.27	0.29	0.28	0.37	0.37	0.34	0.45	0.27	0.15
15	Sir ShadiLal Sugar Ltd	0.57	0.58	0.64	0.46	0.51	0.48	0.55	0.48	0.42	0.19	0.26
16	KCP Sugar Industries Ltd	0.16	0.15	0.07	0.19	0.21	0.18	0.30	0.33	0.28	0.36	0.36
17	Dharani Sugars Ltd	0.39	0.42	0.38	0.34	0.26	0.18	0.13	0.19	0.18	0.18	0.15
18	Piccadilly Agro Industries Ltd	0.19	0.18	0.20	0.15	0.12	0.23	0.22	0.23	0.18	0.06	0.04
19	Piccadilly Sugar Ltd	-0.10	-0.15	-0.30	-0.54	-0.68	-0.80	-0.59	-0.38	-0.36	-0.29	-0.27
20	ThiruArooran Sugar Mills Ltd	0.11	0.16	0.04	0.06	0.19	0.22	0.06	0.06	0.06	0.23	0.24
21	Gayatri Sugars Ltd	0.38	0.40	0.36	0.33	0.30	0.32	0.14	0.04	0.00	0.01	-0.10

22	Empee Sugars Ltd	0.35	0.40	0.29	0.28	0.25	0.08	0.11	0.12	0.12	0.11	-0.08
23	KM Sugar Mills Ltd	0.38	0.37	0.14	0.20	0.22	0.24	0.26	0.19	0.42	0.30	0.30
24	Riga Sugar Company Ltd	0.29	0.27	0.17	0.25	0.24	0.24	0.24	0.13	0.13	0.13	-0.02
25	Girdharilal Sugar & Allied Industries Ltd	0.43	0.55	0.45	0.38	0.88	0.97	0.98	0.97	0.98	0.14	0.16
26	Rajshree Sugar & Chemicals Ltd	0.12	0.11	0.15	-0.01	0.08	0.20	0.17	0.10	0.10	0.15	0.16
27	Kesar Enterprises Ltd	0.29	0.37	0.29	0.45	0.39	0.64	0.50	-0.16	-0.06	-0.38	*

Source: Calculated from Annual Reports of the company

Note: \* These two companies close their books on 31 Dec. Hence the audited financial data for 2015 is not available at the time of writing this article.

Table 1 is the measure of Working Capital to Total Assets. It is a measure of net liquid assets relative to its total capitalization. Working capital is defined as the amount of current assets less current liabilities. The current assets of a firm include cash on hand, accounts receivable, and inventories; the latter two assets are considered current, if cash conversion is expected within an operating cycle of a business. Current liabilities consist of the firm's financial obligations-short-term debt and accounts payable - which will be met during the operating cycle. A positive working capital indicates a firm's ability to pay its bills and negative working capital the firm will experience difficulty in meeting its obligations. It is the amount of net current assets that a company has to meet current debts and take advantage of purchase discounts and profitable short term investments. This ratio was regarded by Altman as being more important as compared to liquidity ratios like current ratio and the quick ratio (Altman 2000, Chuvakhin and Gertmanian 2003). It is observed from Table 1 the ratio of working capital to total assets ranges from highest being 0.50 and the lowest being in negative in the sample. Generally, it is observed that this ratio is high in all the companies probably because of the nature of the sugar industry is such that the investment in current assets in quite high as the procurement of raw material is seasonal in this industry.

Table 2 - Table showing Retained Earnings / Total Assets of sample sugar companies (2005-2015)

No.	List of Sample Companies	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	BalrampurChini Mills Ltd	0.38	0.46	0.30	0.35	0.43	0.33	0.33	0.28	0.30	0.29	0.28
2	Bajaj Hindustan	0.47	0.40	0.26	0.23	0.34	0.28	0.30	0.38	0.19	0.19	0.14
3	Renuka Sugar Mills Ltd	0.17	0.35	0.33	0.37	0.36	0.18	0.12	0.12	0.09	-0.04	-0.21
4	Eid Parry Ltd	0.31	0.28	0.30	0.25	0.24	0.26	0.26	0.22	0.19	0.21	0.17
5	Dhampur Sugar Ltd	0.10	0.40	0.24	0.24	0.24	0.22	0.22	0.20	0.15	0.12	0.10
6	Oudh Sugar Mills Ltd	0.18	0.26	0.12	0.08	0.12	0.04	0.00	-0.04	-0.01	-0.04	-0.09
7	DCM Shriram Industries Ltd.	0.16	0.23	0.21	0.18	0.21	0.23	0.22	0.18	0.18	0.20	0.19
8	Dalmia Bharat Sugar and Ind Ltd	0.24	0.23	0.28	0.31	0.27	0.26	0.31	0.28	0.26	0.25	0.23
9	Dwarikesh Sugar Industries Ltd	0.33	0.38	0.16	0.12	0.16	0.15	0.16	0.11	0.10	0.05	0.05
10	Bannari Amman Sugar Ind. Ltd	0.30	0.41	0.49	0.41	0.52	0.55	0.47	0.51	0.54	0.41	0.38
11	Upper Ganges Sugar Ltd	0.21	0.27	0.20	0.15	0.18	0.11	0.10	0.07	0.06	0.04	-0.01
12	Uttam Sugar Mills Ltd	0.17	0.36	0.26	0.15	0.07	0.07	0.08	0.01	0.03	-0.02	*
13	Rana Sugars Ltd	0.27	0.28	0.18	0.11	0.11	0.11	0.08	0.05	0.05	0.03	-0.01
14	Ugar Sugar Works Ltd	0.20	0.13	0.09	0.12	0.17	0.12	0.13	0.14	0.16	0.12	0.11



No.	List of Sample Companies	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
15	Sir ShadiLal Sugar Ltd	0.52	0.57	0.50	0.18	0.17	0.22	0.17	0.06	0.04	-0.07	-0.23
16	KCP Sugar Industries Ltd	0.29	0.41	0.42	0.43	0.47	0.51	0.41	0.43	0.50	0.46	0.44
17	Dharani Sugars Ltd	0.01	0.04	0.11	0.08	0.05	0.07	0.13	0.13	0.12	0.07	-0.01
18	Piccadilly Agro Industries Ltd	0.09	0.10	0.07	0.07	0.15	0.18	0.23	0.25	0.28	0.32	0.31
19	Piccadilly Sugar Ltd	-0.85	-0.58	-0.50	-0.59	-0.73	-0.70	-0.30	-0.14	-0.17	-0.17	-0.18
20	ThiruArooran Sugar Mills Ltd	0.14	0.17	0.17	0.21	0.17	0.20	0.24	0.24	0.21	0.15	0.12
21	Gayatri Sugars Ltd	-0.27	-0.18	-0.12	-0.17	-0.29	-0.34	-0.02	-0.09	-0.12	-0.19	-0.43
22	Empee Sugars Ltd	-0.27	-0.09	-0.07	-0.05	-0.03	-0.01	-0.09	-0.12	-0.12	-0.19	-0.97
23	KM Sugar Mills Ltd	0.19	0.35	0.12	0.05	0.09	-0.03	-0.11	-0.19	-0.05	0.00	0.00
24	Riga Sugar Company Ltd	0.13	0.16	0.07	0.09	0.11	0.06	0.06	0.04	0.03	0.02	-0.01
25	Girdharilal Sugar & Allied Industries Ltd	-0.43	-0.41	-0.48	-0.05	0.22	0.23	0.29	0.30	0.30	-0.15	-0.10
26	Rajshree Sugar & Chemicals Ltd	0.18	0.21	0.17	0.13	0.14	0.17	0.12	0.10	0.11	0.08	0.03
27	Kesar Enterprises Ltd	0.19	0.20	0.10	0.10	0.12	0.06	0.09	0.01	-0.01	-0.21	*

Source: Calculated from Annual Reports of the company

Note: \* These two companies close their books on 31 Dec. Hence the audited financial data for 2015 is not available at the time of writing this article.

Table 2 indicates the ratio of retained earnings to total assets. Retained earnings to total assets are a measure of cumulative profitability reflecting the earning capacity of a company. A history of profitable operations and reduced debt is signified by firms that retain earnings or reinvest operational profits. Retained earnings generally consist of a company's cumulative net income less any net losses and dividends declared. This ratio indicates the leverage of a firm i.e. the extent to which liabilities is used to purchase assets. Those firms with high retained earnings relative to total assets have lower financial leverage will have less risk of bankruptcy. A new company will have a lower ratio as it has less accumulated earnings and the chances of bankruptcy for a new firm are higher. According to Dun and Bradstreet, 50% of businesses fail within the first five years of operation (Altman 2000, 2002). Table 2 shows that there is a decreasing trend in the retained earnings and the situation of majority of companies has been bad like Renuka Sugar Mills Ltd, Oudh Sugar Mills Ltd, Upper Ganges Sugar Ltd, Rana Sugars Ltd, Sir ShadiLal Sugar Ltd, Dharani Sugars Ltd, Piccadilly Sugar Ltd, Gayatri Sugars Ltd, Empee Sugars Ltd, Girdharilal Sugar & Allied Industries Ltd and Kesar Enterprises Ltd. The situation may drag all these companies into bankruptcy if the profits are low year on year.

Table 3 - Table showing EBIT / Total Assets of sample sugar companies (2005-2015)

No.	List of Sample Companies	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	BalrampurChini Mills Ltd	0.15	0.21	0.01	0.08	0.13	0.05	0.05	0.04	0.08	0.03	0.01
2	Bajaj Hindustan	0.14	0.10	0.03	0.02	0.08	0.04	0.06	0.03	-0.01	-0.01	-0.02
3	Renuka Sugar Mills Ltd	0.23	0.20	0.10	0.12	0.10	0.09	0.03	0.03	0.02	-0.05	-0.10
4	Eid Parry Ltd	0.14	0.12	0.13	0.09	0.27	0.14	0.12	0.10	0.07	0.07	0.07
5	Dhampur Sugar Ltd	0.16	0.19	-0.02	0.04	0.08	0.03	0.03	0.06	0.06	0.03	0.03
6	Oudh Sugar Mills Ltd	0.11	0.20	-0.02	0.06	0.08	-0.03	0.03	0.04	0.07	0.03	0.01

No.	List of Sample Companies	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
7	DCM Shriram Industries Ltd.	0.11	0.14	0.04	0.03	0.11	0.10	0.03	0.02	0.07	0.09	0.05
8	Dalmia Bharat Sugar & Ind Ltd	0.05	0.09	0.15	0.16	0.09	0.08	0.04	0.03	0.05	0.05	0.04
9	Dwarikesh Sugar Industries Ltd	0.19	0.10	0.01	0.02	0.12	0.04	0.06	0.07	0.05	0.02	0.02
10	Bannari Amman Sugar Ind. Ltd	0.10	0.16	0.14	0.04	0.14	0.17	0.05	0.10	0.13	0.04	0.04
11	Upper Ganges Sugar Ltd	0.11	0.18	-0.05	0.03	0.08	-0.01	0.06	0.03	0.06	0.03	-0.02
12	Uttam Sugar Mills Ltd	0.20	0.09	0.01	-0.02	0.01	0.01	0.05	-0.02	0.06	0.01	*
13	Rana Sugars Ltd	0.14	0.10	0.02	-0.01	0.06	0.06	0.03	0.05	0.06	0.04	0.00
14	Ugar Sugar Works Ltd	0.10	0.06	0.02	0.07	0.09	-0.01	0.05	0.09	0.07	0.01	0.01
15	Sir ShadiLal Sugar Ltd	0.21	0.20	0.03	-0.08	0.06	0.08	0.00	-0.08	0.04	-0.10	-0.11
16	KCP Sugar Industries Ltd	0.24	0.31	0.11	0.04	0.07	0.12	0.04	0.09	0.15	0.08	-0.05
17	Dharani Sugars Ltd	0.06	0.16	0.17	0.00	0.09	0.11	0.10	0.09	0.08	0.03	-0.02
18	Piccadilly Agro Industries Ltd	0.05	0.04	0.02	0.03	0.11	0.15	0.22	0.12	0.14	0.13	0.07
19	Piccadilly Sugar Ltd	0.09	0.02	0.01	0.02	0.02	0.08	0.07	0.12	-0.03	0.01	0.00
20	ThiruArooran Sugar Mills Ltd	0.10	0.11	0.02	0.08	0.17	0.06	0.03	0.03	0.05	0.04	-0.01
21	Gayatri Sugars Ltd	0.13	0.15	0.06	0.01	-0.02	0.04	0.04	0.04	0.03	0.00	-0.14
22	Empee Sugars Ltd	0.15	0.18	0.05	0.05	0.02	0.01	0.05	0.01	0.01	0.00	-0.36
23	KM Sugar Mills Ltd	0.12	0.14	-0.09	0.00	0.10	-0.08	0.03	0.08	0.16	0.04	0.04
24	Riga Sugar Company Ltd	0.08	0.11	-0.03	0.05	0.08	0.02	0.02	0.03	0.04	0.03	0.00
25	Girdharilal Sugar & Allied Industries Ltd	0.37	0.04	-0.01	0.68	0.54	0.06	0.05	0.03	0.00	-0.03	0.07
26	Rajshree Sugar & Chemicals Ltd	0.11	0.18	0.09	0.02	0.09	0.15	0.01	0.06	0.09	0.03	-0.01
27	Kesar Enterprises Ltd	0.16	0.14	-0.03	0.05	0.09	0.06	0.07	0.00	0.02	-0.10	*

Source: Calculated from Annual Reports of the company

Note: \* These two companies close their books on 31 Dec. Hence the audited financial data for 2015 is not available at the time of writing this article.

Table 3 shows the ratio of EBIT to Total Assets. This ratio is a measure of an organization's operating efficiency without consideration of tax and leverage factors which is a true depiction of asset production. This ratio estimates the cash supply available for allocation to creditors, the government, and shareholders. Altman (2000) classifies the ratio as a superior measure of profitability that is better than cash flow. Table 3 shows that the earnings to total assets has been bad for companies like Bajaj Hindustan, Renuka Sugar Mills Ltd, Oudh Sugar Mills Ltd, Uttam Sugar Mills Ltd, Rana Sugars Ltd, Sir ShadiLal Sugar Ltd, Piccadilly Sugar Ltd, ThiruArooran Sugar Mills Ltd, Gayatri Sugars Ltd, Empee Sugars Ltd, Rajshree Sugar & Chemicals Ltd and Kesar Enterprises Ltd.

Table 4 - Table showing Market value of equity / Book value of liabilities of sample sugar companies (2005-2015)

No.	List of Sample Companies	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	BalrampurChini Mills Ltd	2.17	2.49	0.98	1.12	2.11	0.84	0.70	0.46	0.36	0.46	0.43
2	Bajaj Hindustan	3.63	2.25	0.60	0.32	0.76	0.32	0.12	0.29	0.19	0.10	0.11
3	Renuka Sugar Mills Ltd	1.93	2.97	2.15	2.19	2.44	0.57	0.33	0.15	0.10	0.10	0.09
4	Eid Parry Ltd	3.81	1.45	0.55	0.50	0.24	0.56	0.58	0.38	0.26	0.26	0.29
5	Dhampur Sugar Ltd	0.99	1.09	0.29	0.23	0.41	0.22	0.22	0.14	0.10	0.10	0.08
6	Oudh Sugar Mills Ltd	0.44	0.71	0.17	0.10	0.16	0.09	0.07	0.04	0.03	0.03	0.03
7	DCM Shriram Industries Ltd.	0.22	0.69	0.19	0.34	0.15	0.26	0.19	0.09	0.09	0.12	0.16
8	Dalmia Bharat Sugar & Ind Ltd	0.37	0.93	0.90	0.97	0.19	0.55	0.22	0.10	0.10	0.10	0.10
9	Dwarikesh Sugar Industries Ltd	1.85	0.90	0.16	0.15	0.28	0.26	0.12	0.11	0.04	0.07	0.03
10	Bannari Amman Sugar Ind. Ltd	1.13	3.51	1.59	1.54	1.59	1.90	0.85	0.84	1.29	0.71	0.61
11	Upper Ganges Sugar Ltd	0.50	0.49	0.19	0.12	0.15	0.09	0.10	0.06	0.04	0.03	0.04
12	Uttam Sugar Mills Ltd	7.26	1.57	0.50	0.20	0.13	0.12	0.11	0.06	0.05	0.05	*
13	Rana Sugars Ltd	1.10	1.18	0.13	0.14	0.14	0.26	0.11	0.06	0.04	0.03	0.03
14	Ugar Sugar Works Ltd	1.06	0.55	0.20	0.29	0.36	0.33	0.34	0.23	0.21	0.23	0.16
15	Sir ShadiLal Sugar Ltd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	KCP Sugar Industries Ltd	0.10	1.24	1.13	1.12	0.97	1.67	0.83	0.71	1.02	0.83	0.85
17	Dharani Sugars Ltd	0.19	0.75	0.34	0.25	0.10	0.14	0.19	0.12	0.12	0.09	0.05
18	Piccadilly Agro Industries Ltd	0.27	0.16	0.08	0.12	0.15	0.44	0.58	0.26	0.25	0.56	0.43
19	Piccadilly Sugar Ltd	0.73	0.30	0.17	0.31	0.60	0.47	0.52	0.35	0.40	0.28	0.29
20	ThiruArooran Sugar Mills Ltd	0.41	0.53	0.31	0.36	0.31	0.40	0.27	0.22	0.14	0.04	0.02
21	Gayatri Sugars Ltd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	Empee Sugars Ltd	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.09	0.03	0.02	0.02
23	KM Sugar Mills Ltd	0.26	1.12	0.30	0.19	0.31	0.48	0.17	0.21	0.08	0.22	0.06
24	Riga Sugar Company Ltd	0.21	0.43	0.10	0.10	0.20	0.07	0.07	0.05	0.09	0.05	0.03
25	Girdharilal Sugar & Allied Industries Ltd	0.00	0.00	0.00	0.00	0.00	0.00	38.94	28.58	40.16	0.30	0.06
26	Rajshree Sugar & Chemicals Ltd	5.53	1.87	0.39	0.26	0.18	0.18	0.19	0.11	0.13	0.07	0.06
27	Kesar Enterprises Ltd	0.40	0.16	0.21	0.16	0.19	0.11	0.12	0.04	0.03	0.03	*

Source: Calculated from Annual Reports of the company

Note: \* These two companies close their books on 31 Dec. Hence the audited financial data for 2015 is not available at the time of writing this article.

Table 4 is the ratio of Market value of equity to book value of total debt. Equity is the total market value of all the ordinary and preferred stocks owned by the firm. This ratio shows the amount that the firm's assets can decrease in value before the assets drop below liabilities and the firm becomes insolvent.

The stock market is the primary estimator of a firm's worth suggests that price changes may predict pending problems if a firm's liabilities exceed its assets. Altman believes this ratio is a more effective financial distress predictor than net worth/total debt (Altman 2000). It is observed from table 4 that the financial health of majority of

sugar companies is poor and the probability of bankruptcy is higher. The companies are required either to increase their market value of equity or decrease book value of debt.

Table 5 - Table showing Sales / Total Assets of sample sugar companies (2005-2015)

No.	List of Sample Companies	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	BalrampurChini Mills Ltd	0.66	0.99	0.50	0.51	0.64	0.38	0.38	0.54	0.76	0.64	0.76
2	Bajaj Hindustan	0.65	0.42	0.31	0.30	0.24	0.26	0.48	0.40	0.26	0.26	0.36
3	Renuka Sugar Mills Ltd	2.27	1.37	0.76	1.00	0.69	0.60	0.40	0.40	0.64	0.86	0.88
4	Eid Parry Ltd	1.22	1.17	0.92	1.10	1.54	1.07	1.09	1.13	0.91	1.04	1.08
5	Dhampur Sugar Ltd	1.09	1.01	0.42	0.43	0.53	0.58	0.58	0.72	0.54	0.67	0.57
6	Oudh Sugar Mills Ltd	0.83	1.13	0.62	0.32	0.55	0.45	0.76	0.75	0.56	0.63	0.83
7	DCM Shriram Industries Ltd.	0.96	1.35	1.07	0.82	1.10	1.03	1.11	1.08	1.16	1.37	1.30
8	Dalmia Bharat Sugar & Ind Ltd	0.48	0.40	0.41	0.43	0.39	0.43	0.50	0.48	0.60	0.69	0.61
9	Dwarikesh Sugar Industries Ltd	0.67	0.66	0.30	0.31	0.60	0.69	0.91	0.82	1.22	0.52	0.52
10	Bannari Amman Sugar Ind. Ltd	0.71	0.95	0.96	0.50	0.67	0.71	0.55	0.76	0.78	0.29	0.38
11	Upper Ganges Sugar Ltd	1.01	1.20	0.50	0.38	0.62	0.51	0.90	0.91	0.47	0.68	0.76
12	Uttam Sugar Mills Ltd	0.78	0.40	0.44	0.46	0.21	0.21	0.65	0.63	0.48	0.72	*
13	Rana Sugars Ltd	0.60	0.39	0.31	0.24	0.32	0.32	0.73	0.47	0.56	0.48	0.53
14	Ugar Sugar Works Ltd	1.42	1.00	0.29	0.78	0.74	0.71	1.21	0.98	1.09	1.04	1.00
15	Sir ShadiLal Sugar Ltd	1.62	1.48	1.11	0.43	0.79	1.12	0.91	0.97	1.10	1.27	1.59
16	KCP Sugar Industries Ltd	0.95	1.14	0.90	0.71	0.60	0.80	0.50	0.77	0.99	0.70	0.86
17	Dharani Sugars Ltd	0.52	1.47	1.17	0.85	0.42	0.57	1.34	0.87	0.70	0.62	0.44
18	Piccadilly Agro Industries Ltd	0.66	0.36	0.46	0.66	1.00	1.06	1.01	0.90	1.11	1.21	1.00
19	Piccadilly Sugar Ltd	1.04	0.75	0.94	1.30	0.91	0.73	0.58	0.55	0.43	0.30	0.27
20	ThiruArooran Sugar Mills Ltd	0.68	0.61	0.86	0.85	0.84	0.69	0.55	0.55	0.56	0.25	0.29
21	Gayatri Sugars Ltd	0.73	0.84	0.64	0.40	0.53	0.45	0.39	0.86	0.62	0.64	0.80
22	Empee Sugars Ltd	1.41	1.41	0.61	0.48	0.19	0.08	0.53	0.23	0.23	0.35	0.27
23	KM Sugar Mills Ltd	1.43	2.98	0.67	1.47	0.95	1.24	2.05	2.33	1.71	0.83	0.83
24	Riga Sugar Company Ltd	0.61	0.90	0.55	0.45	0.61	0.23	0.23	0.47	0.65	0.48	0.49
25	Girdharilal Sugar & Allied Industries Ltd	0.56	0.44	0.85	1.34	0.54	0.00	0.07	0.00	0.00	0.89	1.49
26	Rajshree Sugar & Chemicals Ltd	0.64	0.83	0.84	0.58	0.52	0.68	0.77	0.75	0.86	0.81	0.66
27	Kesar Enterprises Ltd	1.48	1.45	1.10	1.07	0.77	0.59	1.26	0.39	0.41	0.72	*

Source: Calculated from Annual Reports of the company

Note: \* These two companies close their books on 31 Dec. Hence the audited financial data for 2015 is not available at the time of writing this article.

Table 5 is the ratio of Sales to Total Assets which exhibits the ability of the company to generate sales from its efficient use of assets. The uniqueness of this ratio is that if it is applied independently to predict bankruptcy, it

is not at all useful. It becomes useful when applied in combination with other ratios in z score. This ratio varies from one industry to another.

Table 6 - Table showing Z Score of sample sugar companies (2005-2015)

No.	List of Sample Companies	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	Balrampur Chini Mills Ltd	4.12	4.89	2.04	2.57	3.90	2.33	2.19	1.94	2.25	1.94	2.03
2	Bajaj Hindustan	3.99	2.80	1.39	1.22	1.81	1.19	1.38	1.51	0.72	0.67	0.74
3	Renuka Sugar Mills Ltd	4.60	4.61	3.12	3.42	3.32	1.55	1.06	0.96	0.98	0.76	0.34
4	Eid Parry Ltd	4.55	3.01	2.35	2.39	3.20	2.58	2.51	2.32	1.86	1.95	2.01
5	Dhampur Sugar Ltd	2.69	3.06	0.92	1.30	1.53	1.35	1.35	1.55	1.35	1.18	1.14
6	Oudh Sugar Mills Ltd	2.18	2.91	0.98	0.99	1.23	0.78	1.16	1.20	1.13	1.04	1.04
7	DCM Shriram Industries Ltd.	2.00	2.77	1.89	1.68	2.12	2.12	1.91	1.74	2.03	2.23	2.18
8	Dalmia Bharat Sugar & Ind Ltd	1.29	1.65	1.80	2.04	1.24	1.50	1.59	1.48	1.56	1.54	1.47
9	Dwarikesh Sugar Industries Ltd	2.95	2.18	0.72	0.83	1.47	1.30	1.60	1.54	1.66	1.07	1.05
10	Bannari Amman Sugar Ind. Ltd	2.46	4.47	3.38	2.57	3.10	3.33	2.30	2.79	3.23	2.01	2.01
11	Upper Ganges Sugar Ltd	2.43	2.76	0.91	1.04	1.39	0.95	1.60	1.47	1.09	1.21	0.97
12	Uttam Sugar Mills Ltd	6.16	2.38	1.16	0.81	0.74	0.73	1.33	0.94	1.12	1.09	*
13	Rana Sugars Ltd	2.59	2.18	0.81	0.61	1.14	1.21	1.35	1.14	1.28	1.14	0.99
14	Ugar Sugar Works Ltd	3.18	2.18	0.92	1.70	1.82	1.50	2.19	2.01	2.21	1.70	1.46
15	Sir Shadi Lal Sugar Ltd	3.74	3.64	2.69	0.97	1.85	2.27	1.83	1.36	1.79	1.07	1.21
16	KCP Sugar Industries Ltd	2.39	3.67	2.63	2.34	2.32	3.14	2.08	2.49	3.11	2.54	2.26
17	Dharani Sugars Ltd	1.32	3.03	2.55	1.50	1.16	1.32	2.10	1.66	1.43	1.09	0.58
18	Piccadilly Agro Industries Ltd	1.35	0.93	0.92	1.10	1.81	2.34	2.68	2.08	2.31	2.51	1.97
19	Piccadilly Sugar Ltd	0.45	0.00	0.01	0.09	-0.53	-0.66	-0.01	0.50	-0.08	-0.10	-0.13
20	ThiruArooran Sugar Mills Ltd	1.57	1.72	1.39	1.69	2.05	1.66	1.22	1.20	1.19	0.90	0.73
21	Gayatri Sugars Ltd	1.23	1.56	1.12	0.61	0.41	0.48	0.64	0.90	0.57	0.38	-0.38
22	Empee Sugars Ltd	1.93	2.36	1.02	0.93	0.53	0.19	0.77	0.31	0.27	0.21	-2.38
23	KM Sugar Mills Ltd	2.72	5.05	0.88	1.89	1.87	1.51	2.42	2.68	2.72	1.43	1.34
24	Riga Sugar Company Ltd	1.52	2.07	0.82	1.11	1.45	0.72	0.72	0.83	1.03	0.80	0.49
25	Girdharilal Sugar & Allied Industries Ltd	1.72	0.65	0.69	3.96	3.68	1.68	25.17	18.82	25.69	0.94	1.81
26	Rajshree Sugar & Chemicals Ltd	4.73	2.96	1.81	0.95	1.21	1.74	1.31	1.29	1.52	1.25	0.89
27	Kesar Enterprises Ltd	2.87	2.75	1.62	2.02	1.83	1.72	2.28	0.21	0.43	-0.35	*

Source: Calculated from Annual Reports of the company

Note: \* These two companies close their books on 31 Dec. Hence the audited financial data for 2015 is not available at the time of writing this article.

Altman's model shows companies that have a Z - score of > 2.7 are considered as good sign in their financial health compared to those which have a Z-score of < 1.8 had potential serious problems and may not be able to

continue. However, for a company whose Z- score falls between 2.7 and 1.8, it is difficult to determine its status and is in the grey zone. Table 6 shows the financial health of sample sugar companies. From Table 6 it is quite evident that except for a handful of companies like BalrampurChini Mills Ltd, Eid Parry Ltd, DCM Shriram Industries Ltd. Bannari Amman Sugar Ind. Ltd and Ugar Sugar Works Ltd all the other companies in the industry are in red and in bankruptcy as indicated by their z scores. The companies listed above are in grey zone. Bankruptcy does not necessarily mean that the companies are unable to continue their business. According to Altman (1968), the business definition of bankruptcy is the situation that a firm cannot pay lenders, preferred stock, shareholders, suppliers, etc., or a bill is overdrawn. 99% of the sample sugar companies in the industry are in the verge of bankruptcy. The bankruptcy for majority of companies is observed from the year 2010-2011. The ailing problem the sugar industry is facing is the administered pricing of procurement of sugar cane the raw material for sugar industry and falling international prices of sugar. This led to decrease in profits and financial crunch to majority of sugar units which is quite evident in Table 6.

## Conclusion

The financial situation of sugar industry is examined using Altman'sz score. However, the Indian Sugar Industry is facing are examined increasing cost of sugar cane and falling prices of sugar leading to low profitability. The biggest challenge to the policy framers in India is to fix the sugar cane prices optimally, that would ensure viability both to farmers and sugar producers, of course keeping the concerns of the consumers in mind.

The Govt of India appointed a committee (Rangarajan Committee) some years ago to give recommendations for the revival of the sugar industry. The committee has recommended that the price of sugar cane be linked to realization price of sugar and be based on revenue sharing. Accordingly, 70% of the realizations of sugar along with by-products is to be paid by sugar mills as a price for sugarcane. In the alternative 75% of the realizations of sugar alone is to be paid. Indian states of Karnataka and Maharashtra have already partly implemented this and have met with success. However, other state governments are yet to follow. It is to be noted that other top sugar producing countries viz. Brazil, Thailand and Australia have already linked sugar cane procurement to sugar pricing.

The industry may also perform well with better intervention from the government towards building compulsory buffer stocks, diverting part of sugar cane production towards production of ethanol, re-structuring the industry debt and better support prices for exports.

The Government of India can put India solidly on the world sugar map by proactively announcing and implementing a National Sugar Policy. The first element of this would be linking the sugar cane prices to sugar.

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## Optimization Method of Cash Balance

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### Abstract

*Temporarily free funds management implies determining the optimal balance. Traditionally it is considered that the optimal cash balance is the balance when total value of lost profit and transfers is minimal due to non use of temporarily free funds. It is possible to determine the necessary cash balance on the settlement account or cash on hand, and the necessary part of cash balance for conversion into short-term securities (deposits) in order to make a profit with the use of modern economic and mathematical models of optimal cash balance calculation (Baumol, Miller-Orr, Stone). Thus mathematical models of optimal cash balance calculation consider just two interrelated type of assets which are cash and short-term securities (deposits), and two types of factors determining optimal cash balance which are lost profits and the cost of transfer. In this case some factors remain unaccounted, in particular, expense for maintenance of financial responsibility of an enterprise. Such expense arises if there aren't enough funds to extinguish financial liabilities. Changing of cash balance is purely deterministic in some models, while this changing has the only stochastic nature in others that does not match the reality.*

*Thus, the task of an utmost importance is further developing the model of cash optimization, which is the aim of this research. Methodology of this research is based on the use of the systematic approach, which takes into account the interaction of various factors that determine the value of optimal cash balance, as well as regression analysis. As a result, the new economic-mathematical model is developed in order to calculate optimal balance of available funds. It differs from previously developed models and takes into account much more factors. This model uses statistical data for each particular enterprise as a basis for determining equations, which reflect the cash balance impact on the value of costs and losses that are accounted in the model.*

**Keywords:** cash, optimization of cash balance, cash management, economic and mathematical model, Baumol's model, Miller-Orr model, Stone's model.

**JEL Classification:** C10, M41.

### 1. Introduction

The effective cash management is essential in the situation of inflation, reduction of consumer demand, low solvency of enterprises and other crisis phenomena of the modern world economy. An enterprise's earnings, profitability of assets, its solvency and investment opportunities depend on cash management effectiveness. One of the most important cash management tool is to maintain cash balance at the optimum level. Traditionally it is considered that the optimal cash balance is the balance when total value of lost profit due to non use of temporarily free funds and transfers are minimal.

Economic and mathematical models were developed to calculate the optimal cash balance such as: W. Baumol's model (Baumol 1952), Miller-Orr model (Miller and Orr 1966), Stone's model (Stone and Bernell 1972). All these models allow calculating the optimal amount of cash balance when it is necessary to determine the amount of money that should be invested in short-term securities. The base of the developed models' objective function is

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minimal expense of transfers and minimal total value of lost profit due to nonuse of temporarily free funds. At the same time these models don't take into account demand for cash in order to fund operating activities of an enterprise, they don't take into account expense that arise due to lack of cash (cost of short-term loans, penalties and interest on overdue obligations). It appears that these models consider principally cash and securities and don't pay enough attention to cash flow of operating activity. Thus, the task of an utmost importance is enhancing the said models taking into account the cash required for operating activities and the cost expense that arise due to lack of cash.

## 2. The review of cash balance calculation methods

### 2.1. Baumol's model

Baumol 1952, Kovaleva 2011, Makarova 2009, Melnikov 2011, Michalski 2008, Rogatenuk and Seit-Ablaeva 2013, Tobin 1956

Suppose, according to Baumol's model, the income of free cash assets is expected at the beginning of the period. This income is the result of excess of the expected cash flow over its outflow. This cash could be partially or completely invested in short-term securities (other options aren't considered in Baumol's model). It is possible to calculate the amount of cash that can be left in a monetary form, in other words, the optimal cash balance with the help of Baumol's model. The amount of cash that is above the optimal cash balance should consequently be invested in securities to gain invest income.

The calculated optimal cash balance ( $Q_{opt}$ ) is the maximum allowable according to Baumol's model. The money over the maximum optimal cash balance is invested in highly liquid securities. The cash is equally expended up to zero balance and then it is replenished in a lump by sale of highly liquid securities. Baumol's model is a pure deterministic – expenditure and replenishment of cash balance are repeating the same cycle each time.

Criterion of optimality of cash balance is minimum total cost of conversion of securities into cash (K) and lost profit due to non use of temporarily free funds (LP) (Melnikov 2011). The objective function is:

$$F = K + LP \rightarrow \min. \quad (1)$$

The amount of expenditure on the conversion of the securities into cash (K) is determined by multiplying the costs per conversion (k) by the number of conversions during the period. The number of conversions is calculated as the number of cycles of cash balance replenishing by selling short-term securities. It will be necessary to replenish the cash balance ( $V / Q$ ) times in order to respond to cash need (V) during the analyzed period by using cash balance (Q). Thus, the amount of cost of the conversion of securities into cash during the analyzed period is defined by the formula

$$K = k \times \frac{V}{Q}. \quad (2)$$

Lost profit due to nonuse of temporarily free funds (LP) is defined by multiplying return of securities during the analyzed period (r) by average cash balance ( $Q/2$ ). Thus the objective function becomes:

$$F = k \times \frac{V}{Q} + r \times \frac{Q}{2} \rightarrow \min. \quad (3)$$

Having the first derivative of the objective function (3), the optimal value of cash balance can be determined according to Baumol's model:

$$Q_{opt} = \sqrt{\frac{2 \times V \times k}{r}}. \quad (4)$$

In the authors of this article opinion, Baumol's model practical application gives rise to concerns. It is not clear how to determine the need for cash during the analyzed period (V) according to W. Baumol (1952). If this need is an unexpected expenditure of cash for operating activities during the analyzed period it is not clear:

- Why is this expenditure covered under the conversion of short-term securities, but not at the expense of income from operating activities?
- How is it consistent with the fact that the amount of money that can be invested in securities is determined as the difference between the amounts of expected inflows and payments for operating activities? It

turns out that the expected payments for operating activities are covered under the proceeds from these activities, but not by selling securities.

Besides, it isn't clear why the amount of difference between the expected inflow and cash outflow could not be invested in securities completely according to Baumol. It would make investment income maximal and cost of conversion minimal. If Baumol's model supposes that "protective capacity" is required for covering contingency fund why the amount and the volatility of this expenditure are not taken into account in determining the optimal cash balance.

Why are not obligations and penalties taken into consideration for the optimal cash balance calculation? We think, in view of the existence of these issues, the possibility of Baumol's model practical application is questionable.

Moreover, Baumol's model defect is the assumption that the cash flows of an enterprise are steady and predictable, which does not reflect the reality. This defect is mentioned in different research articles, for example Pollok (2003). Miller-Orr model was developed in connection with this issue.

## 2.2. Miller-Orr model

Miller and Orr 1966, Miller and Orr 1984, Teryokhin and Podgornova 2012, Neave 1970, Pokrovskiy 2012, Krizhevskaya 2000

The opposite assumption is the basis of Miller-Orr model that the net cashflows has stochastic nature. It differs from deterministic Baumol's model (Miller and Orr 1966). As marked in the article (Miller and Orr 1966), the net cash flows change as if they are received by a random number generator according to this model.

Only two types of assets also, as well as in Baumol's model, are taken into account, which are cash and liquid securities. It is mentioned that transactions could be completed at any time at a given cost per conversion, irrespective of its direction or amount (Miller and Orr 1966). The existence of minimum and maximum levels of cash balance and the optimal cash balance are supposed. The minimum level of cash balance is fixed and does not impact on the optimal cash balance calculation. The optimal cash balance is determined as some runoff of money over the required minimum.

According to the article, (Miller and Orr 1966) the minimum cash balance is assumed to be zero in order to simplify the demonstration of the Miller-Orr model. The maximum allowable cash balance is in three times more optimal. The detailed mathematical derivation of this equation is presented in the article (Miller and Orr 1966). Cash balance can fluctuate, until it reaches the lower or upper limit. The transfer is carried out in such moments of purchase or sale of securities. The basis of the objective function of Miller-Orr model, as well as Baumol model, is the minimum cost of transfer and lost profit due to nonuse of temporarily free funds. Given the fact that the Miller-Orr model is a pure stochastic, the objective function looks like this:

$$\varepsilon(c) = \gamma \times \frac{\varepsilon(N)}{T} + v \times \varepsilon(M) \rightarrow \min, \quad (5)$$

where  $\gamma$  – the cost per transfer;  $\varepsilon(N)$  – the expected number of transfers;  $v$  – the daily rate of interest earned on the portfolio;  $\varepsilon(M)$  – the average daily cash balance.

The expression for the calculation of the optimal cash balance is obtained on the basis of the objective function (5) (Miller and Orr 1966):

$$Q_{\text{opt}} = \frac{4}{3} \times \left( \frac{3\gamma}{4v} \times \delta^2 \right)^{1/3}, \quad (6)$$

where  $\delta^2$  – the variance of the daily change in the cash balance.

The detailed mathematical derivation of this formula is presented in the article (Miller and Orr 1966). As well as in Baumol model, the optimal cash balance increases with the higher cost of transfer and decreases with the lower cost of securities rate.

The new aspect of determining the optimal cash balance according to the formula (6), in comparison with Baumol model, is the presence of the variable  $\delta^2$  characterizing the variability of the cash balance and the "lack of synchronization" between inflows and outflows.

It can be seen from the above that Miller-Orr model has the following advantages compared with Baumol model:

- The model is stochastic and the variance of the daily change in the cash balance ( $\delta^2$ ) is taken into account that makes it more realistic;
- Although it considers only cash and securities, it takes into account the dynamics of net cash of operating activities by including the variance of the daily change in the cash balance  $\delta^2$  to the model;
- The model considers the existence of the allowable minimum cash balance.

At the same time, the optimal cash balance according to Miller-Orr model is calculated without taking into account the need for cash in operating activities, excluding the costs and losses caused by the lack of money to cover debts. Thus, the assumption that the Miller-Orr model is limited to the scope of “cash – securities” leads to a limitation of its practical application.

Exceptionally stochastic nature of the model does not fully correspond to reality, where, along with random fluctuations, logical processes and cyclic variations take place. Stone's model was developed to improve Moller-Orr model.

### 2.3. Stone's model

Stone 1972, Angelovska 2010, Ezerskaya 2008, Grinenko 2004, Borgoyakov 2013, Vickson 1985

According to Stone's model it is supposed that the optimal cash balance will be determined with the help of Miller-Orr model. This model does not contain any new mathematical equations, but complements procedures for the cash balance management.

In contrast to Miller-Orr model, regulation of cash balance when it reaches the minimum or maximum level is carried out only after obtaining the forecast of its change over the next few days. For example, getting the maximum level of cash balance will not cause an immediate transfer of cash into securities if relatively high inflows are expected in the coming days. This will reduce commission expenses for transfers. Managers of an enterprise carried out forecast of the cash balance. The forecast is based on case studies and managers' experience.

Thus, according to Stone's model it is required to make an operational forecast of cash inflow and outflow in order to decide whether to buy or sell securities. It makes this method significant in practice. However, the optimal cash balance and its maximum allowable level calculation is not without disadvantages, which were inherited from Miller-Orr model, as it is implied to use this model unchanged.

This review has showed that the said scientific problem requires a solution. In particular, the development of economic and mathematical model should be beyond “cash – securities”, taking into account the large number of factors affecting the value of the optimal cash balance.

## 3. Methodology

### 3.1. Definitions

An enterprise should have enough cash balance to meet its current financial liabilities. The optimal cash balance calculation must take into account the condition of sufficiency of funds to meet liabilities. The optimal cash balance calculation must take into account lack of cash for settlement with creditors that will cause costs in the form of accrued interest, penalties, and fines. On the other hand, free cash should not be held in bank accounts not bringing any return. Therefore, the optimal cash balance should be calculated with the possibility of short-term investments in order to bring additional return. Consumer demand reduction of unutilized cash balance (inflation), in our view, should be seen as a form of lost profits.

Thus, according to the authors of this article, *the optimal cash balance* is such balance, which is sufficient for the current enterprise payments and corresponds to the minimum total lost profit arising due to nonuse of temporarily free funds and minimum expenses caused by the lack of cash to meet financial liabilities.

The difference of this definition from other authors' approaches is that it supposes to take into account the amount of expenditures caused by the lack of cash to meet liabilities when calculating the optimal cash balance. According to the definition the optimal cash balance must be not less than the required amount for current enterprise payments. This condition should be the restriction of the developed model. As well as according to other approaches, lost profit arising due to nonuse of temporarily free funds is taken into account when calculating the optimal cash balance. The feature of the developed model is that it considers reduction of the value of money due to inflation as a lost profit.

### 3.2. Economic and mathematical model

The developed economic and mathematical model includes:

- The objective function which is tending to minimize the amount of expenses in connection with late satisfaction of obligations (SO) and the lost profit due to non-use of temporarily free funds (LP):

$$F = SO + LP \rightarrow \min; \tag{7}$$

- The restriction: the optimal cash balance may not be less than the amount of expected obligations repayment. It is supposed to take the average amount of payable liabilities per day as obligations minimum value.

Expenses arising from the lack of cash in order to meet obligations (SO) include costs of an enterprise to cover scarcity of funds on the settlement account are: interests of short-term loan and penalties for failure of timely payment of financial obligations.

The lost profit arising due to nonuse of temporarily free funds (LP) is the amount of profit that an enterprise would receive if temporarily free funds have been invested, for example: placed on deposits, invested into securities, used to extend interest loans and so on. The relative cost of lost profit from each monetary unit can be set as the average level of profitability of investments acceptable to an enterprise. The rate of such return should be decreased on the average value of the relative cost of transfer, if the enterprise actually invests temporarily free funds into securities.

If an enterprise does not do short-term investments into financial assets, it carries the inflationary losses due to nonuse of temporarily free funds. In this case it is proposed to use the average percentage of inflation instead of the relative cost of lost profits.

### 3.3. Information base

The dependence of the amount of expenses due to lack of cash to meet liabilities, (SO) on the cash balance can be obtained by constructing the regression equation. Statistical data of the daily cash balances and costs received from accounting and operational records, as well as by calculation, is required for this equation (see Table 1).

Table 1 – Data for the regression equation reflecting dependence of the amount of expenses due to lack of cash to meet liabilities, (SO) on the cash balance

Figure	Application	Information resources	Procedure of calculation
The average daily cash balance	Used to get the regression equation	Calculated on the basis of accounting data on cash balance at the beginning and at the end of the day (account "Cash")	Cash balance at the beginning and the end of the day may not reflect inflows and outflows during the day, one or more of cash balance value should be used during the day in order to determine the average cash balance of money
The amount of liabilities funded under the short-term loan for current expenses	Used for the calculation of interest on loans for immediate repayment of obligations	The amount of liabilities repaid under overdraft, credit card or other short-term loan is determined on the basis of analytical accounting data (by taking into account settlements with suppliers, staff and other creditors)	
The estimated value of the interest on the loan for current expenses	Used to get the regression equation		The amount of liabilities funded under a loan, multiplied by the average daily interest rate and by the average credit period in days

The amount of unliquidated obligations	Used to calculate penalties, fines for overdue liabilities	Determined according to the data of accounting or finance department	
The expected value of fines and penalties in connection with late payment obligations	Used to get the regression equation	Determined on the basis of agreement or legislation	The amount of unliquidated liabilities multiplied by the daily rate of interest and by the number of days of the average period of delayed payment

#### 4. Results

The optimal cashbalance is determined by the developed method on the example of a small enterprise. To determine the optimal cash balance. The enterprise’s statistical data has been gathered (according to Table 1), the cost of expenditure arising as a result of the lack of cash to meet liabilities (SO) and the form of dependence of this expenditure on the cash balance have been determined in order to calculate the optimal cash balance (Figure 1).

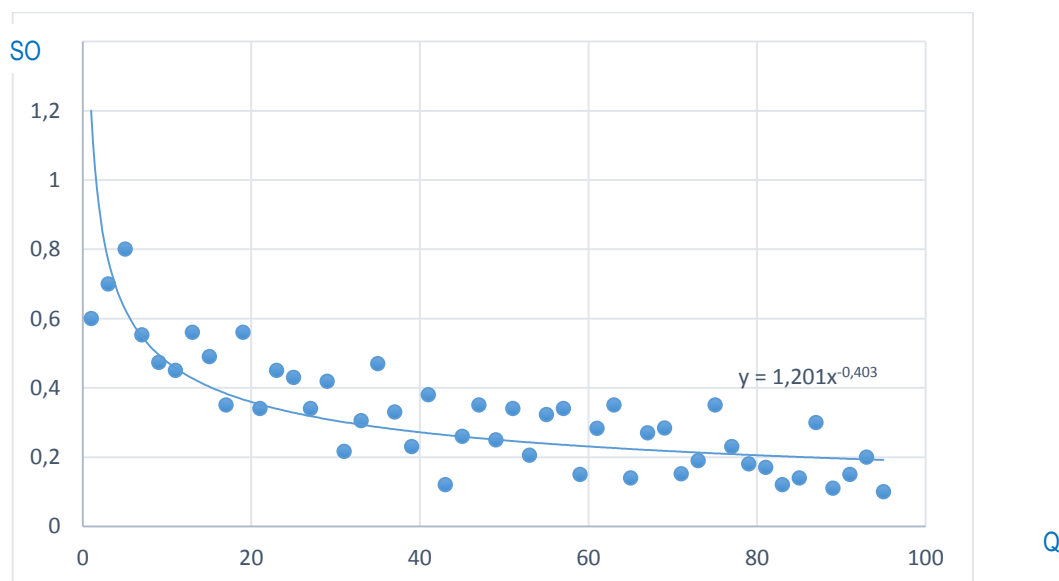


Figure1 - The graph of the dependence of expenses arising as a result of the lack of cash to meet liabilities (SO) on the cash balance (Q)

The mathematical dependence of expenses (SO) on the cash balance has been determined with the help of Office Excel spreadsheets and has the form:

$$SO = 1,201 \times Q^{-0,4} \tag{8}$$

The said enterprise does not make short-term investments in financial assets, so the rate of inflation reflects the loss of value of money. The amount of lost profits due to nonuse of temporarily free funds will be determined by multiplying their balance on the inflation rate, which reflects the loss of value of money for the analyzed period (in this case within the month). According to (Table of inflation (2016, January, 30)) the inflation was 12,9% in Russia.

Thus, the objective function of the described example has the form

$$F = 1,201 \times Q^{-0,4} + \frac{0,129}{12} \times Q \rightarrow \min \tag{9}$$

The graph of the objective function for the optimal cash balance calculation is the following:

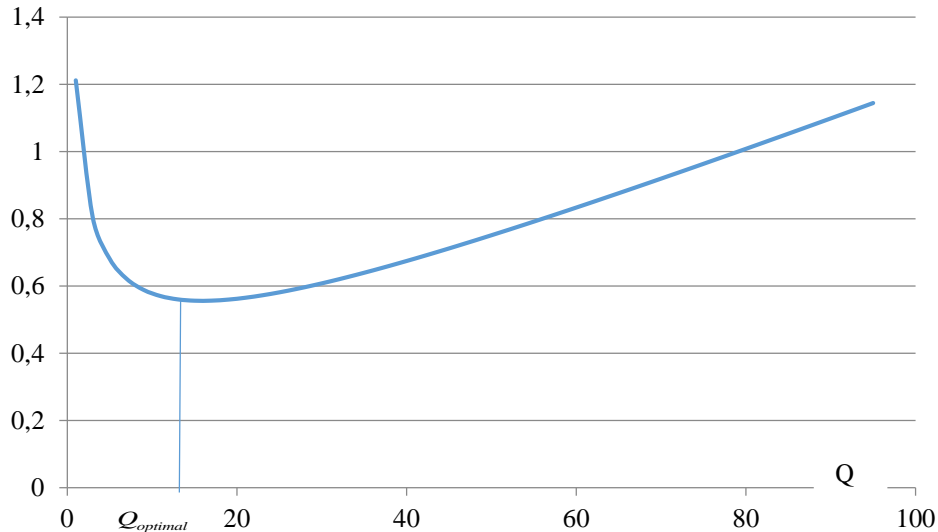


Figure 2 - The graph of the objective function (7), thousands of cash units

Figure 2 shows that the objective function has a minimum, which corresponds to the optimum value of the cash balance. The optimal value of cash balance which is 15 thousand of cash units is obtained with the use of the “Solver” tool of Office Excel. If the actual cash balance is less than the optimal one, the objective function value increases due to the fact that the enterprise incurs additional costs to maintain its solvency, costs for payment of penalties and interest to creditors (SO). If the cash balance increases relative to the optimal balance lost profits (the loss from inflation) is growing which leads to increase of the value of the objective function.

The average daily amount of liabilities to maturity is 11 thousand of cash units in the studied enterprise. The optimal cash balance must be higher than this value to provide operating activities. The obtained optimal balance is 15 thousand of cash units which corresponds to this restriction.

## 6. Discussion

To define an optimal cash balance including the minimal total amount of lost profit is a crucial scientific issue. The minimal total amount can be in the form of missed profit from the nonuse of temporarily free funds and costs residues triggered by a deficiency of cash balance for accounting on obligations. Traditional approaches to solve the issue correspond to forming a different task. The main idea of the task is to define the cash balance in which the minimal total amount of lost profit is connected with free funds and costs for cash conversions which are not invested in securities. Thus, when we consider the determination of cash balance, 2 options appear: 1) money is in the form of clear balance; 2) money is invested in securities. However, there are some questions and issues to maintain organization paying capacity while the cash balance is conducted and possibilities of financial investment in securities are considered. Besides, financial consequences of cash balance for developing the main organization activity are not taken into account. According to the information there is a limit of traditional approach application for cash balance automation in practice.

This developed model is different from the traditional ones by the fact that it is not limited by the definition “cash – securities”. It presupposes finance need to maintain the main organization activity and any types of investments.

The supposed model includes:

- costs appearing because of a lack of finances to satisfy obligations:
  - percentages of loan attraction to cover urgent costs;
  - if financial obligations are not satisfied in time, a payment fee may occur;
- missed profit connected with spare cash nonuse. It is a profit amount which the organization could get, if spare cash were invested, for example:
  - placed in bank deposit;
  - invested in securities;
  - used for interest-bearing loans and etc.

Thus, optimal cash balance is a residue in which a total amount of costs is minimal. Simultaneously, the optimal cash balance cannot be less than expecting obligation amounts. For the practical model application, it is necessary to provide the system of management accounting with all basic data. However, according to the practice of the model application it is necessary to work out subsystems of the management accounting for cash balance optimization that is not a subject of the research. In particular, the model should reflect only the costs caused by a deficiency of cash balance which is the result of finance short in a particular day. An accurate definition of all cost amounts and referring them to a particular cash balance amount is necessary to get regression equilibrium reflecting cost dependence caused by a deficient cash balance.

Besides, the subject of further research should be an accurate algorithm of management actions to provide the actual cash balance to its automatic amount. In accordance with Miller-Orr model and the Stone's model it is necessary to set the minimal and maximal accessible cash balance. It means it is crucial to develop and work out methods for accounting. In accordance with the Stone's model it is important to consider the forecast of cash flow amount. It is important to specify forecast procedures.

It defines directions of the further research in the sphere of cash balance optimization.

## Conclusion

The authors represented a new economic mathematical model for accounting of optimal cash balance. The model is not limited by the definition "cash – securities" and considers need of finances for the main organization activity. The model also accepts any type of spare cash investment and considers the lost profit as a decrease of purchasing power of finance nonuse.

At the same time the system of management accounting should be developed for the practical model application. Besides, the subject of further research should be an accurate algorithm of management actions to provide the actual cash balance. All of this defines directions of further research in the sphere of cash balance optimization.

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## Labour and Social Relations as the Economical Category and the Efficiency of the Regional System of Labour and Social Relations

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### Abstract:

*An economic instability which is associated with the continuing economic crisis of 2008-2010, aggravated by oil prices downturn and Western economic sanctions against Russia, leads to deterioration of the of regions of the Russian Federation. A systemic regulation of social and labour relations in the Russian economy is important in order to return the Russian economy to sustainable development at the present stage. The aim of our research is development of the main ways to increase the functional efficiency of regional system of the social and labour relations. Authors offered a methodology based on evaluation of efficiency of the social and labour relations of the region. The systemic approach, which presupposes the overall and deep studies of social and labour relations, was also used in the research. Mathematical method of statistics factor analyses) and the method of expert review were also used. On the basis of the authors' methodology (evaluation of the efficiency of the social and labour relations) the rating of Ural region territories was prepared in terms of the efficiency of social and labor relations regulation, identified the advantages and disadvantages of the social and labour relations regulation in different regions of the Russian Federation. The results of the research allow define the strategy of development of the social and labour sphere of the region in modern conditions.*

**Keywords:** regional economics, regulation, labour relations, evaluation methodology, rating of efficiency.

**JEL Classification:** F66.

### 1. Introduction

#### 1.1. Problem setting

The aim of this research is to define the term of social and labour relations as the economical category, to develop the theoretic and methodological basis of their systematic regulation including the definition of the terms "labour relations", social and labour relations". The aim also includes the identification of the levels of social and labour relations, definition of the term "social and labour relations", development of the basic ways of their efficiency rise. The reform of 1990s has led to the production decline, decrease in the quality of life, poverty. Most of the workers lost their social and labour status. The reform negatively affected the labour motivation. As a result, labour has lost its value; the possibilities of participation in management fell down, the contradictions between the interests of workers and capital owners intensified. At the beginning of the 21<sup>st</sup> century there were some tendencies for the stable development of market economy in the Russian Federation. But at the present they are undermined by the world crisis. People faced the problems of unemployment and social and labour relations regulation. Now there are plenty of unsolved problems, which make obstacles to the work efficiency rise such as: unemployment, different

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incomes of population, incomes below subsistence minimum, draw backs in regulation of social and labour relations.

It is necessary to conduct an accurate study of social and labour relations efficiency and it can be proved by the following:

- necessity of efficient and motivated labour and the absence of its mechanism in different regions.
- necessity of system regulation of social and labour relations of the region and the absence of the mechanism of its theoretical and methodological bases.
- necessity of labour and social relations efficiency rise in different regions on the ground of coordinated functioning of various institutions of regional system of social and labour relations.

The stable economy development and its rise largely depend on the state and development of social and labour relations at different levels. The importance of social and labour relations efficiency rise for the region and for the theoretical and practical formation of effective regional policy as well as its complexity require profound theoretical grounds and methodological developments.

### 1.2. The research objective

In the frameworks of the problem the project has various aims:

- to develop the theoretical bases for the system regulation of labour and social relations, to give the definition to such terms as “labour relations”, social and labour relations”, to reveal the system of social and labour relations, its structure, subjects and objects, to define the term “labour sphere and “ social and labour sphere“, as well as find the differences between the system of social and labour relations and social partnership, to develop the concepts, which characterize social and labour sphere;
- to analyze the modern state of social and labour relations, find out regional development peculiarities, problems, contradictions and tendencies of development.
- to examine the peculiarities of the legislations in the sphere of social and labour relations on the basis of the analysis of federal and regional legislation of all constituent regions of Russian federation in the sphere of social and labour relations and social partnership.
- to develop methodological bases for social and labour relation regional monitoring. To monitor some definite parts of social and labour sphere of Chelyabinsk region. To compare the state of social and labour sphere of the region and the influence of the world crisis on it.
- To analyze the efficiency of social and labour relations of Ural region on the basis of the author’s methodology of social and labour efficiency.
- to develop a development strategy of social and labour relations at the present situation.

#### *Hypothesis of the research*

Taking into consideration the ideas of modern state of social and labour relation sphere of regions, tendencies and the problems of development, it is possible to state that there is the objective necessity of the system approach to the regulation of social and labour relation. The discrepancy of the methods of regulation of social orientation of the economy requires the development of theoretical basis and methodology of regional system formation dealing with regulation of social and labour relations.

### 1.3. Latest research and publications analysis

The problems of social and labour relations and their regulation were examined by Abalkin (2007), Belkin (2013), Belkina (2003), Volgin *et al.* (2011), Kamenetskii (2003), Krivosheev (2004), Odegov and Loginova (2013) and others. Representatives of foreign economic schools such as Erhard (1960), Masloy (1999), Nelson and Winter (1982), Stiglitz (2010), Norton and Kaplan (2003), Drucker (1993), Kelso (2007) and others give grounds to the smooth and conflict-free modernization of the present system of social and labour relations in market economy. Above mentioned authors partly deal with social and labour relations, but do not research them as the whole system.

Conducting the research, we needed the literature on labour relations. The works by Belkina (2003), Volgin *et al.* (2011), Gerchikov (2005), Katulsky and Menshikova (2010), Kolesnikov (1993), Kleiner (2006), Rakitskiy (2010) and others are devoted to this problem. But there is no precise definition of the term *labour and social and labour relations*, which are often made equal.

The issues of regional partnership formation and development were analyzed in the works of Kolmakova (2006), Kolmakova (2013), Belkin and Belkina (2013) and others.

Such authors as Drucker (1993), Kelso (2007) and others estimated the influence of positive aspects of democratization of managerial decisions on company's social stability. The analysis of the resources has shown that the theory of social partnership had not been learnt thoroughly. There is no unanimity in terms definitions, no methodology in social and labour relations analysis in different companies. The problems of formation, efficiency, competitiveness are burning for Russia now. As a result, there appeared the necessity of social partnership in labour sphere – a new concept of employer's and employee's relationship, which main aim is to find the balance between different classes.

Despite the great contribution of the scientists into the formation of social and labour relations, they did not reflect the conceptual basis of the systematic regulation of regional social and labour relations. The analysis of the resources proved that modern books on labour economics, encyclopedias, monographs, and theses do not reflect the terms of "labour relations", "social and labour relations", "social sphere" and "social and labour sphere". The problems of social and labour relations regulation in the market are learnt insufficiently and such terms as "system of social and labour relations", "national system of social and labour relation regulation", "regional system of social and labour relation regulation" are absent in the economic literature.

It must be underlined that scientific research on social and labour relations of a region is absent at the moment. There is no system of data acquisition and analysis of the state of social and labour relations in the whole country as well as in separate regions. Above mentioned reasons resulted in this research work, which is important for the stable national and regional economic development of Russia.

The information base of the research includes the official statistic and informational resources of Rosstat (statistic collections "Regions of Russia. The main characteristics of Russian Federation constituent entities". Regions of Russia. Social and economic characteristics", "Russia in numbers"), International labour organization, materials of Russian and foreign periodicals. Papers of Informational Bank of reference law systems: "Konsultant plus", reports of the state labour inspection in Chelyabinsk region, data of sociological researches, conducted by the authors.

## 2. Research methodology

### 2.1. Definition of social and labor sphere of region

Cyclic nature of economic dynamics in terms of a downward phase has a negative impact on all economic processes in a country, including development of social and labour sphere. J. Schumpeter has noted that economic development is impossible without any balance, and it is considered to have some impulses in this process. He paid attention to cyclic nature of economic dynamics, and the role of crises as stages in development. Cycle ideas are currently being considered when analyzing social systems. An economic instability, which is associated with the continuing economic crisis of 2008-2010, aggravated by oil prices downturn and Western economic sanctions against Russia, leads to deterioration of the regions of the Russian Federation. A systemic regulation of social and labour relations in the Russian economy is important in order to return the Russian economy to sustainable development at the present stage.

Under regional social and labour sphere we understand a multi-level system consisting of many elements and levels, including the local social and labour sphere of the region's organizations (consisting of the employment areas and local socio-labor relations), municipal social and labour sphere of regional municipal entities (including municipal system of social and labour relations) and regional system of social and labour relations (Kolmakova 2013, 13-14). The structure of social and labour sphere of the region is presented in Figure 1.

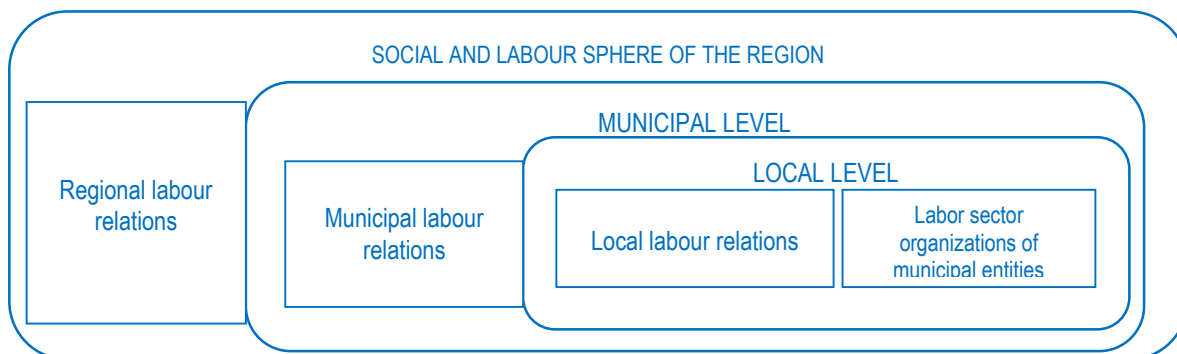


Figure 1 - The structure of regional social and labour sphere

Social and labour relations are an important element of the social and labour sphere by which we understand relations in the framework of the entire state, region, municipality or organization which employers joins,

trade unions organizations, state and municipal authorities and management, trade unions, employers' organizations, various parties and movements on the development of legislative, normative and other acts in order to align interests, to establish and to observe labour rights and property rights of subjects of labour relations in organizations. (Kolmakova 2013)

Regional system of social labor relations is a sophisticated structure. It includes the totality of municipal social and labour relations which exist in municipal institutes of the region, social and labour relations at the regional level in the framework of social partnership between regional authorities, regional employers' associations and territorial associations of trade unions. A regional system of social labor relations in addition to the subjects of their regulation also includes other subjects of regulation, which can function as courts or public prosecution offices, as the Federal labour Inspectorate of Russia, as political parties and movements. (Kolmakova 2006, 4) The economy needs a balance of market roles and government roles, which the activities of non-market and non-governmental institutions encourage to achieve, as mentioned by Joseph Stiglitz, Nobel laureate in economics. (Stiglitz 2010, 3)

A purpose of regulation of social and labour relations at all levels is the impact on the local social and labour sphere (by which we understand the social and labour sphere of enterprises) aimed to ensure its effective functioning and development on the basis of economic and social interests coordination and rights of employers (owners) and employees. These are relationship between the subjects and objects of regulation of social and labour sphere, as well as relationships within the regulating and regulated systems (between individual links, levels of regulation, etc.). The result of such regulation is a direct impact on a labor process. We distinguish the concept of "labour management" and "regulation of labor relations" (Kolmakova 2006, 58-59). Labour management refers to the local level, where a labour process is performed.

2.2. Method

The main method of the research is the quality analysis in combination with the economical and static and expert analyses. The systemic approach, which presupposes the overall and deep studies if social and labour relations, was also used in the research. Mathematical method of statistics factor analyses) and the method of expert review were also used. The important part of the empirical base of the research consists of independent sociological researches of social and labour sphere, including researches of Chelyabinsk Branch of Economics University of Ural Department of Russian Academy of Sciences under scientific guidance of the author, among which are: "The role of municipal authorities as the institution of the social and labour relation regional system regulation", conducted under the author's guidance in February 2014.

The author's methodology of social and labour relations efficiency was developed. The estimation of social and labour relations efficiency is planned to be fulfilled at several stages. Here is the following procedure:

- At the first stage it is necessary to set some factors which are used in the evaluation. The factors are connected with the processes occurring in the social and labour sphere of the region and either directly or indirectly influences the state of social and labour relations. These factors may be put into numbers according to statistics data. At this stage the number of such factors is settled.
- At the second stage each factor is given numerical characteristics according to statistics data. Here is the table which shows regions and the factors are listed in the columns (Table 1):

Table 1 - The second phase of the research methodology

Factors Fj	F1	F2	F3	F4	F5	.....	Fj
Regions I							
I1	F <sub>1i1</sub>	F <sub>2i1</sub>	F <sub>3i1</sub>	....	....	.....	F <sub>ji1</sub>
I2	F <sub>1i2</sub>	F <sub>2i2</sub>	F <sub>3i2</sub>	....	....	.....	F <sub>ji2</sub>
I3	....	.....	.....	.....	.....	.....	
In	F <sub>1in</sub>	F <sub>2in</sub>	F <sub>3in</sub>	....	....		F <sub>jin</sub>

Note: F<sub>jin</sub>-the numerical meaning of the factor j in the region n; n- number of regions j - number of factors

At the third stage there is an analysis of all factors and each region is given the place according to the factors: high-the first, low-the last. Here is the table of regions with their correlation with factors (Table 2):

Table 2 - The third phase of the research methodology

Factors F <sub>j</sub>	F1	F2	F3	F4	F5	.....	F <sub>j</sub>
Regions I							
I1	m <sub>1i1</sub>	m <sub>2i1</sub>	m <sub>3i1</sub>	....	....	.....	m <sub>ji1</sub>
I2	m <sub>1i2</sub>	m <sub>2i2</sub>	m <sub>3i2</sub>	....	.....	.....	m <sub>ji2</sub>
I3	....	.....	.....	.....	.....	.....	
I <sub>n</sub>	m <sub>1in</sub>	m <sub>2in</sub>	m <sub>3in</sub>	....	....		m <sub>jin</sub>

Note: m<sub>jin</sub>-the place of the region according to the factor j; n- number of regions; j - number of factors

At the fourth stage there is a sum of all factors, which influence the efficiency of social and labour relations in regions:

$$R_k = \sum_{k=1}^j m_k * i_n \tag{1}$$

But the factors R1...Rn are preliminary and require specification, that is why according to the expert analysis we find the share of each factor which influences the efficiency of social and labour relations in regions. Total amount is 1.00.

$$\sum_{k=1}^j S_k = 1 \tag{2}$$

Here are the places of all factors according to their share:

$$\sum_{z=1}^n m_1 * i_z * s_1 + \sum_{z=1}^n m_2 * i_z * s_2 + ... + \sum_{z=1}^n m_j * i_z * s_j = \sum_{z=1}^n R_z \tag{3}$$

At the fifth stage there is an evaluation of the places according to the efficiency of social and labour relations. The place is given according to the final evaluation. The method of complex econometric analysis of the influence of social and labour relations on the economic growth of the region is also included in the research and includes the following stages:

- 1<sup>st</sup>stage. The selection of factors for the analysis. The criteria are availability and period of the permanent data according to the factors.
- 2<sup>nd</sup>stage. The calculation of correlation matrix {r<sub>ab</sub>}, which allows to make the final selection of the factors. The line coefficients double correlation r<sub>ab</sub> factors a and b for the selection of the volume are calculated according to the standard method. The reliability of results is achieved with the method "region-year", according to which there is a great amount of data on each factor in all regions for all periods.
- 3<sup>rd</sup>stage. The statistic processing of the data to receive the number of line coefficient of double correlation. The final number let to settle with which factors the level of great regional product is connected and which factors are not so important for the number of coefficient correlation.
- 4<sup>th</sup>stage. The evaluation of temporary lag. It is supposed that the connection between the great regional product and the factor which were taken for the analysis, does not become apparent in the period of the number of great regional product, but in some period (lag).
- 5<sup>th</sup>stage. The analysis between the factors, which characterize the level of development of social and labour relations and statistically important numbers. The factors according to which their relation with the economic growth is important, may be taken as the base of monitoring of the development of the system of social and labour relation at different stages.

### 3. Results

According to our methodology the indicators P1 - P10 have been calculated taking into account the specific weight of their significance for constituent entities of the Ural Federal district (Labor and Employment in Russia. Statistical Handbook 2013, "Russia in figures 2013", Statistical Handbook 2013): P1 — GDP (Gross Regional Product) per capita, P2 — growth rate of nominal wages, P3 — ratio coefficient of nominal wage to the subsistence minimum, P4 — total amount of overdue wage, P5 — Gini coefficient, P6 — labour force participation with income below the subsistence minimum in total employment in the regions of the Urals Federal district, %. There is no such indicator in statistics digests, so the calculation has been made according to the share of population size with incomes below the subsistence minimum in the regions of the Ural Federal district, %; P7 — unemployment rate in

Ural Federal district, % (ILO International Labour Organization methodology); P8 —number of victims from manufacture accidents per 1000 working staff; P9 —share of the number of industry workers employed in harmful and dangerous working conditions (% of the total number of industry workers); P10 —number of organizations that are on strike in constituent entities of the Urals Federal district (% of the total number of employees of organizations in the region).

According to the calculation results with the help of our method in rating socio-labour relations efficiency on the basis of these indicators the Chelyabinsk region and the Khanty-Mansiysk AD takes the first and the second places, then there is the Yamalo-Nenets AD, Tyumen, Sverdlovsk and Kurgan region (see Table 3).

Table 3 - A rating of the effectiveness of the system of social and labor relations in constituent entities of the Urals Federal district

Constituent entity of the Urals Federal district	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	The estimated indicator of efficiency	Efficiency rating
Kurgan region	0.09	0.15	0.03	0.60	1.20	0.10	0.50	0.10	0.30	0.50	3.57	6
Sverdlovsk region	0.15	0.12	0.09	0.50	0.80	0.30	0.75	0.30	0.18	0.60	3.79	5
Tyumen region	0.18	0.09	0.18	0.60	0.20	0.40	1.25	0.40	0.24	0.60	4.14	4
Khanty-Mansiysk AD	0.18	0.06	0.12	0.60	0.60	0.50	1.00	0.50	0.36	0.60	4.52	2
Yamalo-Nenets AD	0.18	0.03	0.15	0.60	0.40	0.60	1.50	0.20	0.12	0.60	4.38	3
Chelyabinsk region	0.12	0.18	0.06	0.60	1.00	0.20	1.50	0.60	0.06	0.60	4.92	1

According to the study, which might probably have some errors and assumptions we have come to the conclusion that there is a need to calculate some indicators, which directly affect efficiency of social and labour relations.

The practical value of the research lies in the specification of regional social and labour methods regulation and constituent parts of regional system of social and labour regulations, which allow us to find out up-to-date adjustment of the situation in labour sphere. The main statements and conclusions have put into definite methodological and practical recommendations, which may be used by state authorities, trade unions, employers' groups, dealing with labour issues in the whole country as well as at the regional, municipal and local levels during the preparation of branch and territorial agreements in the frameworks of social partnership, state policy of employment regulation.

We have developed methodological bases for monitoring social and labour sphere of Chelyabinsk region in order to prove that it is necessary to collect regularly and to analyze the data on the state of regional social and labour sphere, to detect and analyze the changes, happening at social and regional sphere, to avoid negative tendencies, leading to the social tension, as well as to make prognosis for the important processes in this sphere.

On the basis of the authors' methodology (evaluation) of the efficiency of the social and labour relations prepared the rating of Ural region territories in terms of the efficiency of social and labor relations regulation, the advantages and disadvantages of the social and labour relations regulation in different regions of Russian Federation were identified.

#### 4. Discussion

According to the study, which might probably have some errors and assumptions we have come to the conclusion that there is a need to calculate some indicators, which directly affect efficiency of socio-labour relations, but today these indicators are not included in statistics digests, e.g.: a differentiation coefficient of wages in decile groups (salary ratio of 10 % highly paid employees to 10 % lower paid ones), a collective agreement coverage of major regional organizations, etc. When analyzing the state of a socio-labour sphere of the region some indicators of labor force in the region are of great importance, they are such as: education of the labour force in the region, the share of workers with higher education, the share of employees involved in innovative activities, as well as the share of expenditures on research and development in the total GRP. Innovative potential of labour resources is becoming a critical part of an innovation component of a socio-labour sphere potential. Hence, one of the

peculiarities of its formation is presented by an inextricable connection between education and work activity of a worker throughout all working life. In order to fulfill modern requirements a worker must be capable of learning and retraining. Numerous studies have shown that an employee with higher basic level of education is more receptive to new knowledge, usually having a great creative potential. That's why the participation of employers and local government in financing a study, training and upgrading qualifications of workers is a tendency of socio-labour sphere development in modern conditions. In our opinion this factor needs to be considered in the suggested method. The data of our study show that the increase in a level of development differentiation of socio-labor relations in the region discourages and holds back adopting one policy of socio-economic reformation and national market formation, and it increases the danger of regional crises.

## Conclusion

The authors suggest future work to further improve the techniques (updating a set of indicators to calculate the efficiency) and the implementation of the methodology of social and labour relation in the computer program with the help of Visual Basic in Excel. This program may be used while social and labour relation efficiency evaluation in any constituent entity of the Russian Federation.

The practical value of the research results in its complex and systematic character, which allows to use it while teaching such subjects as "Labour economy", "Social and labour relations of the region" and others as well as while development of learner's guides and profound studies of the social and labour relations problem at higher school in the future.

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