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ON THE DETERMINANTS OF INTERNATIONAL FINANCIAL INTEGRATION IN THE GLOBAL BUSINESS AREA

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Abstract

Through this article we aim to shed light on the determinants of international financial integration in the current global finance area. We tell de jure indicators and de facto indicators apart and seek to assess the marginal explanation power of global (common) factors. Several measures of international financial integration are discussed and tested on both developed markets and the major emerging markets over the period 1988 to 2008, using a dynamic panel methodology. Our findings show that socioeconomic stability, trade openness, local investment, budget surplus, financial development and growth opportunities leads international financial integration. Furthermore, we ascertain the marginal explanation power of the global factors in the sustained rising IFI. Indeed, world interest rate, world economic situation and world PER are a prime determining factors. Our results corroborate recent empirical theory as well as provide a potential usefulness for international portfolio managers and for domestic governors aiming to improve their attractiveness indices.

Keys words: financial integration, international trade, asset–liabilities, FDI, common factors, Dynamic Panel

JEL classification: F02, F15, F21, F3, F4

1. Introduction

It is by common consent that the two last decades have been marked by an increasing international financial integration (Agenor 2003, Lane, and Milesi–Ferreti 2001, 2003, Vo 2005b, Bekaert *et al.* 2007, Vo, and Daly 2007). Academic literature allots this increase to development in the economic and financial cross–border relationship but also to synchronization of the business cycles in the new context of financial globalisation (Bordo, and Helbling 2003, Imbs 2004, Schiavo 2008). Consequently, the attention is directed towards research in the nature of links which lead the interdependence of international stock markets and the mechanisms of international synchronization.

In the same way, international investors need to understand the economic and financial reality of international financial integration (henceforth, IFI). Successively, good comprehension of this reality should clarify recent statements of the empirical literature that contends the rising trend of the IFI (Lane, and Milesi–Ferrtti 2003, 2007, Vo, and Daly 2007), and justifies the interference between country–specific (idiosyncratic) and global (common) risk factors (Bordo, and Helbling 2003, Arfaoui, and Abaoub 2010) but also the critical macroeconomic volatility (Abugri 2008, Andersen *et al.* 2005, Bekaert *et al.* 2009). The article aims to present and discuss the idiosyncratic and common factors likely to lead the financial integration in the current global finance area.

2. Literature review

In actual fact, the diversity of definitions assigned to IFI is well documented in financial theory of capital markets. In turn, explanations carried to this concept are closely related to these predetermined definitions. However, previous studies did not establish a link between prerequisites and consequences of the IFI, especially in the current sustained equity markets interdependence.

For example, Von Furstenberg (1998) focuses on the concept of capital mobility and the prerequisites of IFI. La Porta *et al.* (1998), study the relationship between legal conditions and IFI. Henry (2000), studies the importance of economic modernization, financial development and domestic investment on emerging market integration. Edison *et al.* (2002), interest in the importance of domestic economic growth as a spur of foreign capital flows. Adam *et al.* (2002), focus on the role of financial development in the improvement of IFI in the European Union. Devereux *et al.* (2002a,

2008), connect the degree of IFI to implications of domestic tax policy. Bekaert, and Harvey (2000), Bhattacharya, and Daouk (2002), highlight the importance of the protection of shareholders rights and the role of insiders in the development of stock markets. Bordo, and Helbling (2003), ascertain the relevance of economic integration and the international trade in the definition of synchronization and IFI. We quote, also, Vo, and Daly (2004), who revisited the connection between capital flows and economic growth on Asian emerging markets. Bansal, and Pasricha (2010), contends that FDI and foreign portfolio investment have statistically significant impact on GDP growth. In other respects, the results we posit are mixed by considering the differences of studied samples as well as the used measures and approximations. In this direction, Vo (2005b), derives a diversity of measures of the IFI, to establish an inter–country comparison. Recently, Vo, and Daly (2007), tell between *de jure* indicators and *de facto* indicators.

To our knowledge, previous works documented well the determinants of the IFI while told between its consequences and prerequisites. However, we suppose that these investigations deserve a control for the relevance of global factors in the current framework of a sustained IFI (Vo 2005b, Daly, and Vo 2007, Lane, and Milesi–Ferretti 2007) and of a common stochastic trend between international stock markets (Kasa 1992, Phylaktis, and Ravazzolo 2005). Moreover, Ferson, and Harvey (1998), contend that future research must see in the way of global risk factors. At the same, Bordo, and Helbling (2003), ascertain that global shocks are the dominant influence of stock market synchronization across all exchange rate regimes. In this direction, we seek to contribute to the empirical literature by an actualization of the *de jure* and *de facto* indicators as well as by taking a particular interest in *de jure* indicators having has common feature.

We mention that recent studies support the close connection between global factors and stock market performance (Abugri 2008, Henriques, and Sadorsky 2008). Furthermore, we justify our choice by the absence of study that aimed at connecting the *de facto* indicators of IFI, with the global factors, especially in the presence of an increasing business cycles synchronization (Bordo, and Helbling 2003, Shin, and Wang 2004, Imbs 2004, Schiavo 2008), a sustained changes in stock market industrial structures (Bekaert *et al.* 2007) and, more generally, of the international financial industry.

The remainder of this article is organized as follows: Section 3 describes the data and states our hypothesis. Section 4, outlines the model and methodology. Section 5, interprets and discuss results and Section 6, concludes the article.

3. Description of data and hypothesis' statement
3.1. Presentation of selected variables and declaration of hypothesis
We follow proposals of the empirical literature (Cottarelli, and Kourelis 1994, Von Furstenberg 1998, Vo 2005, Vo, and Daly 2007) and we admit a selection of variables related to economic and financial conditions as well as legal and institutional environment. However, recent empirical literature contends that asset returns are conditional to both local risk factors and global risk factors. Similarly, by highlighting the sustained increasing IFI, it seems suitable to verify the contribution of *de jure* indicators having a common feature. With this aim in view, we try to contribute to the empirical literature by considering this hypothesis.

Local–specific factors

Domestic business environment in host countries is often considered as very determining factor of the performance of international portfolio investment. Indeed, deviation from international parities and market frictions are likely to form an additional source of risk but are liable to make up extra risk premiums. On the other hand, if country–specific conditions have dominant features, then stock markets of those countries will converge towards a state of segmentation. The extreme case, if local factors become less influential, then financial assets pricing will be relatively affected by global (common) factors.

Anyway, local–specific factors mirror the domestic economic and financial state, the development of national markets and the institutional and lawful environments. In this direction, we consider domestic economic growth, local inflation, trade openness, domestic investment, budget surplus, domestic financial development, local growth opportunities, lawful and institutional environment and a dummy variable for financial liberalization. We state that these variables are divided by GDP, to ensure certain homogeneity and to avoid possible biases related to different sizes

of countries. We mention that the selected variables include those having a direct link with IFI, and those having an indirect link.

The domestic economic growth. Empirical literature contends that the sustained growth of national production is far from being without relationship with performance and depth of stock markets (Edison *et al.* 2002, Vo 2005, Vo, and Daly 2007). Indeed, international investors are directed at stock markets belonging to countries which post a regular economic dynamics and potential growth opportunities. At the same, the convergence of national production of a given country towards international standards informs about the economic synchronization of that country and, thus, potential trend towards world economic integration. In that's the case, national economic circumstances are likely to lead foreign capital flows. Moreover, Vo, and Daly (2004), affirm that the economic growth spur net private capital flow insofar as capital flows are far from being an accelerator of emerging economies growth. In the same way, Edison *et al.* (2002), ascertain a weak impact of IFI on economic growth and suggest the relevance of the opposite relationship. In this direction, we expect a potential suitability of this variable and we suppose a positive relationship between national economic growth and IFI, for both developed markets and emerging markets. Consequently, we declare the null hypothesis as follows:

H_0: there is a positive relationship between economic growth and IFI.

We approximate the economic growth by annual growth of GDP, measured in constant price to neutralize the effect of local inflation. The variable economic growth presents a mean value equal to 3.4627, a median value equal to 2.4000, and a standard deviation equal to 3.3008.

Economic stability (local inflation). If we develop our reasoning in terms of socio–economic and financial conditions, then we will be able to affirm that economic and monetary stability leads financial development and, then, financial integration. Moreover, inflation is a central variable that influence interest rate, foreign exchange rate, real return and, more generally, external financial positions. For instance, Vo, and Daly (2007), affirm that inflationary countries are likely to have a national currency which depreciates and which creates less advantages for international investors. Consequently, it makes up a capital flight and supports a state of segmentation. Adler and Dumas (1983), Lewis (1999), assert that local inflation risk affects international asset holdings. Lemmen, and Eijffinger (1996), show that inflation explains significantly IFI in the European Union.

In addition, the convergence of local inflation towards international standard rates is likely to solve the puzzle of equity home bias and then spur IFI. Consequently, national monetary stability is liable to fuel holding of foreign assets and international diversification strategies. In that case, the weaker is the gap between local inflation and world inflation, the more increasing is the financial integration level. Conversely, the attractiveness of foreign investment is closely related to inflation risk in host countries. From where, we expect to observe a negative relationship between local inflation and IFI for both developed and emerging markets. We state the null hypothesis as follows:

H_2: Local inflation affects negatively IFI.

We approximate the inflation rate by annual growth of GDP deflator, available from world development indicators of the World Bank. This variable presents a mean value equal to 56.6313, a median value equal to 3.7959, and a standard deviation equal to 321.3256.

Trade openness. This ratio is frequently employed by empirical literature such as Yi (2003), Vo, and Daly (2004), Vo (2005), Vo, and Daly (2007). It translates the economic integration level and informs about connection between economic integration and financial integration. Indeed, a country which has a good economic behaviour and a good openness to international trade is likely to improve its national attractiveness indices. Moreover, financial theory contends that economic integration supports financial integration.

For instance, Obstfeld, and Rogoff (2000), show that there is a direct link between gains from international diversification and the trade openness. Indeed, trade costs are likely to create a gap between marginal rates of substitution and, consequently, limit gains from the negotiation of economic goods. Lane, and Milesi–Ferretti (2003), Vo, and Daly (2007), support the hypothesis that trade openness leads IFI insofar as commercial relationship results in international financial transactions. Bordo, and Helbling (2003), suppose that international trade affect positively international business cycle synchronizations. Thus, countries which are more integrated in international trade are in a more favourable position to improve their processes of IFI (Imbs 2004, Kwanho, and Wang 2004). Conversely, Bekaert, and Harvey (2000), show that the openness to international trade increases

exposure of domestic markets to global risk factors. Nevertheless, we expect the suitability of this variable and wait to observe a positive relationship between trade openness and IFI for both developed markets and developing markets. Consequently, we declare the null hypothesis as follows:

H₃: Trade openness affects positively IFI.

We approximate the trade openness by opening rate. The opening rate is equal to:

$$(X_{it} + M_{it}) / PIB_{it} \tag{1}$$

This variable shows a mean value equal to 40.6379, a median value equal to 41.2225, and a standard deviation equal to 19.4355.

Local investment. Local investment dynamics (that it is public or private one) forms a positive signal for foreign investors and portfolio managers. It translates the whole domestic economic dynamics and particularly, national tax policy and, then, the after tax required return. It informs, also, about the dynamics of national saving, the interest rate and the liquidity of stock markets. We think in this direction, insofar as tax benefit forms a successful instrument to attract foreign investors. Thus, the more advantageous is a national tax policy, the more is increasing the degree of IFI. Consequently, we expect to observe a positive relationship between local investment and IFI. We state the null hypothesis of the positive relationship as follows:

H₄: Local investment affects positively IFI.

We approximate this factor by the volume of local investment as share of GDP. This variable exhibits a mean value equal to 24.8010, a median value equal to 24.1600, and a standard deviation equal to 8.2941.

Local tax policy. The main idea is that budget surplus involves a high burden tax for economic actors comparing to a budget deficit. Alternatively, the budget deficit implies low burden tax for economic actors as well as for investors. Thus, the budget surplus results in a rigid national tax policy.

In this framework, the tax policy is likely to influence local investment dynamics and foreign capital flows. For instance, Devereux *et al.* (2002a), Lane, and Milesi–Ferretti (2003), show that tax policy forms a successful tool for domestic governors. Initially, foreign investments are directed at countries which release more advantageous tax policy. Then, firms and financial intermediaries (portfolio managers) seek advantageous tax rates to implement financial transactions and to carry out their order books, respectively. Finally, the presence of high income tax compels holders of these incomes to move to other countries to avoid the tax burden. In this direction, Lane, and Milesi–Ferretti (2003), show that the rigidity of national tax policies spurs the mobility of capital flows insofar as international investors seek to invest abroad to conceal assessable incomes from the control of domestic regulators. Koenig, and Zeyneloglu (2010), contend that implications of a national tax policy are closely related to equity home bias and IFI.

Under the assumption that the budget surplus involves a high burden tax, we expect to observe a negative relationship between the budget surplus and the IFI. Consequently, we formulate the null hypothesis as follows:

H₅: Budget surplus affects negatively IFI.

This variable "budget surplus" exhibit a mean value equal to 14.6039, a median value equal to 13.3600, and a standard deviation equal to 4.7544.

Financial development. Financial theory of capital markets contends that financial development leads asset returns through two channels: a direct channel related to the intrinsic stock market functions which organize exchanges of funds, financial relationship, and diversification of risk, liquidity and firms' takeover. An indirect channel defined by the role of the domestic financial system in the financing of the economy, the improvement of national indices which leads national firms' profitability. Moreover, empirical literature (*inter alia,* Bekaert, and Harvey 1997, Henry 2000a, b, Kim, and Wu 2007, Baele *et al.* 2007), supports the determining role of financial development in the improvement of IFI and suppose the existence of a strong relationship between financial development and IFI. We approximate the financial development by two control variables, namely; **1.** the development of stock market measured by market capitalization of listed companies as share of GDP:

$$Market\,capitalisation_{it} / GDP_{it} \tag{2}$$

And **2.** the volume of domestic banking credit as share of GDP:

$$\text{Domesticbankingcredit}_{it} / \text{GDP}_{it} \tag{3}$$

A sizeable stock market is liable to achieve a high degree of international financial integration. Furthermore, a dynamic market is likely to attract additional foreign investors. Moreover, local financial intermediation increases the international reflection of resident investors (Mann, and Meade 2002, Lane, and Milesi–Ferretti 2003, 2005). So we expect to observe a positive relationship between the financial development and the IFI, for both developed markets and emerging markets. Consequently, we state the null hypothesis as follows:

H$_6$: Financial development is associated to a positive relationship with IFI.

Stock market capitalization as share of GDP, exhibits a mean value equal to 58.1315, a median value equal to 45.7761, and a standard deviation equal to 41.1222. "Domestic banking credit as share of GDP", exhibits a mean value equal to 105.4408, a median value equal to 92.9953, and a standard deviation equal to 68.5335.

Gross Dividend Yields. Dividends indices informs about financial profitability of domestic market and about financial performance of listed companies. Thus, dividend yields can be considered as a kind of "dashboard" for domestic and international investors. However, this variable should be interpreted with caution and the analysis of its relation with IFI should have an extended pragmatic view. Indeed, rational reasoning allows inferring that foreign investors are directed at stock markets which release marginal dividend yields (comparing to other markets). This behaviour is equivalent to reasoning on the short term horizon given investors' aversion. On the contrary, the reasoning on the long term lets us to think that a high dividend yields (dividend per share) is equivalent to a low PER. This evidence involves weak growth opportunities and, potentially, a lower degree of IFI (Bekaert *et al.* 2007). By reference to Bekaert *et al.* (2007), a stock market which posts high PER must have a high growth rate comparing to the world growth rate (high rate of retention). In terms of growth opportunities, a national stock market that exhibit high growth opportunities (high PER) is liable to attract additional foreign investments. On the short term now, a national stock market that exhibit high dividend yields is likely to attract international investors. In this direction, we support the hypothesis of a robust relationship between the dividend yields and the IFI. Insofar as empirical literature recommends the relevance of the relationship between PER and IFI (Bekaert *et al.* 2007), we consider the lack of data and we use the variable gross dividends yields while achieving a more correct interpretation. Consequently, we expect observing a significant relationship between the two variables while expressing some reservation about the sign of this relationship. From where, we declare the null hypothesis as follows:

H$_7$: Gross dividend yields is closely related to international financial integration.

Gross dividend yields presents a mean value equal to 2.5910, a median value equal to 2.4000, and a standard deviation equal to 1.4856.

Domestic institutional and legal environment. The idea is that capital mobility and IFI suggest a mutual confidence between capital holders and governors in the host countries. Indeed, institutional and legal environments (La Porta *et al.* 1998, 1999, Bhattacharya, and Daouk 2002, Stulz 2005, 2006), credibility, governance (Pinkowitz *et al.* 2005, Stulz 2005) and management style (Obstfeld 1994, Mayers, and Jin 2005, Giannetti, and Simonov 2005, Stulz 1999, 2006) are essential prerequisites to IFI. For instance, La Porta *et al.* (1997), suggest that a good external financial behaviour of a given country depends on insiders' position as well as on the protection of shareholders' rights. Bhattacharya, and Daouk (2002), show that the countries which have a weak institutional protection of shareholders' rights and a weak enforcement of insider trading regulation as well as a weak applications quality of the law are liable to have less developed stock markets. Yeyati *et al.* (2009), stipulate that restrictions on capital flows form a good *de jure* indicator of IFI. Kalemli–Ozean *et al.* (2010), interests in this question in the euro zone and ascertain that the convergence of legislative regulations spur the financial integration.

We use country–indices of corruption perception (*Corruption Index perception: CPI*) computed and diffused by *International Transparency* and The University of Passau. These indices are scores which vary between 0 (more risky) and 10 (less risky) and the variable is fitted through a logarithmic

transformation [ln(CPI)] before being entered in the model. Our basic viewpoint is that investors prefer, in first order, the most profitable markets and, in second order, the less risky markets belonging to countries which release a modern governance style. In this direction, a high sustained score involves an increasing trend towards IFI. From where, we expect to observe a positive relationship between the two variables. Then, we declare the null hypothesis as follows:

H$_8$: Corruption affects negatively the IFI.

Corruption indices "Leg.inst.", exhibits a mean value equal to 1.5481, a median value equal 1.6486, and a standard deviation equal to 0.5521.

Financial liberalization. We take aim for using a dummy variable for financial liberalization insofar as financial liberalization is an essential stage to switch from an extreme state of financial segmentation to a state of financial integration (Bekaert, and Harvey 2000, 2005).

Global (common) factors

Seeing that each national stock market evolves in an international economic situation, the contribution of common factors is reasonable and forms a central aim in our hypothesis' test. A global factor is, in that case, any factor having a global feature and liable to affect simultaneously national markets. Under the hypothesis of perfect integration, international asset pricing is far from being completely isolated of global factor implications. From now, we state that the study of the relationship between global factors and IFI has an explicit relevance. Consequently, we select a vector of three variables, namely; world interest rate, world industrial production and world PER.

World interest rate. Empirical literature shows that under the perfect integration hypothesis, world interest rate leads international asset pricing via world market risk premium (Bekaert, and Harvey 1997, 1998, De Santis, and Gerard 1998, Adler, and Qi 2003). Moreover, world interest rate conditions the mechanism of portfolio allocation and arbitrager's strategies. In this direction, a fall in international interest rates results in an increase of capital mobility towards markets which release marginal gains (Bekaert *et al.* 2002, Abugri 2008). In parallel, the world interest rate constitutes a signal with affective informational contents and is likely to stimulate capital mobility. Indeed, the fall in international interest rate can be interpreted as a prerequisite to the revival of investment and a reduction in firms cost of capital. Moreover, the fall in international interest rates leads capital flows to change destination towards the emerging and bullish markets (Bekaert *et al.* 2002). Consequently, their financial integration level is liable to increase.

On the whole, dynamics of the world interest rate results in an increase of IFI of some markets but in a fall for other markets. Insofar as our sample consists of both developed markets and emerging markets, we express some reservation about the sign of this relationship and we declare the null hypothesis as follows:

H$_9$: IFI is closely related to world interest rates.

We approximate this variable by the three–month Eurodollar deposit rate available from Federal Reserve Board (FRB). This variable exhibits a mean value equal to 4.9571, a median value equal to 5.3100, and a standard deviation equal to 2.0347.

World industrial production. World economic situation informs about the economic profitability of firms and the worldwide growth opportunities. Several empirical studies establish a direct link between changes of world economic situation and international stock market behaviour. At first, a sustained world economic growth is likely to develop a global perspective to international investors. Then, the research of investment opportunities reinforces international capital mobility and cross–border financial transactions. Furthermore, a good economic situation is a favourable signal for a fall in the probability of default of firms and sovereign credits. Moreover, Bekaert, and Harvey (1997, 1998), De Santis, and Gerard (1998), show that *ex ante* gains from international diversification is determined by default premiums. Consequently, we expect to observe a positive relationship between world industrial production and IFI. The opposite case of declining world economic situation changes the destination of investment flows towards developing countries having high economic growth rates (Edison *et al.* 2002, Vo, and Daly 2007). In this direction, the two variables are expected to establish a close relationship. Consequently, we state the null hypothesis as follows:

H$_{10}$: World industrial production is associated to a positive relationship with IFI.

We use US industrial production, available from Federal Reserve Board, to proxy for world economic situation. This variable exhibits a mean value equal to 89.4159, a median value equal to 95.1424, and a standard deviation equal to 17.2595.

Global growth opportunities. Growth opportunities tell about firms' profitability and, more generally, stock market behaviour. Thus, international investors will be more dynamic on international stock markets which post growth opportunities. In the same way, a national stock market which exhibit growth opportunities that converges on global growth opportunities is likely to attract additional foreign investors. Consequently, we can affirm that the convergence of growth opportunities mirrors the degree of financial integration.

As a matter of fact, several factors allows setting up a successful prediction of growth opportunities in the host countries and, particularly, on national stock markets. Indeed, economic performance and the control of risk make it possible to expect growth opportunities. For instance, corporate financial theory often uses market value over book value (M/B), to proxy for Tobin's Q, to measure investment opportunities. Recently, Bekaert *et al.* (2007), approximate growth opportunities by the PER. From where, we admit world PER available from Datastream and we declare the null hypothesis as follows:

H_{11}: Global growth opportunities affect positively IFI.

The world PER, shows a mean value equal to 20.4268, a median value equal to 19.9083, and a standard deviation equal to 2.9827.

3.2. Sources of data and descriptive statistics

Selected data are usual measures of capital flows following the dictates of a logical intuition as well as lessons of financial theory of capital markets but justified by empirical literature. As a matter of fact, we tell apart between *de jure* indicators and *de facto* indicators. Thus, empirical literature defines the former as prerequisites of IFI and the latter as consequences of IFI.

We mention that the most rational in our work is that we rely on a logical inclusion of both stock measures and flow measures insofar as portfolio investment flows are affected by short term fluctuations but direct investment remains associated to an array of other mechanisms with medium and long term features. Moreover, we initially thought about defining the concept of IFI in its broad sense. Indeed, this concept should cover not only the ability of foreign investors to be directed at domestic markets in the host countries but also the ability of domestic market residents to target foreign markets.

Being the relationship between the both indicators, we meet the two by an empirical relationship. Indeed, we insert *de facto* indicators in the vector of dependent variables and *de jure* indicators in the vector of independent variables. In addition, we state that construction of the variables was been inserted within the framework of previous studies. We cite, among others, Lane, and Milesi–Ferretti (2003, 2007), Vo (2005b), Kim, and Wu (2007), Bekaert *et al.* (2007).

As for sources of the data, we use the following databases: foreign assets and foreign liabilities as share GDP are obtained from Datastream. While, FDI inflows and FDI outflows as share of GDP, are available from *International Financial Statistics* (IFS) as well as from *World Development Indicators* (WDI) diffused by the World Bank. Annual growth of GDP, local inflation, opening rate, local investment, budget surplus, market capitalization of listed companies and domestic banking credit are available from WDI. Likewise, gross dividend yields (GDY) are obtained from *World Federation of Exchange* (WFE). Data on corruption (Legal institutions) are available from *"corruption pricing index"* diffused by *Transparency International* of the University of Passau. World interest rate and US industrial production are available from Federal Reserve Board (FRB) while world PER (WGO) is extracted from Datastream.

Finally, the whole data relates to a sample of 15 international stock markets, namely; G7's stock markets (Canada, France, Germany, Italy, Japan, UK and USA) and the eight major emerging markets (Argentina, Brazil, Chile, India, Korea, Malaysia, Mexico and Thailand). The period of study spreads out of 1988 to 2008. We justify the choice of this extended period by considering the importance which knew the international economic and financial scene during the two last decades, notably, the increasing trend of IFI and the sustained worldwide synchronizations. Moreover, this period allows considering fluctuations on short periods and, also, trends on medium and long term.

Although we try to carry out a logical and scientific selection, we must mention that we accounted for the magnitude of the heterogeneity of data allotted to differences of computations methods and construction of data in use by each country. For instance, Vo, and Daly (2007), say that countries create data on foreign assets and foreign liabilities by employing book values and other data by employing market values. In the same way, diffusers of macroeconomic and financial data raise the problem of carrying out a calculation method in constant price in opposition to other calculation methods in current price. Considering these dispositions allows minimizing the heterogeneity of the data as well as structural differences between economies and national stock markets.

Table 1, summarizes descriptive statistics of the data. Analysis of these statistics allows contending the dynamics of IFI (Figure 1, Figure 2, and Figure 3) which suggests a sustained variation through time and from country to country. For instance, Aggregate stock of assets and liabilities as share of GDP (IFI.1), presents a standard deviation equal to 17.1725, and a value which varies between –48.6914 (Canada, 2007) and 190.2048 (Italy, 1993). The highest standard deviation is observed in the second measure (IFI.2) by employing aggregate stock of liabilities as share of GDP, with an mean value equal to 8.6965, a minimal value equal to –22.5266 (Canada, 2007) and a maximal value equal to 237.7082 (Italy, 2005).

Table 1. Descriptive Statistics of the selected measures of IFI

Variable	Mean	Median	Std. Dev.	Min.	Max.
IFI.1	2.6576	0.0094	17.1725	–48.6914	190.2048
IFI.2	8.6965	0.0399	30.4666	–22.5266	237.7082
IFI.3	3.0601	2.0827	3.3318	–2.7574	25.4727
IFI.4	–5.0752	0.5118	26.3252	–237.2824	31.9185
IFI.5	5.8411	2.79708	16.7777	–65.5214	191.2898

The table recapitulates *de facto* indicators of IFI. IFI.1 is the sum of assets and liabilities as share of GDP (A+L/GDP). IFI.2 is the liabilities as share of GDP (L/GDP). IFI.3 is the aggregate flows of FDI as share of GDP (FDI Net inflows + FDI Net outflows/GDP). IFI.4 is equal to (FDI outflows + Assets Equity/GDP), and IFI.5 is equal to (FDI Net inflows + FDI Net outflows + A+L/GDP). All the data are expressed in annual frequency and spreads out of 1988 to 2008.

Source: Derived by the authors

We mention that intensity of the relationship between indicators confirms the best choice of the data and the good achievement of our intentions insofar as correlation coefficients are significantly low. Indeed, average correlation coefficient is equal to 14.35%. This result emphasizes the absence of redundant information in the used indicators.
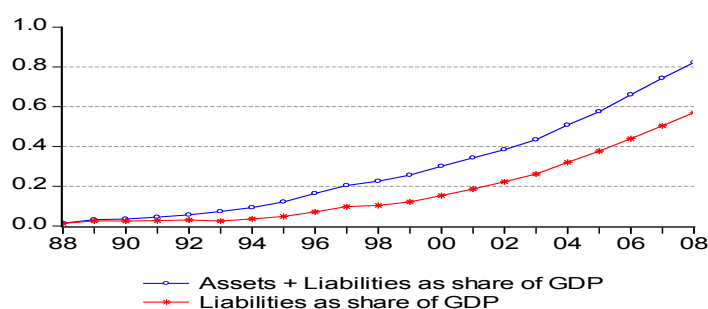
Figure 1. Cumulative changes of aggregate stock of Asset and Liabilities as share of GDP

Source: Derived by the authors.
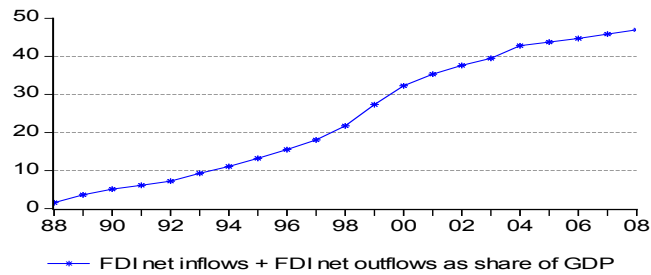
Figure 2. Cumulative changes of aggregate FDI net flows as share of GDP

Source: Derived by the authors.
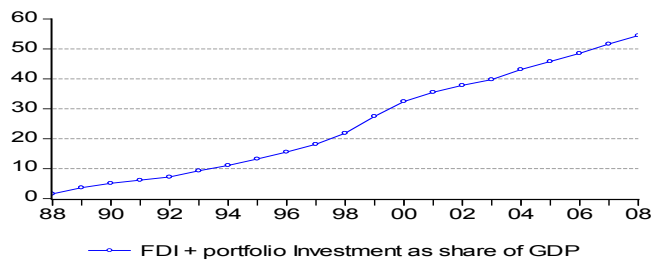
Figure 3. Cumulative changes of aggregate FDI and portfolio investment flows as share of GDP

Source: Derived by the authors.

Table 2. Descriptive Statistics of *de jure* indicators

Variable	Mean	Median	Std. Dev.	Min.	Max.
GDP	3.4627	2.4000	3.3008	–13.1267	12.6697
Inflation	56.6313	3.7959	321.3256	–4.0000	3057.6290
Trade openness	40.6379	41.2225	19.4355	10.6752	101.1822
Local investment	24.8010	24.1600	8.2941	11.1400	53.5800
Budget surplus	14.6039	13.3600	4.7544	8.1800	31.9900
Market capitalisation	58.1315	45.7761	41.1222	0.2849	198.8124
Domestic banking credit	105.4408	92.9953	68.5335	22.4786	322.0129
GDY	2.5910	2.4000	1.4856	0.3000	14.7000
Legal inst	1.5481	1.6486	0.5521	–0.5621	2.2192
World rate	4.9571	5.3100	2.0347	1.1400	9.1600
US industrial production	89.4159	95.1424	17.2595	65.6313	112.9453
WGO	20.4268	19.9083	2.9827	16.8478	28.0333

Source: Derived by the authors.

By reference to Table 2, we observe a meaningful variation in the selected variables supporting the hypothesis of an economic and financial dynamics on both developed markets and emerging markets. Indeed, the growth of GDP exhibits a standard deviation equal 3.3008, a minimal value equal to –13.1267 (Malaysia, 1998) and a maximal value equal to 12.6697 (Argentina 1991). GDP deflator, as proxy to local inflation, presents a standard deviation equal to 321.3256, and a minimal value equal to –4.0000 (Canada 2007) and a maximal value equal to 3057.6290 (Argentina 1989).

Table 3. Matrix of correlation coefficients for the whole used variables

	IFI.1	IFI.2	IFI.3	IFI.4	IFI.5	GDP	Inf.	Trade	Invst	Budget	Mktcap.	Dom.–credit	GDY	Leg.–inst	Lib.–Fin	W.rate	Indust.–prod	WGO
IFI.1	**1.000**																	
IFI.2	0.559	**1.000**																
IFI.3	−0.107	−0.094	**1.000**															
IFI.4	−0.075	−0.841	0.104	**1.000**														
IFI.5	0.829	0.405	0.098	0.084	**1.000**													
GDP	−0.141	−0.172	−0.046	0.118	−0.142	**1.000**												
Inflation	0.065	0.008	−0.112	0.028	0.047	−0.206	**1.000**											
Trade	−0.068	−0.015	0.177	−0.016	−0.019	0.055	−0.212	**1.000**										
Invst.	0.005	0.114	−0.019	−0.134	−0.006	0.064	−0.211	0.120	**1.000**									
Budget surpl	−0.001	−0.101	−0.096	0.117	−0.014	0.116	0.186	−0.358	−0.497	**1.000**								
Mkt.cap.	−0.182	−0.124	0.525	0.089	−0.033	−0.017	−0.184	−0.061	0.196	−0.247	**1.000**							
Dom.–credit	−0.053	−0.019	0.069	0.015	−0.009	−0.275	−0.032	−0.229	0.413	−0.304	0.531	**1.000**						
GDY	0.179	0.076	0.081	0.022	0.193	−0.099	0.284	−0.097	−0.298	0.129	−0.164	−0.229	**1.000**					
Leg.–inst.	−0.045	0.015	0.405	−0.005	0.059	−0.282	−0.043	−0.051	0.323	−0.296	0.548	0.609	−0.036	**1.000**				
Lib.–Fin.	0.017	0.066	0.170	−0.059	0.038	−0.098	−0.249	0.108	0.109	−0.216	0.261	0.189	−0.137	0.264	**1.000**			
Wrate	−0.035	−0.017	−0.012	−0.005	−0.033	0.093	0.157	−0.127	0.026	0.073	−0.144	−0.084	0.077	−0.047	−0.427	**1.000**		
Indust.–prd.	−0.120	−0.012	0.285	−0.069	−0.073	−0.065	−0.197	0.335	0.019	−0.137	0.350	0.142	−0.169	0.088	0.402	−0.445	**1.000**	
WGO	−0.070	0.028	0.244	−0.046	−0.025	−0.050	0.006	−0.056	−0.007	0.023	0.019	−0.036	−0.137	−0.007	0.047	0.141	−0.136	**1.000**

The table summarizes the whole indicators of IFI. "GDP" is the annual growth of GDP. "Inflation" is PPP over GDP. "Trade" is the opening rate. "invst" is the local investment as share of GDP. "Budget surplus" is the budget surplus as share of GDP. "Market cap.", is market capitalisation of listed companies as share of GDP. "Domestic credit" is domestic banking credit as share of GDP. GDY is gross dividend yields of each national stock market. "Leg.inst." is a rating of corruption or *"Corruption Pricing Index"* (CPI), published by *"Transparency International"*. "Wrate", is the three–month Eurodollar deposit rate. "indust.prod.", is the index of American industrial production and "WGO" is the world PER.

Source: Derived by the authors.

This evidence corroborates Edison *et al.* (2002), who contend that less developed countries are those which carry out high economic growth rates. We observe the same evidence, for international trade, domestic stock markets, and domestic banking markets. At the same, global variables ascertain the financial and economic dynamics. For instance, industrial production exhibits a standard deviation equal to 17.2595, and world PER presents a standard deviation equal to 2.9827.

4. Model and methodology
4.1. The model

In the light of our hypothesis, we formulate the basic econometric model, in panel data, as follows:

$$IFI_{it} = \alpha + \sum_{k=1}^{K} \beta_{kit} X_{kit} + \eta_{it} \tag{4}$$

$$
\begin{array}{cccc}
Y & = & X & \beta & + & \eta \\
(NT \times 1) & (NT \times K) & (K \times NT) & (NT \times 1)
\end{array}
$$

Where, dependent variable is changes in IFI level of country i, at year t. α is a constant and x_{kit} is the kth independent variable of country i, at year t. $i = 1, ..., N$ and $t = 1, ...,T$. β_k, are parameters to be estimed. η_{it} is an error term that include individual characteristics, temporal characteristics et idiosyncratic error, respectively.

$$\eta_{it} = \upsilon_i + \theta_t + \varepsilon_{it} \tag{5}$$

With, $\forall i$, $E(\varepsilon_{it}) = 0, E(\varepsilon_{it}^2) = \sigma_\varepsilon^2$ (homoskedasticity hypothesis). $\forall i \neq j$, $E(\varepsilon_{it} \varepsilon_{jt}) = 0$ (contemporaneous correlation between individuals). $\forall t \neq s$, $E(\varepsilon_{it} \varepsilon_{is}) = 0$ (Absence of autocorrelation) and $\forall_i$, $E(x_{it} \varepsilon_{it}) = 0$ (absence of orthogonality).

However, we have to mention that the panel data approach allows improving empirical estimates and tests. At first, allows taking into account of unobserved heterogeneity (Balestra, and Nerlove 1966). Then, it permits to decompose the total variability *(within vs. between)* and, of course, the use of an extended sample increases the number of degrees of freedom and reduces possible biases that relates to collinearity. However, dynamic panel data models with GMM, allows for non–normality and conditional heteroskedasticity, both likely features of the country data.

4.2. Empirical methodology

Recent empirical literature often considers autoregressive specifications with composed errors which possibly consist of exogenous variables. Being the sample combining of time series and cross–sectional data, panel data models are also suitable to analyze dynamic effects. Indeed, dynamic panel data models allows to past realizations of the dependent variable to affect its present variation via the Arellano–Bond's estimator. Consequently, we consider the following specification of the model:

$$y_{it} = \alpha + \beta y_{i,t-1} + \sum_{k=1}^{K} \gamma_{kit} X_{kit} + \theta_t + \upsilon_i + \varepsilon_{it} \tag{6}$$

Where, β represents the lagged dependant variable $y_{i,t-1}$. Incorporation of this dynamics in the basic model produces a significant change in the interpretation of the equation. Indeed, without the lagged variable, X_{kit} represent the whole of information producing y_{it}, observed. With this lag, we have the whole history of the explained variable. Thus, any measurable impact must be conditioned with this history.

We have to point out that in the presence of fixed effect, there is no correlation between the lagged endogenous variable and the error term [endogeneity: $E(y_{it} \varepsilon_{it}) = 0$]. In other words, rejection

of the hypothesis of strict exogeneity excludes the feedback of the error towards independent variables. In parallel, in a dynamic model, randomness results in the lost of exogeneity of the lagged endogenous variable. First differentiation of Eq. (6) eliminates υ_i, and implies the absence of strict exogeneity. Consequently, it involves a possible prediction of contemporaneous regressors by past chocks [$E(\varepsilon_{it-1} / y_{it-1}) \neq 0$; $E(\Delta\varepsilon_{it} / \Delta y_{it-1}) \neq 0$]. The solution is a use of instrumental variables in the equation while we stakeout orthogonality between y_{it-1} and ε_{it}. Generally speaking, estimation method with instrumental variables allows breaking with the link between residuals and independent variables (orthogonality hypothesis).

Arellano, and Bond (1991), derived the generalized method of moments (GMM) for the estimate coefficients in the presence of the lagged endogenous variable, of predetermined variables and differences of the strictly exogenous variables. As a matter of fact, GMM method is developed for a dynamic panel estimate and was been recommended by Holtz–Eakin *et al.* (1990), Arellano, and Bond (1991), Arellano, and Bover (1995), Blundell, and Bond (1997), as an improvement of empirical estimates and tests. Of course, the GMM approach allows to take advantage of time series variation in the data, to take account of unobservable specific effects (υ_i), to include a lag of the dependent variable as regressor and to control for endogeneity on the explanatory variables. However, this method require considering two specification tests; the Sargan test for over–identifying restrictions, or test of validity of the instruments and the test of Arellano–Bond of serial correlation of second order in the residuals.

Since Arellano, and Bond, this method of estimate was been considered in a sustained way by empirical literature. We cite, *inter alia*, Beck *et al.* (2000), Carkovic, and Ross (2002), Edison *et al.* (2002), Vo, and Daly (2007).

5. Results and discussion

Tables 4–8, summarize estimation results of various specifications of the basic model. The first inference to be raised relates to the effect of past realizations of IFI on its contemporaneous variations. Indeed, the relationship is significantly positive at the 1% level, on the whole specifications of the model (IFI.1, IFI.3).

Table 4. Panel estimation of aggregate stock of Assets and Liabilities as share of GDP

Variables	Model 1 Coef.	Model 1 Std. Dev.	Model 2 Coef.	Model 2 Std. Dev.	Model 3 Coef.	Model 3 Std. Dev.	Model 4 Coef.	Model 4 Std. Dev.
LD.IFI.1	0.161***	0.058	0.162***	0.058	0.161***	0.058	0.161***	0.058
Constant	2.305	1.482	1.607*	0.835	2.471*	1.286	1.740**	0.752
GDP	−0.178	0.410	−0.179	0.409	−0.189	0.409	−0.196	0.409
Inflation	−0.001	0.004	−0.001	0.004	−0.001	0.004	−0.0008	0.004
Trade openn.	0.065	0.159	0.061	0.158	0.066	0.158	0.059	0.158
Invst.	−0.547	0.552	−0.557	0.552	−0.563	0.535	−0.611	0.532
Budget surplus	1.821	1.200	1.904	1.191	1.775	1.197	1.858	1.188
Market cap.	−0.028	0.052	−0.028	0.051	−0.027	0.051	−0.029	0.051
Domest. Credit	−0.066	0.071	−0.065	0.071	−0.065	0.069	−0.061	0.069
GDY	2.346**	0.982	2.230**	0.962	2.355**	0.978	2.217**	0.959
Leg. Inst.	−4.912**	2.793	−5.033*	2.783	−4.888*	2.776	−4.985*	2.771
Lib. Fin.	2.402	7.265	3.680	7.022	2.499	7.089	4.608	6.601
World rate	−0.086	0.703	−0.227	0.657	—	—	—	—
Indust. prod	−0.772	0.495	−0.548*	0.301	−0.826*	0.440	−0.591**	0.281
WGO	0.341	0.593	—	—	0.401	0.565	—	—
	Stat.	**p–value**	**Stat.**	**p–value**	**Stat.**	**p–value**	**Stat.**	**p–value**
Wald Chi2(k)	46.40	0.0000	46.25	0.0000	46.66	0.0000	46.41	0.0000
Sargan test	257.59	0.7263	258.37	0.7105	258.63	0.7276	259.71	0.7310
Abond test	0.44	0.6610	0.45	0.6544	0.43	0.6673	0.43	0.6698

Asterisks ***, **, and *, denote statistical significance at the 1%, 5% and 10% levels, respectively.
Source: derived by the authors.

In this direction, we can point out that a given state of integration is likely to be maintained thanks to an international reputation as well as to the awareness developed with investors in the reference country. However, the financial reputation is not necessarily an economic reputation. Thus, we notice a negative relationship between IFI and economic growth. This result can be interpreted thoroughly on two levels: Firstly, recent empirical investigations contend that less developed countries carry out high economic growth and with a given rate that exceed the growth of their IFI. Secondly, developed countries tend to carry out a rather slow growth of both their economic situations and IFI. This result seems to be plausible and corroborates recent empirical literature. We quote, inter alia, Edison et al. (2002), Vo (2005), Vo, and Daly (2007).

We notice, also, that inflation exerts a negative effect on IFI (except measures 3 and 4, Table 6 and 7). Initially, in most cases, international investors are directed at hedging against stochastic inflation risk and strive to avoid inflationary countries. Thus, *equity home bias* becomes an alternative way to manage inflation risk on international stock markets. Our results support, also, the point of view that trade openness allows to implement international financial transactions and then, to spur domestic market dynamics. We cite, notably, documentary credit, brokerage, commission, insurance, Freight forwarder.

Domestic economic dynamics is, of course, a prerequisite to economic and financial integration. Moreover, empirical literature supports the close link between gains from international diversification and trade openness (Lane, and Milsei–Ferretti 2003). At the same, local investment is a significant positive determinant of IFI (except measures 1 and 5). As a matter of fact, the local investment translates domestic economic dynamics, sustained productivity, dynamics of local consumption and national saving, a foreseeable behaviour of prices and interest rates. Moreover, the local investment was been known as a prime indicator of domestic economic policy and tax policy. From where, international investors will be directed at countries which post an economic revival.

We state the existence of a negative relationship between burden tax in the host countries and the dynamics of foreign investment. Indeed, domestic budget deficit affect positively IFI. Thus, we can infer that budget deficit results in a modern and advantageous domestic tax policy. This result confirms the hypothesis that low burden tax is a determining factor of investment decision and notably investors who target after tax incomes. Moreover, the budget surplus is a variable frequently employed in empirical literature. We cite, among others, Wei (2000), Devereux *et al.* (2002a, 2008), Vo, and Daly (2007).

Table 5. Panel estimation of aggregate stock of Liabilities as share of GDP

Variables	Model 1		Model 2		Model 3		Model 4	
	Coef.	Std. Dev.	Coef.	Std. Dev.	Coef.	Std. Dev.	Coef.	Std. Dev.
LD.IFI.2	–0.008	0.062	0.0013	0.062	0.002	0.062	0.009	0.062
Constant	–0.019	0.050	–0.028	0.0503	–0.002	0.046	–0.0104	0.047
GDP	0.033	0.032	0.031	0.032	0.032	0.032	0.030	0.032
Inflation	–0.012	0.048	–0.016	0.048	–0.009	0.048	–0.014	0.048
Trade	–0.773	1.976	–1.131	1.965	–0.689	1.979	–1.003	1.961
Invst.	5.046*	2.948	4.891*	2.958	5.507*	2.942	5.321*	2.943
Budget surpl.	–0.206	4.460	0.112	4.477	–0.730	4.441	–0.427	4.446
Market cap.	0.928*	0.528	1.057**	0.516	1.021**	0.526	1.127	0.516
Domest. Credit	1.132	1.784	0.942	1.792	0.941	1.788	0.785**	1.793
GDY	–0.103	0.442	–0.162	0.441	–0.106	0.444	–0.155	0.442
Leg. inst.	–7.372***	1.278	–7.488***	1.283	–7.422***	1.284	–7.516***	1.287
Lib. Fin.	0.840	1.318	0.358	1.318	0.271	1.275	–0.108	1.285
World rate	0.646	0.594	0.601	0.582	—	—	—	—
Indust. prod.	–11.955	9.705	–8.829	8.339	–8.041	8.445	–5.269	7.368
WGO	2.382	2.359	—	—	2.186	2.327	—	—
	Stat.	p–value	Stat.	p–value	Stat.	p–value	Stat.	p–value
Wald Chi2(k)	44.27	0.0001	43.32	0.0000	43.52	0.0000	42.51	0.0000
Sargan test	151.46	0.9794	146.29	0.9907	150.08	0.9831	145.85	0.9913
Abond test	–0.46	0.6488	–0.40	0.6893	–0.37	0.7112	–0.32	0.7477

Asterisks ***, **, and *, denote statistical significance at the 1%, 5% and 10% levels, respectively.

Source: derived by the authors.

Interpretation of financial *de jure* indicators allows inferring that financial development forms a prime determinant of IFI. However, we mention that results are both mixed and interesting insofar as we worked on a heterogeneous sample and we attend a juxtaposition of bank–based system and market–based system in the considered countries. By reference to measures 2 and 3, the IFI has a positive relationship with financial development at the 1% and 5% levels. As a matter of fact, the development of domestic stock market and banking market translates the robustness of a lawful system, of a transparency and managerial integrity, a style of governance and a robust financial foundation. The rationality of international investors stakes the whole of these attributes. Thus, the more developed is a domestic market, the more attractive is liable to be.

As we developed while declaring the hypothesis (H_6), the relationship between gross dividends yields and IFI can be interpreted in twice levels. Indeed, a reasoning in short term horizon induce investors to prefer distribution of the benefit to receive dividend yields but a reasoning on the long term get them to prefer a high retention rates fixed by their target–firms. Although the different measures (*de facto*) of the IFI posts mixed results, we had the advantage of obtaining significant relationship between the two (IFI.1, IFI.3, and IFI.5). However, this relationship tends to be positive as long as a gross dividend yield is a variable which attracts foreign investors independently of their horizon of reflection. Moreover, all the significant coefficients are associated to a positive sign.

Table 6. Panel estimation of aggregate FDI flows as share of GDP

Variables	Model 1		Model 2		Model 3		Model 4	
	Coef.	Std. Dev.	Coef.	Std. Dev.	Coef.	Std. Dev.	Coef.	Std. Dev.
LD.IFI.3	0.354***	0.049	0.363***	0.049	0.353***	0.049	0.363***	0.049
Constant	−0.157	0.151	−0.493***	0.094	−0.228*	0.129	−0.490***	0.084
GDP	0.005	0.0424	0.002	0.043	0.007	0.042	0.0006	0.043
Inflation	0.0002	0.0006	0.0002	0.0006	0.0002	0.0006	0.0002	0.0006
Trade openness	−0.039**	0.018	−0.045**	0.018	−0.038**	0.018	−0.045**	0.018
Invst.	0.099*	0.059	0.104*	0.059	0.114**	0.057	0.102*	0.057
Budget Surplus	0.044	0.132	0.127	0.133	0.057	0.131	0.129	0.133
Market cap.	0.013**	0.006	0.012**	0.006	0.013**	0.006	0.012**	0.006
Domest. Credit	−0.018**	0.009	−0.021**	0.009	−0.019**	0.009	−0.020**	0.009
GDY	−0.132	0.118	−0.211*	0.117	−0.139	0.117	−0.212*	0.117
Leg. Inst.	0.184	0.251	0.111	0.254	0.186	0.251	0.112	0.253
Lib. Fin.	−0.381	0.774	0.274	0.758	−0.554	0.752	0.301	0.707
World rate	0.070	0.075	−0.004	0.071	—	—	—	—
Indust. prod.	0.116**	0.051	0.224***	0.035	0.138***	0.045	0.224***	0.032
WGO	0.169***	0.061	—	—	0.151***	0.058	—	—
	value	p–value	value	p–value	value	p–value	value	p–value
Wald Chi2(k)	253.16	0.0000	239.58	0.0000	252.41	0.0000	240.46	0.0000
Sargan test	272.83	0.7102	270.19	0.7376	273.78	0.7369	271.01	0.7299
Abond test	0.47	0.6349	0.42	0.6732	0.47	0.6401	0.43	0.6697

Asterisks ***, **, and *, denote statistical significance at the 1%, 5% and 10% levels, respectively.

Source: derived by the authors.

Institutional and legal environment (IFI.1, IFI.2, and IFI.5) is, also, an essential determinant of the IFI. As a matter of fact, empirical literature contends that bad governance, management's failings, weak protection of shareholders' rights and, generally speaking, existence of market distortions make up a constraint to the process of financial development (Bhattacharya, and Daouk 2002, Mayers, and Jin 2005, Giannetti, and Simonov 2005, Stulz 2005, 2006). From where, we point out that our results corroborate lessons of fundamental financial theory as well as recent empirical literature. At the same, we state that the strategies of joing stock market modernization and financial liberalization let to acquire comparative advantages and reinforce attractiveness indices. Our results allow confirming this reasoning and ascertain a significant positive relationship between financial liberalization and the IFI.

Assessment of the contribution of common factors confirms the relevance of our initial predictions. Thus, we define various specifications of our basic model via an action on the three global

factors. Results allow observing that world interest rate is associated to a positive relationship with IFI. In addition, getting ride of this variable does not influence the explanatory power of the other variables, which confirms the absence of multicolinearity. In actual fact, the world interest rate can be qualified as a source of disclosure of signals on international stock markets. It defines cross border capital flows, international parities, performance of economic sectors and, more generally, world economic situation.

Table 7. Panel estimation of FDI outflows and Assets as share of GDP

Variables	Model 1		Model 2		Model 3		Model 4	
	Coef.	Std. Dev.	Coef.	Std. Dev.	Coef.	Std. Dev.	Coef.	Std. Dev.
LD.IFI.4	−0.047	0.061	−0.047	0.061	−0.027	0.061	−0.025	0.060
Constant	−0.371***	0.103	−0.365***	0.102	−0.265***	0.094	−0.264	0.094
GDP	0.007	0.063	0.007	0.063	0.003	0.063	0.004	0.063
Inflation	0.064	0.096	0.063	0.095	0.066	0.097	0.071	0.096
Trade openness	−0.253	3.776	−0.279	3.743	0.327	3.790	0.668	3.746
Invst.	8.023	5.544	7.986	5.531	9.125	5.567	9.177*	5.557
Budget Surplus	7.781	8.968	7.805	8.947	4.604	8.912	4.398	8.885
Market cap.	−1.068	1.078	−0.998	1.044	−0.705	1.077	−0.795	1.049
Domest. Credit	−1.092	3.358	−1.061	3.347	−1.266	3.381	−1.364	3.369
GDY	0.323	0.897	0.294	0.889	0.457	0.902	0.496	0.893
Leg. Inst.	−0.002	2.567	0.004	2.562	0.118	2.585	0.128	2.582
Lib. Fin.	12.171***	2.717	12.108***	2.675	10.486***	2.600	10.685***	2.588
World rate	2.426**	1.202	2.323**	1.165	—	—	—	—
Indust. prod.	−37.139*	20.083	−34.055**	17.145	−12.127	16.922	−15.083	14.779
WGO	0.971	4.677	—	—	−2.143	4.613	—	—
	value	p–value	value	p–value	value	p–value	value	p–value
Wald Chi2(k)	27.79	0.0152	27.82	0.0096	23.80	0.0330	23.79	0.0217
Sargan test	65.78	1.0000	65.87	1.0000	67.54	1.0000	67.40	1.0000
Abond test	−0.49	0.6265	−0.48	0.6303	−0.45	0.6563	−0.44	0.6620

Asterisks ***, **, and *, denote statistical significance at the 1%, 5% and 10% levels, respectively.
Source: derived by the authors.

Table 8. Panel estimation of aggregate FDI and Asset + Liabilities as share of GDP

Variable	Model 1		Model 2		Model 3		Model 4	
	Coef.	Std. Dev.	Coef.	Std. Dev.	Coef.	Std. Dev.	Coef.	Std. Dev.
LD.IFI.5	−0.003	0.059	0.0005	0.059	−0.003	0.059	−0.0004	0.059
Constant	2.849*	1.477	1.178	0.854	2.759**	1.283	1.241	0.770
GDP	−0.345	0.415	−0.345	0.415	−0.352	0.413	−0.368	0.414
Inflation	−0.004	0.005	−0.003	0.005	−0.004	0.005	−0.003	0.005
Trade openness	−0.001	0.178	−0.007	0.179	0.015	0.178	−0.001	0.178
Invest. local	−0.307	0.566	−0.313	0.567	−0.261	0.550	−0.336	0.547
Budget surplus	1.243	1.244	1.495	1.237	1.218	1.236	1.455	1.232
Market cap.	0.008	0.054	0.006	0.054	0.008	0.054	0.007	0.054
Domest. Credit	0.032	0.074	0.029	0.074	0.023	0.073	0.027	0.073
GDY	2.395**	1.030	2.118**	1.013	2.388**	1.028	2.088**	1.011
Leg. Inst.	−6.771**	2.784	−6.878**	2.786	−6.848**	2.776	−6.896**	2.777
Lib. Fin.	−0.721	7.360	2.553	7.132	−2.136	7.208	2.834	6.707
World rate	0.341	0.714	−0.006	0.671	—	—	—	—
Indust. prod.	−0.964**	0.488	−0.436	0.308	−0.949**	0.436	−0.464	0.289
WGO	0.829	0.598	—	—	0.852	0.569	—	—
	value	p–value	value	p–value	value	p–value	value	p–value
Wald Chi2(k)	25.73	0.0280	23.86	0.0325	26.36	0.0152	24.36	0.0182
Sargan test	255.45	0.6058	256.55	0.6041	254.92	0.6102	256.36	0.6137
Abond test	−1.14	0.2553	−1.15	0.2492	−1.12	0.2638	−1.16	0.2441

Asterisks ***, **, and *, denote statistical significance at the 1%, 5% and 10% levels, respectively.
Source: derived by the authors.

At the same, marginal contribution of the world economic situation is considered. According to measures 1, 2, 4, and 5, signs of coefficients associated to this variable are significantly negative. By analogy with local economic growth, we can interpret this result by the presence of countries which carry out both economic growth and IFI level with a lower rate than the world average. We ascertain this evidence from Table 2, where the average value of local economic growth is equal to –64.01%, with a standard deviation equal to 5.9878, while the average of world economic growth is equal to 2.88%, with a standard deviation equal to 0.0296.

As we developed it just before, economic integration implies that growth opportunities share a common trend between countries. By reference to Bekaert *et al.* (2007), if all growth opportunities are competitively priced and exploited on international capital markets, then country–specific PER should converge to global PER. Consequently, IFI is liable to carry out higher worldwide growth opportunities. Moreover, foreign investors will be directed at international stock markets which reveal marginal growth opportunities. In parallel, a stock market that exhibit local growth opportunities converging towards international standards is likely to switch from an initial state of segmentation towards an extreme state of integration.

In actual fact, local growth opportunities in excess of world growth opportunities tell about the bullish trend towards IFI. According to our results, we ascertain that global growth opportunities exhibit a significantly positive relationship with IFI. Thus, we can confirm our basic reflection by which the existence of worldwide growth opportunities spurs capital mobility and portfolio investment flows and, then, ensure a sustained growth of IFI. Consequently, we declare that the PER is a prime indicator which has been acquired an extended magnitude in connection with the subject of international financial integration.

On the whole, we appreciate the relevance of the global (common) factors in the current framework of an increasing IFI. Notably, we realize the marginal contribution of *de facto* indicators having a global feature. Of course, this evidence results in the local growth which knew national economies as well as domestic stock markets during the last two decades (Lane, and Milesi–Ferretti 2003, Imbs 2004, Vo 2005b, Vo, and Daly 2007, Schiavo 2008). Although the nature of the relationship between *de jure* indicators and *de facto* indicators often depends on employed measures, we point out that our results are plausible and economically interpretable. Moreover, our findings confirm the initially stated hypothesis and corroborate recent empirical literature.

Lastly, we confirm the validity of our findings. Indeed, the conducted specification tests, Sargan test and Abond test, reveal a meaningful statistics. So we contend that our instruments are valid and do not exhibit correlation biases.

6. Conclusion

This article tries to shed light on the concept of IFI within its both theoretical and empirical frameworks. Firstly, IFI is associated to basic concepts of financial theory of capital markets. Secondly, the relevance of this topic is highlighted and inserted within its real economic framework. Thus, we realize that the diversity of analyses and interpretations presented by previous studies is allotted to the diversity of definitions carried to this concept. In this direction, we consider that a discussion of the miscellaneous approaches of measures makes up an essential stage before implementing empirical tests and projecting obtained results on their real framework.

The article aims **1.** to explicit growth of the IFI and to clarify its determining mechanisms and **2.** to contribute to the actualization of the empirical literature in the current context of a sustained cross–border economic and financial synchronization. Technically, we try to tell between *de jure* indicators and *de facto* indicators while assessing the marginal contribution of common factors. In parallel, we work on a sample of the most developed international stock markets over an extended period (1988 to 2008). Moreover, the analysis was reinforced by dynamic panel data approach with GMM, to minimize potential estimation biases and to ensure a reliability of the results.

Our findings support the hypothesis of an increasing international financial integration and confirm the relevance of both adopted measures and selected indicators. Indeed, we ascertain that socio–economic stability, trade openness, local investment, domestic tax policy, financial development and local growth opportunities make up a successful management tool for financial integration. At the same, we appreciate the contribution of global factors and justify the hypothesis of sustained financial globalisation. Indeed, world interest rate, world economic situation and world PER are a prime

determining factors of cross–border investment flows and, then, IFI. We point out that our results corroborate recent empirical literature (for instance, La Porta, and Lopez–De–Silanes 1997, Wei 2000, Lane, and Milesi–Ferretti 2003, Bordo, and Helbling 2003, Vo 2005, Stulz 2005, 2006, Vo, and Daly 2007, Bekaert *et al.* 2007, Schiavo 2008). Moreover, financial theory of capital markets stipulates that equity risk premium is mainly defined by the price of covariance risk conditionally to global risk factors (for instance, Bekaert, and Harvey 1995, 2000, De Santis, and Gerard 1997, 1998, Gerard *et al.* 2003, Carrieri *et al.* 2006).

Finally, we have to mention that the robustness of our results is confirmed for several reasons. Initially, we employed an extended number and diversified *de facto* indicators of IFI. Then, we used an advanced empirical methodology which offers an advantage in a number of observations and a number of degrees of freedom and controls for estimation biases. Furthermore, we worked on a sample of both developed and emerging countries and, lastly, we carried out a geographical diversification criterion to consider the various financial and industrial structures of the selected international stock markets. We suppose that our results provide a practical usefulness for portfolio managers and, especially, for domestic governors who aim at promoting their attractiveness' indices.

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DO CAPITAL MARKETS VALUE EARNINGS AND CASH FLOWS ALIKE? INTERNATIONAL EMPIRICAL EVIDENCE

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Abstract

In this study we examine empirically the value relevance of earnings and cash flows in three major capital markets, two Anglo–Saxon, the UK and the USA and one code law country, France. Our dataset consists of more than 41,000 USA, UK and French firm–year observations over a nine year period. Multivariate statistical regression analysis is undertaken to test the major research hypotheses. Results show that the value relevance of earnings and cash flows is country specific. Specifically, results indicate that earnings are valued more in France and less in the Anglo–Saxon countries, due to the fact that the financial reporting in the Anglo–Saxon countries is less conservative and managers may manipulate easier financial information. Moreover, as hypothesized, results show that cash flows are the most (least) value relevant in the USA and the UK (France). In summary, results support that there are substantial differences in the way investors and financial analysts perceive earnings and cash flows in the UK, France and the USA. The results of this study should be of great importance to the major stakeholders such as investors, creditors, financial analysts, especially after the recent global financial crisis and the latest collapses of colossal organizations worldwide.

Keywords: capital markets, earnings, cash flows, France, empirical

JEL Classification: G14, G15, G30

1. Introduction

Empirical capital markets research examined extensively the type of financial information that could be useful in explaining stock prices. The valuation of earnings has been among the major empirical questions raised in numerous studies. The usefulness of earnings has also been examined recently in relation to cash flows (Barth *et al.* 2010, Charitou, and Vlittis 2010, Bali *et al.* 2009, Banker *et al.* 2009, Ball *et al.* 2003, Bartov *et al.* 2001, Charitou *et al.* 2000, among others). Evidence exists to support that earnings are more useful than cash flows in certain countries. However, to date comparative international research on the value relevance of cash flows has been limited

Even though earnings are considered the primary variable in the capital markets, mainly for security valuation and for credit and investment decisions (Ball *et al.* 2003, Banker *et al.* 2009, Chan *et al.* 2006), they were criticized because management uses their discretion to manipulate earnings, and thus earnings may become a less reliable measure of performance and cash flows could be preferable. Proponents of cash flows support that cash flows are not manipulated by management. Moreover, cash flows enable users to assess the changes of the net assets of a company, its financial structure (including its liquidity and solvability), as well as its capacity to adapt to changes of the context or of opportunities. On the other hand, cash flows cannot be reported alone because they are influenced by timing and matching problems. Thus, due to these limitations, neither of these two measures can be used in isolation for security valuation purposes. Empirical research thus far provided evidence to support that earnings dominate cash flows in the marketplace. Existing evidence though on the incremental information content of cash flows beyond earnings has been inconclusive. The inconclusive results in prior studies and the limited research on this issue provide motivation for this study.

This research study differs from prior studies in the following respects. First, it examines not only the value relevance of operating cash flows beyond earnings, but it also examines the role of earnings and cash flows using data from UK and USA (Anglo–Saxon countries) and France (a code

law country) in order to determine whether the valuation role of financial information differs in these countries. Since there are several financial reporting, economic and social differences between the above countries, it is expected that this study will provide new insight regarding the effect, if any of these differences, on the value relevance of earnings and cash flows in these countries.

We hypothesize that the association of operating cash flows and earnings with security returns is affected by the country the organization belongs to. Multivariate regression models will be employed to examine the value relevance of earnings and cash flows in the capital markets over a nine year period. Multivariate regression panel analysis was undertaken to test the major hypotheses. A sample of more than 41,000 firm year observations from the USA, UK and France was used to test the research hypotheses. The major conclusions of the empirical results are summarized as follows. First, regarding hypothesis one, which stated that earnings are valued by investors beyond cash flows and moreover, cash flows are valued by investors beyond earnings, our statistical analysis revealed the following: given cash flows, earnings are always very important to investors and financial analysts for investment purposes; given earnings though results show that cash flows are important to investors in the Anglo–Saxon countries USA and UK possibly due to the lower importance that investors place on the manipulated earnings in these less conservative countries. As far as France is concerned, results reveal that investors in that conservative country place much more attention to earnings and little or no attention to cash flows. Second, as far as hypothesis two is concerned, which states that investors and financial analysts pay different attention to financial information, such as earnings and cash flows, depending on the country their investment decision relates to, our statistical results support this hypothesis. We hypothesized that the value relevance of earnings will be the highest in France since it has the most conservative financial reporting system. On the other hand, we expect that the value relevance of earnings will be the lowest in the UK and USA because they have the least conservative financial reporting system. Hence, we expect that cash flows will be the most (least) value relevant in the USA and UK (France).

In summary, evidence provided in this study supports that indeed there are substantial differences in the way investors and financial analysts perceive financial information such as earnings and cash flows in UK, France and USA.

2. Critical Review of the Literature
2.1. Financial reporting in France, the UK and the USA
The three countries to be examined in the present study are the UK, the USA and France. The UK was selected because there is a controversy in the UK financial reporting literature regarding the value relevance of earning and cash flows. UK studies provided inconclusive results in the past regarding the information content of earnings and cash flows. As far as the USA is concerned, it was selected to be used as a benchmark because the majority of research undertaken thus far examined US firms. However, USA studies examined only certain issues that relate to the value relevance of earnings and cash flows and the present study will provide a comprehensive analysis regarding the value relevance of financial information. Moreover, recently the FASB in the US has been moving towards harmonization of its accounting rules with the IAS. The IAS issued the IFRS statement #7, which requires all listed firms to prepare the statement of cash flows. As far as France is concerned, this country was selected because, contrary to the common law system followed in the UK and the USA, the French financial reporting system is based on code law. Preliminary evidence in the literature thus far, indicates that the value relevance of earnings and cash flows depends on whether the firms examined are under a common law or under a code law system. Thus far, studies have not examined empirically all these issues (Vuolteenaho 2002, Uhrig–Homburg 2005, Charitou, and Vlittis 2010).

2.2. Differences in the value relevance of earnings
between Anglo–Saxon countries (USA and UK) and France
One of the major research questions raised in prior studies and in the present study is whether these earnings differences play an important role in the valuation of securities. One would expect the association of earnings with security returns to be higher in Anglo–Saxon countries (USA and UK) than in France for the following reasons. First, in Anglo–Saxon countries, where financial reporting is mainly influenced by common law, accounting practices traditionally rely on professional judgment. This

permits judgment in the preparation of financial statements. In contrast, in France, because of the influence of the code law system, accounting rules are proposed by governmental committees. This implies a high level of uniform practices that can be in opposition with the true and fair view approach. To the extent that the adoption of this approach is expected to provide more value relevant financial reporting figures, the association between earnings and security returns is expected to be higher in Anglo–Saxon or code law countries (USA and UK) than in code law countries (i.e. France).

Moreover, the tax system influences the financial reporting rules in France since financial statements are prepared for both tax and financial reporting purposes. In contrast, the alignment of financial reporting with tax reporting is quite low in Anglo–Saxon counties (USA and UK). This difference might tend to lead firms to adopt tax minimizing reporting methods so that earnings may not reflect economic reality, which is supposed to weaken the association of earnings with security returns (Ali, and Hwang, 2000, Ball *et al*. 2000, Haskins *et al.* 2000; Weetman 2005, Accounting Standards Board 1991, Dumontier, and Raffournier 2002).

Finally, since firm financing is mainly provided by capital market participants in the USA and in the UK, the financial reporting systems focus more on earnings measures. In France, ownership being largely by bankers or family members that have direct access to internal financial information and firms relying heavily on debt financing, the accounting principles focus mainly on reporting to creditors. Thus, this may reduce the relevance of accounting numbers for shareholders and their association with security returns (Orpurt, and Zang 2009, Givoli *et al.* 2009, Dumontier 1998, Nobes, and Parker 2004, Cheng, and Yang 2003).

3. Research Hypotheses

The inconclusive results in prior studies and the limited research on this issue provide motivation for this study. The research hypotheses to be tested are:

H₁: Operating cash flows (earnings) are associated with security returns, given operating earnings (cash flows) in the UK, USA, and France.

H₂: The value relevance of earnings and cash flows is country specific.

A discussion on each of the above hypotheses follows.

Hypothesis 1: Operating cash flows (earnings) are associated with security returns, given operating earnings (cash flows) in the UK, USA, and France.

As it has already been discussed, prior studies provided inconclusive results regarding the value relevance of earnings and cash flows (Bartov *et al.* 2001, Easton, and Harris 1991, Bali *et al.* 2009). This hypothesis predicts that operating earnings (cash flows) are associated with stock returns given operating cash flows (earnings). The objective of this hypothesis is: i) to provide empirical support for the propositions made by all international standard setting bodies that both earnings and cash flows play a very important role in explaining stock returns, and ii) to provide further evidence regarding the usefulness of operating cash flows in explaining security returns, given operating earnings and thus strengthen the evidence provided by prior studies regarding the usefulness of operating cash flows. This hypothesis was tested in prior studies mainly using data from Anglo Saxon countries, with mixed and inconclusive results. In summary, the results of prior studies are consistent with the existence of statistical association of earnings and stock returns, given operating cash flows.

Hypothesis 2: The value relevance of earnings and cash flows is country specific.

The inconclusive results in prior studies and the limited research examining the value relevance of earnings and cash flows in both Anglo–Saxon and code law countries, lead us to examine this research issue. Thus, the issue of the value relevance of earnings and cash flows is still an open research question. Are earnings or cash flows valued more in Anglo–Saxon or code law countries? (Bartov *et al.* 2001, Bali *et al.* 2009, Banker *et al.* 2009).

This hypothesis predicts that operating earnings and operating cash flows are associated with security returns. Prior studies provided very limited evidence on the relative informativeness of earnings and cash flows in France, the UK and the USA. Since we have already shown that there are significant financial reporting differences between these counties, we expect that these differences will affect the value relevance of earnings and cash flows in these countries. We hypothesize that the value relevance of earnings will be the highest in France since it has the most conservative financial reporting system. On the other hand, we expect that the value relevance of earnings will be the lowest

in the UK because it has the least conservative financial reporting system. Hence, we expect that cash flows will be the most value relevant in the UK and in the USA and the least value relevant in France.

4. Methodology
4.1. Sources of data

All industrial US, UK and French firms that have available monthly data for security returns, and available annual data for operating earnings, operating cash flows and market value of equity for the nine year period starting 1998 were included in the sample. Consistent with prior empirical studies, observations that were regarded as outliers were excluded from the sample, i.e. observations with absolute change in earnings/market value, absolute change in cash flows/market value, earnings/market value and cash flow/market value greater than 150%. Also observations that were in excess of three absolute studentized residuals were considered outliers and were excluded from the sample. These restrictions resulted in approximate reduction of the sample size of about 2%, which is consistent with prior empirical studies. Therefore, the final sample size used for regression analysis purposes is over 36,000, 4,200, and 1,100 firm–year observations for the USA sample, the UK sample and the French sample, respectively. The data were collected from NYSE/AMEX/NASDAQ reports, from company filings from SEC/EDGAR and from the annual reports of our sampled firms.

4.2. Measurement of financial and market variables

To test the above models, empirical models were constructed. They are defined as follows:

Stock Returns (RET_{it}): The return for security i in year t was defined as cash dividends (DIV), plus capital gains (losses), divided by the market value of equity at the beginning of the fiscal year.

$$RET_{it} = (P_t - P_{t-1} + DIV_t) / P_{t-1} \tag{1}$$

where:

P_t – security price of the firm at the end of the fiscal year t

DIV_t – Cash dividends for the year t

Stock Returns were calculated for the 12 month period, ending three months after the fiscal year–end. Since the theoretical variable 'permanent earnings' is unobservable, it will be replaced with ex–post earnings and cash flow variables to proxy the theoretical variable. Operating Earnings (E) is defined as tet profit before extraordinary items, discontinued operations, special and non–operating items. Cash flow from operations (CFO) is defined as operating earnings plus all non–cash expenses and revenues (non–current accruals) plus net changes in all working capital accounts related to operations, except for changes in cash, marketable securities, and debt in current liabilities (current accruals).

4.3. The Empirical Models

In order to test whether **a.** both the levels and changes of earnings are valued in the capital markets, **b.** cash flows are valued in the capital markets by investors beyond earnings, and **c.** both the levels and changes of cash flows are valued by investors in the market place in the UK, USA and France, the following multivariate regression models will be used:

$$RET_{it} = b_0 + b_i E + b_2 \Delta E + e_I \tag{2}$$

$$RET_{it} = b_0 + b_i E \qquad\qquad + b_3 CFO + e_I \tag{3}$$

$$RET_{it} = b_0 + \qquad b_2 \Delta E \qquad\qquad + b_4 \Delta CFO + e_I \tag{4}$$

$$RET_{it} = b_0 \qquad\qquad + b_3 CFO + b_4 \Delta CFO + e_I \tag{5}$$

where:

E – Operating Earnings; ΔE – Change in operating–earnings; CFO – Operating cash flows; ΔCFO – Change in operating cash flows; RET_{it} – stock return for firm i measured over a 12–month return interval ending three months after the fiscal–year–end.

All independent financial variables used in the above models are deflated by the market value of equity of the firm (P) at the beginning of the fiscal–year[1].

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[1] Deflation leads to the reduction of heteroscedasticity problems.

Model 2 tests the value relevance of both the levels and changes of earnings in the marketplace. Since financial reporting in the Anglo–Saxon countries is capital market oriented compared to the French system which is much more conservative and code law oriented, it is expected that the sum of the coefficients of earnings for the Anglo–Saxon countries be greater than the sum of these earnings coefficients for the French firms.

Models 3 and 4 test the value relevance cash flows (earnings) beyond earnings (cash flows). Specifically, Model 3 relates to the information content of the levels of earnings and cash flows, whereas Model 4 relates to the value relevance of the changes in earnings and cash flows. In recent years standard setting bodies worldwide and researchers paid more attention to cash flows, partly because cash flows cannot be manipulated by management. Moreover, cash flow advocates support that since organizations cannot survive without generating cash from their operations, cash flows should be valued beyond earnings. If cash flows are valued beyond earnings, then the coefficient of cash flows in Model 2 above is expected to be positive and significant. The stronger the association of earnings with security returns, the lower the significance of cash flows will be expected. Since in Anglo–Saxon countries capital market participants pay substantial attention to earnings, other things being equal, cash flows are expected to be more value relevant in countries that have much more conservative systems, such as France. In contrast though, in France cash flow statements are not required and this may affect negatively the value relevance of cash flows in the capital markets partly because this measure is not as known to capital market participants as it is in Anglo–Saxon countries.

Model 5 tests the value relevance of the levels and changes in cash flows. It is expected that the coefficients of the levels and changes of cash flows be positive and statistically significant if they are valued by investors in the capital markets. In all three countries, it is expected that cash flows will be valued in the capital markets.

Model 6 includes all four independent variables (both levels and changes of earnings and cash flows). This model tests whether the level and changes of earnings (cash flows) are valued beyond cash flows (earnings). Prior studies in the USA and in the UK showed an association between earnings and security returns, but the results regarding the value relevance of cash flows beyond earnings have been inconclusive. As far as the value relevance of cash flows beyond earnings in France is concerned, there has been very limited empirical evidence thus far. If cash flows (earnings) are valued by investors beyond earnings (cash flows) then the coefficients of these variables are expected to be positive and statistically significant.

5. Empirical Results

The research hypotheses discussed earlier are tested in what follows empirically. Country specific empirical results of the value relevance of earnings and cash flows in the UK, the USA and France are presented below.

Table 1. Descriptive statistics for all US, UK and French firms

Country	Variable	Mean	Median	St. Dev	Min	Max
	E	−0.008	0.038	0.192	−1.485	1.437
	ΔE	0.007	0.051	0.187	−1.477	1.499
USA	CFO	0.057	0.078	0.226	−1.496	1.488
	ΔCFO	0.009	0.005	0.245	−1.479	1.499
	RET	0.08	0.005	0.562	−0.998	3.778
	E	0.057	0.072	0.144	−1.416	1.375
	ΔE	0.005	0.008	0.157	−1.497	1.481
UK	CFO	0.123	0.107	0.204	−1.397	1.479
	ΔCFO	0.002	0.007	0.245	−1.487	1.356
	RET	0.092	0.073	0.372	−0.957	1.699
	E	0.037	0.058	0.135	−1	0.582
	ΔE	0.008	0.005	0.144	−1.114	1.092
FRANCE	CFO	0.184	0.134	0.237	−0.989	1.455
	ΔCFO	0.006	0.005	0.269	−1.335	1.224
	RET	0.055	0.03	0.318	−0.82	1.16

E – operating earnings; ΔE – Changes in earnings; CFO – Operating cash flows; ΔCFO – changes in Operating Cash Flows; RET – annual security returns.

5.1. Descriptive statistics and correlation analysis

In this part we discuss, analyse and critically evaluate the descriptive statistics and correlation analysis results.

5.1.1. Descriptive statistics

Table 1 presents descriptive statistics for all earnings, cash flows and security returns variables examined in the study for all three countries (USA, UK and France). As it has already been hypothesized earlier in this study, we expect differences in the value relevance of earnings and cash flows with security returns. These descriptive analysis results will provide an indication as to whether there exist differences in financial reporting among countries. We expect differences in the level of earnings due to the fact that there are financial reporting differences between these countries, which is also reflected in the different level of conservatism that exists in each countries' system. Specifically, results indicate the following: **a.** the mean security return for UK and USA is the highest (0.092 and 0.08, respectively), whereas in France is somewhat lower, 0.055, **b.** the mean earnings level is higher for UK (0.057) and lowest for USA, possibly because a number of US firms experienced greater losses (the median for the US firms is positive). For the French dataset the mean of earnings levels is 0.037; **c.** the mean of the cash flow levels is shown to be the highest for the French dataset (0.184) and lower for UK and USA (0.123 and 0.057, respectively); **d.** as expected the standard deviation of the levels and changes of cash flows is always higher than the level and changes of earnings in all three countries. These results are consistent with the results provided in prior empirical studies.

5.1.2. Correlation analysis

Table 2 presents Pearson correlation results for all dependent and independent variables used in the study, namely, security returns (RET), levels and changes of earnings (E and ΔE) and levels and changes of cash flows (CFO and ΔCFO). As it has been hypothesized, we expect differences in the value relevance of earnings and cash flows in different countries.

Table 2. Correlation Matrix for all US, UK and French firms

PANEL A: USA	E	ΔE	CFO	ΔCFO	RET
E	1	0.458 *	0.516 *	0.184 *	0.321 *
ΔE		1	0.265 *	0.412 *	0.267 *
CFO			1	0.565 *	0.238 *
ΔCFO				1	0.100 *
RET					1
PANEL B: UK	E	ΔE	CFO	ΔCFO	RET
E	1	0.560 *	0.501 *	0.153 *	0.297 *
ΔE		1	0.371 *	0.393 *	0.257 *
CFO			1	0.564 *	0.247 *
ΔCFO				1	0.133 *
RET					1
PANEL C: FRANCE	E	ΔE	CFO	ΔCFO	RET
E	1	0.429 *	0.290 *	0.108 *	0.336 *
ΔE		1	0.261 *	0.266 *	0.303 *
CFO			1	0.507 *	0.147 *
ΔCFO				1	0.061 **
RET					1

Where E − operating earnings; ΔE − Changes in earnings; CFO − Operating cash flows; ΔCFO − changes in Operating Cash Flows; RET − annual security returns.

*, **, ***, significant at alpha level = 0.01, 0.05, 0.10 level, respectively.

Results show the following: **a.** as expected the correlation between the level and changes of earnings and security returns is higher than the correlation between cash flows and security returns. This is partly due to the fact that security analysts, investors and creditors have traditionally emphasized earnings, as expected; **b.** the correlation between earnings and cash flows is higher in the

UK and the USA than in France. This is due to the fact that the French financial reporting system is more closely aligned to the tax system; **c.** the correlation between security returns and the levels of earnings is the highest in all three countries, whereas the correlation between security returns and changes in cash flows is again consistently the lowest in all three countries.

5.2. Regression analysis results

In this part, regression analysis results that relate to the test of the research hypotheses are presented, analysed and critically evaluated.

Table 3. Multivariate analysis regression results for all firms for the USA, UK and France

Country	Intercept	E	ΔE	CFO	ΔCFO	E+ΔE	CFO+ΔCFO	F–value	VIF	R^2adj
	a	b1	b2	b3	b4	b1+b2	b3+b4			
USA	0.0807 *	0.566*	0.438*			1.004*		1648.8 *		
(a)	−28.374	−34.143	−25.746			57.088		[0.000]	1.257	8.40%
	0.0525 *			0.480*	−0.054*		0.426*	606.32 *		
(b)	−17.341			−30.674	(−3.729)		30.295	[0.000]	1.469	3.30%
UK	0.0578 *	0.576*	0.314*			0.890*		232.98 *		
(a)	−9.621	−12.601	−7.453			21.548		[0.000]	1.458	10.00%
	0.0358 *			0.460*	−0.013		0.447*	135.566 *		
(b)	−5.191			−13.865	(−0.487)		15.509	[0.000]	1.467	6.10%
FRANCE	0.0297 *	0.596*	0.430*			1.026*		97.86 *		
(a)	−3.314	−8.41	6.492			13.98		[0.000]	1.226	14.30%
	0.017			0.209*	−0.021		0.188*	12.94 *		
(b)	−1.353			−4.63	(−0.532)		4.424	[0.000]	1.347	2.00%

Model a: Level and changes of earnings: RET = a + b1 E + b2 ΔE
Model b: Level and changes of cash flows: RET = a + b1 CFO + b3 ΔCFO
Where E: operating earnings, ΔE: Changes in earnings, CFO: Operating cash flows, ΔCFO: changes in Operating Cash flows; RET: annual security returns.
All independent variables (E, ΔE, CFO, ΔCFO) are deflated by the market value of the firm at fiscal year end of the previous year.
*, **, *** Statistically significant at a=1%, 5% and 10% respectively; ( ), Figures in parentheses represent t–statistic; [], Figures represent p–value

5.2.1. Results related to the value relevance of earnings

Table 3 (Model a) tests the value relevance of both the level and changes of earnings. We expect the sum of these coefficients of these variables to be positive and statistically significant. Moreover, the sum of these coefficients is expected to be close to unity and to approximate the true coefficient of the permanent earnings (Easton, and Harris 1991). If these earnings coefficients are positive, it means that investors perceive increases in operating earnings as good news and any increases in the firm's earnings are expected to increase stock prices.

Consistent with our hypothesis, all the coefficients of the levels and changes in earnings are positive and statistically significant. The sum of these coefficients is positive and statistically significant and it is close to unity for all three countries. As far as the R^2 is concerned, it is relatively higher in France (14.3% vs. 10% and 8.4% in the UK and in the USA, respectively) even though financial reporting in France is code–law oriented and it is more conservative. Moreover, the F–value of all models in the USA, the UK and France is relatively high and statistically significant as it is supported by the p–value of the models (p–value in all models is 0.000, supporting strong statistical significance).

5.2.2. Results related to the value relevance of cash flows

As far as the value relevance of the levels and changes in cash flows is concerned (Model b, Table 3), it is expected that the coefficients be positive and statistically significant. If these coefficients are positive, it means that investors perceive increases in operating cash flows as good news and any increases in the firm's cash flows are expected to increase stock prices. The results indicate that the sum of these coefficients is indeed positive and statistically significant, indicating that

cash flows are valued positively in the marketplace by investors. The R^2 of the models is higher in the UK and lowest in France, indicating that cash flows are not valued as much in France as they are valued in the UK. Moreover, the F–value of all models in the USA, the UK and France is relatively high and statistically significant as it is supported by the p–value of the models (p–value in all models is 0.000, supporting strong statistical significance).

Furthermore, as it was expected that both the size of the cash flow coefficients and the model's R^2s are relatively lower than the equivalent earnings statistics presented in the same table (model a). These results thus indicate that taken independently, earnings are valued more in the marketplace than cash flows. Again, these results are consistent with the expectations and with prior empirical evidence.

In summary, the multivariate analysis results presented in Table 3 are consistent with our Hypothesis 1, i.e., that the level and changes of earnings and cash flow variables are value relevant in all three countries, USA, UK and France.

Thus far, in multivariate analysis, earnings and cash flow variables were examined alone in the models. In order to examine whether investors, analysts and creditors take into consideration simultaneously both earnings and cash flows, multivariate regression analysis will be undertaken that includes all level and changes of earnings and cash flows. This analysis follows.

5.3. Multivariate regression analysis results on the value relevance of earnings and cash flows for the USA, the UK and France

Research hypothesis 1 predicts that the levels and changes of operating earnings (cash flows) are associated with stock returns given operating cash flows (earnings). The objective of this hypothesis is: **1.** to provide empirical support for the propositions made by all international standard setting bodies that both earnings and cash flows play a very important role in explaining stock returns, and **2.** to provide further evidence regarding the relative informativeness of operating cash flows (levels and changes) in explaining security returns, given operating earnings and thus strengthen the evidence provided by prior studies regarding the usefulness of operating cash flows. This hypothesis was tested in previous studies using USA and UK data, with mixed and inconclusive results.

The multivariate regression model results presented in Table 4 are used to provide support for the research Hypothesis 1. The critical analysis and discussion of the multivariate regression models tested which follows relates to: **1.** value relevance of cash flows (earnings) beyond earnings (cash flows) (Table 4), **2.** value relevance of both levels and changes of cash flows (earnings) beyond earnings (cash flows) (Table 4). Both pooled results as well as annual results are presented in this analysis.

Table 4. Multivariate analysis regression results for all years tested for all firms
for the USA, the UK and France

Country	Constant	E	ΔE	CFO	ΔCFO	VIF	F – value	R adj
USA	0.0759 *	0.666 *		0.152 *			1350.2 *	
(a)	−25.267	−38.126		−10.281		1.372	[0.000]	7.00%
	0.0746 *		0.716 *		−0.0291 **		1035.1 *	
(b)	−25.859		−42.335		(−2.255)	1.205	[0.000]	5.50%
UK	0.0288 *	0.598 *		0.239 *			235.1 *	
(a)	−4.491	−13.685		−7.713		1.334	[0.000]	10.10%
	0.0892 *		0.576 *		0.0574 **		164.3***	
(b)	−16.031		−14.909		−2.328	1.183	[0.000]	7.40%
FRANCE	0.014	0.7566 *		0.0723 ***			76.0*	
(a)	−1.231	−11.128		−1.867		1.092	[0.000]	11.40%
	0.0502 *		0.6818 *		−0.025		59.2 *	
(b)	−5.637		−10.66		(−0.728)	1.076	[0.000]	9.10%

Model a: Level of earnings and cash flows: RET = a0 + b1 E + b3 CFO
Model b: Changes of earnings and cash flows: RET = a0 + b2 ΔE + b4 ΔCFO
Where E: operating earnings, ΔE: Changes in earnings, CFO: Operating cash flows, ΔCFO: changes in Operating Cash flows; RET: annual security returns. All Independent variables (E, ΔE, CFO, ΔCFO) are deflated by the market value of the firm at fiscal year end of the previous year.
*, **, *** Statistically significant at a=1%, 5% and 10% respectively; ( ), Figures in parentheses represent t–statistic; [], Figures represent p–value

Thus far, in previous models, only the earnings or cash flow variables alone were entered in the models. In order to test the value relevance of cash flows (earnings) beyond earnings (cash flows), Models (a) and (b) in Table 4 were tested. Since the value relevance of earnings has been established in previous studies, we hypothesize that the coefficients of the earnings variables to be positive and statistically significant. On the other hand, although the coefficient of cash flows is expected to be again positive and significant, it is still remained an empirical question to be tested, since thus far previous studies provided inconclusive results.

As we hypothesized, all the coefficients of the levels and changes of earnings variables presented in Table 4 are positive and statistically significant. The size of the level of earnings coefficients ranges from 0.576 to 0.756. Similar results are also provided for the changes in earnings coefficients in Model (b). Thus, we conclude that the value relevance of earnings in all three countries is similar, i.e. investors in all three countries pay similar attention to the earnings information in making investment decisions. As far as the incremental information content of cash flows is concerned, again all coefficients of the level of cash flow variable in Model (a) are positive and statistically significant. Specifically, the coefficient of the level of cash flows is 0.072, 0.152 and 0.239 for France, the USA and the UK respectively. As it can be seen, investors and security analysts in the UK pay more attention on the operating cash flows than the investors do in France and in the USA. In contrast, investors in France pay the least attention on operating cash flows in making investment decisions. As far as Model (b) is concerned, which tests the changes of cash flows, results indicate that investors in the UK pay significant attention on the changes of cash flows in making investment decisions. In summary, in UK all cash flow coefficients are positive and significant whereas in the USA and France the coefficient of the changes in cash flows are negative, indicating that lag cash flows are statistically significant in explaining security returns. As far as the models' R^2s is concerned, it is shown that in France it is the highest and in the USA it is the lowest. Regarding the importance of the models is concerned; the F–values are relatively high and statistically significant in all three countries. The p–value of all three models is 0.000, indicating very high statistical significance. Moreover, as far as the correlation between the variables included in the model is concerned, the Variance Inflation Factors (VIF) show that the VIFs are as expected, relatively low, indicating that the models tested do not have any collinearity problems.

5.4. Multivariate analysis regression results to test
whether the valuation of earnings and cash flows is country specific

Hypothesis 2 predicts that operating earnings and operating cash flows are associated with security returns, but the valuation of earnings and cash flows is expected to differ in these countries because their financial reporting systems differ. In the UK and in the USA the financial reporting system is less conservative, common law oriented, whereas in the non Anglo–Saxon country France, the financial reporting system is much more conservative and code law oriented.

Thus far there has been very limited research on the valuation of earnings and cash flows in France, the UK and the USA. Since we showed earlier in this study that there are significant financial reporting differences between these counties, we expect that these differences will affect the value relevance of earnings and cash flows in these countries. We hypothesized that the value relevance of earnings will be the highest in France since it has the most conservative financial reporting system. On the other hand, we expect that the value relevance of earnings will be the lowest in the UK and in the USA because they have the least conservative financial reporting system. Hence, we expect that cash flows will be the most (least) value relevant in the USA and the UK (France).

Statistical regression results presented in the present study support our hypothesis that earnings and cash flows are country specific, i.e. that they differ depending on the country.

First, multivariate results presented in Tables 3 to 4 support again our hypothesis that the investors in these countries value differently financial information such as earnings and cash flows due to the financial reporting differences in these countries. Specifically, results in Table 3 indicate that total earnings, as measured by the sum of the level and changes of earnings (b1+b2), is valued by investors in all three countries, but results show that earnings are valued more in France and less in the Anglo–Saxon countries. Specifically, b1+b2 in France is 1.026 whereas in the USA and the UK is 1.004 and 0.89 respectively. These results are also supported by the R^2 of the models in each country. As it can be seen in Table 3 the highest R^2 is in the French model (14.3%), whereas in the UK and the

USA is lower (10% and 8.4%, respectively). As already discussed, these results are due to the fact that the financial reporting in the Anglo–Saxon countries is much more liberal (less conservative) and managers may manipulate easier the financial statements.

Second, multivariate results presented in Table 3 support again our hypothesis that investors in these countries value differently cash flows due to the financial reporting differences in these countries. Specifically, results indicate that total cash flows, as measured by the sum of the level and changes of cash flows (b3+b4), is valued by investors in all three countries, but results show that cash flows are valued more in the Anglo–Saxon countries and less in France. Specifically, the sum of the coefficients b3+b4 in France is 0.188 whereas in the USA and the UK it is 0.426 and 0.447, respectively. These results are also supported by the R^2 of the models in each country. As it can be seen in Table 3 the lowest R^2 is in the French model (2%), whereas in the UK and in the USA is higher (6.1% and 3.3%, respectively). As it has already been discussed, these results are due to the fact that the financial reporting in the Anglo–Saxon countries is much more liberal (less conservative) and managers may manipulate easier the financial statements, and since earnings are expected to be of lower quality in these countries, financial analysts and investors are expected to pay more attention to cash flows.

Third, results in Table 4 support the hypothesis that when earnings and cash flows are taken together by investors and financial analysts, these stakeholders pay more attention to earnings but less attention to cash flows in France. The opposite happens in the Anglo–Saxon countries, namely, the USA and the UK. These results are consistent with the previous discussion.

6. Conclusions

In this study we examined and tested empirically two major hypotheses that relate to the role of financial information, and especially earnings and cash flows in three countries, two Anglo–Saxon, the UK and the USA and one code law country as France.

Multivariate regression panel analysis was undertaken to test the major hypotheses of the study. A sample of more than 41,000 USA, UK and French firm–year observations were used to test the research hypotheses. The empirical results support the proposed research hypotheses. Specifically, multivariate results indicate that earnings are valued more in France and less in the Anglo–Saxon countries. These results may be due to the fact that the financial reporting in the Anglo–Saxon countries is much more liberal (less conservative) and managers may manipulate more the financial statements. Second, multivariate results indicate that cash flows are valued by investors in all three countries, but results show that cash flows are valued more in the Anglo–Saxon countries (e.g. the USA and the UK) and less in France. As it has already been discussed, these results may be due to the fact that in Anglo–Saxon countries managers may manipulate more earnings, and thus financial analysts and investors pay more attention to cash flows because earnings are perceived to be of lower quality in these countries.

The results of this study have practical implications and should be of great importance to the major stakeholders such as investors, creditors, financial analysts, especially with the recent global financial crisis and the major collapses of giant organizations worldwide such as Lehman Brothers, Bear Stearns, GM, among others. Regulatory bodies, investors, financial analysts and the financial press, blamed among others, the possible manipulation of financial information supplied to the investors by these organizations. The question raised, is whether this type of information is taken into consideration by investors in their investment decisions.

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PORTFOLIO OPTIMAL CHOICE UNDER VOLATILITY AND PRICE RISK IMPACT APPLIED TO DERIVATIVE TRANSACTIONS

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Abstract

The idea that derivatives can complete the market and increase the efficiency of the portfolio has been debated for a long time in the literature of specialty. Our contribution in this study is to build upon these intuitions and to choose an explicit case for a realistic model of the incomplete market with a realist set of derivatives. In particular, we push the existent intuition a step forward, asking ourselves: which are the optimal dynamical strategies for an investor to control not only his holdings, but also the derivative ones? Which is the benefit resulted from the inclusion of the derivatives? We ask these questions focusing on two specific aspects of the incomplete market that have been very good documented in the empiric literature for the aggregated stock market: the stock volatility and the price jumps. In a specific way, we adopted an empiric realistic model for the aggregated stock market that includes three types of risk factors: the risk of the impacts of the prices' diffusion, the risk of the prices jumps and the volatility risk. Considering this condition of the market as already given, we resolve the dynamic allocation problem (Merton 1971) of an investor with a large utility of which opportunity of investment includes not only the risky stock and the usual bonds without risk, but also the stock derivatives.

1. Derivatives. Basis and development

Representing one of the most important field of finances, the theory of the derivatives has known in the last thirty years, starting with the elaboration of the model that stands at the base of the derivate products valuation – the Black – Scholes model – a dynamical evolution both in the innovation level and in the one of theoretical substantiation (Constantinescu, and Bică 2007). Used both for risks covering, as well as for speculations, the derivatives find themselves in the most varied institutions portfolios – from risk funds and financial institutions, to corporations or even individual investors.

The derivatives' prices, as the ones of the support actives, are affected by an important aleatory component. Their predictability can be situated between the determinist evolution and the total aleatory one. Sure, the two cases are extreme and imply, on one hand the market's manipulation and on the other hand the lack of any information regarding the stage and the evolution of a market. Often the adaptation of the prices is based on the two approaches.

The results had not been always satisfying and in these crisis conditions, classic models cannot be used. Despite all this, the expansion of the models for the evolution of different financial actives has ensured the financial industry development and has stimulated innovation (Ungureanu, and Stefanescu 2006).

The development of the financial field generates higher and higher risks and more expensive from the coverage point of view. The use of the risk valuation techniques can ensure a more realistic perception over the value of a portfolio and can substantiate the decisions regarding the coverage strategies. Sure, the field of operation for any analyst or financial manager is full of probability, and

the results cannot be better than the entry data and the hypothesis they were build upon. It also must be underlined the fact that the technical nature factors, which the risk administration processes incorporate, can prove serious obstacles in the way of defining an adequate strategy and can generate serious errors in the decisional process. We speak about the manipulation of large historical databases for different variables, belonging to some markets with very different characteristics, which can burden over the degree and their way of correlations. On this way, but at higher levels can appear including lacks or, more serious, errors of communication that affect the decisions.

That is why, **the level of risk exposure** of each company or financial institution, must incorporate its own appreciation regarding the losses that these can support in case of an unfavourable market evolution. The models and the transactional techniques must be regarded as instruments that can furnish to an advised manager useful estimations, they cannot replace the experience, information and, why not, the flair of the analyst/operator and less to the manager (Stefanescu L., and Stefanescu A. 2006, Stefanescu L., Ungureanu L., and Stefanescu A. 2004).

Using an array of econometrics analysis upon the stock price volatility series, Oh, Swee–Ling *et al.* (2010) found partial market integration for the pre–crisis; whereas in the post–crisis, complete integration prevails. Hence, the financial meltdown in 1997 is said to be a contagion led crisis as markets integrate well off after the crisis than prior to it. Nonetheless, long run portfolio asset diversification benefits across the ASEAN–5 basin are reduced as markets are integrated in both the pre– and post–crisis.

Guidi (2010) indicates that several different models can be used in forecasting stock market volatility of NICs stock markets although simple symmetric GARCH models can be usefully used in this task. He examined the ability of non linear models in an out–of–sample forecasting for daily return volatility of NICs stock markets.

In Romania, derivative products are for now used only marginally, both in the matter of the coverage technique of the financial risk, as well as speculative instruments. The implementation of a specialized market of the products in Romania, with an acceptable liquidity and diversified contracts from the point of view of the dates of payment and support actives is progress. Development, in these conditions, of some systems of valuation adapted to the local market is a necessary stage. The calibration of some classic models, like the Black – Scholes – Merton model, the derivative models and the binominal model, or more sophisticated numeric models in the case of the more complicated products could represent the first step in this measure. The most important and difficult problem from this point of view is the **choice of the volatility estimation techniques depending on the type of the underlying asset** and eventually **the derivate product day of payment.** The situation is much more difficult because the national market has some characteristics resulted from the long and oscillating line of the economic transition.

2. Optimal transactional strategies

Although transactions with derivative products represent now the world's largest business, despite the increasing usage of the derivatives and of the interest for these, little is known about the optimal transactional strategies that include derivatives. In private, academic studies regarding the dynamic allocation of the actives, in a typical way exclude derivatives from the investment portfolio. In the complete market approach, such exclusion can be very well justified through the fact that the derivatives on stocks are redundant (Black, and Scholes 1973, Cox, and Ross 1976). Then when the market is not complete – either because of the rare transactions or of the presence of additional sources of uncertainty – it becomes then suboptimal because it excludes the derivatives.

The idea that **derivatives can complete the market and increase efficiency** has been debated for a long time in the literature of specialty. S. Ross has studied the key role of derivatives in an extended way (Ross 1976), among others, (Breeden, and Litzenberger 1978, Arditti, and John 1980, Green, and Jarrow 1987), in the static hypothesis, and much more recent, by Bakshi, and Madan (2000) for the dynamic hypothesis. In a field where the investor buys and keeps the investments, Haugh, and Lo (2001) use derivatives to mime the dynamic transactional strategy of the underlying asset stock. Using the historical data regarding the stock, Merton, Scholes, and Gladstein, (1978) have researched the characteristics of the profit using different investment strategies. Carr, Jin, and Madan (2001) consider that the problem of the optimal portfolio in the hypothesis of the price jump through the inclusion of an equal number of stock transactions to the one of number jumps of the price. In a

context of, information Brennan, and Cao (1996) analyze the role of the derivatives in the transactional opportunities improvement. Ahn, Boudoukh, Richardson, and Whitelaw (1999) consider the role of the portfolio hypotheses in the VAR hypothesis.

Our contribution in this study is to build upon these intuitions and to choose an explicit case for a realistic model of the incomplete market with a realist set of derivatives. In particular, we push the existent intuition a step forward, asking ourselves: which are the optimal dynamical strategies for an investor to control not only his holdings, but also the derivative ones? Which is the benefit resulted from the inclusion of the derivatives? We ask these questions focusing on two specific aspects of the incomplete market that have been very good documented in the empiric literature for the aggregated stock market: the stock volatility and the price jumps. Both aspects have been the objects of numerous studies. Jorion (1989) has documented the importance of jumps in the profits of the aggregated market of the stock transactions among others. Recent studies underline the importance of the stock volatility and of the jumps, including the studies of: Andersen, Benzoni, and Lund (2002), Bates (2000), and Bakshi, Cao, and Chen (1997). In a specific way, we adopted an empiric realistic model for the aggregated stock market that includes three types of risk factors: the risk of the impacts of the prices' diffusion, the risk of the prices jumps and the risk of volatility. Considering this condition of the market as already given, we resolve the dynamic allocation problem (Merton 1971) of an investor with a large utility of which opportunity of investment includes not only the risky stock and the usual bonds without risk, but also the stock derivatives.

What makes the derivatives so valuable in such of hypothesis of the multiple risk factors is the fact that **stock transactions and sure bonds cannot offer the exposure to each risk factor.** For example, the risky stock transaction can only offer a "package of transactions" of risk exposures: with exposures at the diffusion risk and jump risk, but not to the volatility risk. With the help of the derivatives, this "package of transactions" can be broken in three individual components. For example, an option *at–the–money,* being very sensitive at the market's volatility, offers exposure at the volatility risk; an option *put out–of–the–money*, being more sensitive to the negative risk jump of the price rather to the one of diffusion, serves to the jump risk separation from the diffusion one. Although we can think at derivatives in their most general terms, not all the financial contracts can offer such a service. For example, derivatives on bonds and long–term bonds can offer access only to the rate risk of the interest on short–term, which is a constant in our hypothesis. Given the fact that the three risk factors are at the stock aggregated market level, the linear combinations of the individual stock stocks are less probable to offer independent exposure to such risk factors.

Then we introduce the derivatives to complete the market, let us say a *put at–the–money* and *put out–of–the–money* option, we need to make additional assumptions regarding the insurance of the volatility risk and insurance of the jump risk implied by such derivatives. Such an assumption is made, and the derivatives are introduced, the market is complete. Alternative, we can start with the discount stock factor that sustains giving–up to the risk and profit involved by these derivatives and the risky action, working only with discount stock factor. These two approaches are equivalent and the key element that is important our analysis is the specification of the market's prices of the three risk factors.

In our quantitative example, this thing was possible by taking a position in risky stock and buying the *put out–of–the–money* to cover the negative jump risk.

3. The J. Liu and J. Pan model regarding dynamical strategies with derivatives
3.1. Stock price dynamics

The dynamic allocation problem of the assets is resolved in a complete shape in the Liu, and Pan (2003) model; they resolve the investor's optimal profit dynamics, finding the exposure to the three risk factors that offer the dynamics of the optimal profit. As a result, they found the optimal positions in the risky transaction and the two transaction derivatives that have the optimal exposure to the risk factors, the ability of the transaction derivatives to complete the market being essential, which is formalized in their study as a non–redundant condition of the chosen derivatives. As a result, the optimal value of the derivatives on transactions portfolio depends on how sensitive are the chosen derivatives to the volatility of the action. Their result shows, as well, that two different economical sources exist from which the need to have access to the volatility risk increases.

$$dS_t = \left(r + \eta V_t + \mu(\lambda - \lambda^\varrho)V_t\right)S_t dt + \sqrt{V_t}\,S_t dB_t + \mu S_{t-}\left(dN_t - \lambda V_t dt\right) \qquad (1)$$

$$dV_t = \kappa(\bar{\upsilon} - V_t)dt + \sigma\sqrt{V_t}\left(\rho dB_t + \sqrt{1-\rho^2}\,dZ_t\right) \qquad (2)$$

where: S_t – is the underlying stock price; V_t – represent the stock volatility; B and Z – are the standard Brownian movements; N – represents the jump of the price. All the three shocks B, Z and N are considered as being independent. This model includes, in addition to the **shock of the usual diffusion of the price B,** two risk factors that are important in the aggregated characterization of the action's market: **the stock volatility and the jumps of the price.** In a specific way, the instantaneous variation V, is a stock process with a long–term signification, that $\bar{\upsilon} \geq 0$ the reversion rate $\kappa > 0$, the volatility coefficient $\sigma \geq 0$. This formulation of the stock volatility, according to Heston (1993), allows the diffusion of the shock price B to enter in the volatility's dynamics through the constant coefficient $\rho \in (-1, 1)$, introducing the correlations between the price and the volatility shocks – important characteristic in the problem's data.

The random arrival of the event regarding jumps is dictated by the jump of the price N with a stock intensity of the new arrival $\{\lambda V_t : t \geq 0\}$ for the constant $\lambda \geq 0$. In an intuitive way, the conditioned probability at the time t of another jump after $t + \Delta t$ is a more reduced Δt, approximately $\lambda V_t \Delta t$. This formulation according to Bates (2000), has the intuitive interpretation that, jumps happen, usually on volatile markets. According to Cox, and Ross (1976), we will adapt amplitudes of the determinist jump. This is conditioned by the arrival of a jump, the jumps of the action's price through a multiple constant $\mu > -1$, with the limitation at -1, representing the total routine situation (bankruptcy). As it becomes clear later on, this specification of the determinist jump's amplitude simplifies the analysis in the sense that only a derivative on stocks as underlying asset in addition is needed to complete the market regarding the jump's component. This formulation, although simple, is capable to capture the unexpected nature and with a high impact of the jumps that cannot be produced by diffusions. Well, η and λ^ϱ are constant coefficients that capture the two components of the premium action: one for the B risk diffusion and the other for the N jump risk. The detailed explanations regarding these two parameters will be provided in the following section through the introduction of the stochastic factor of discount for this economy.

3.2. A quantitative analysis of the most favourable strategies

For the quantitative analysis, we will fix the risk free rate $r = 5\%$ and we consider three cases of the price jump: **1.** $\mu = -10\%$ jumps once every 10 years; **2.** $\mu = -25\%$ jumps once every 50 years; **3.** $\mu = -50\%$ jumps once every 200 years. These cases of price jumps were projected to capture the rarity, the nature of big impact of large dimension events. For each case of price jump we adjusted the composition of diffusion of the market volatility $\sqrt{\bar{\upsilon}}$ so that the total market volatility to be always fixed at 15% per year. For each case of the price jump, we will consider more levels of the premium of the $\lambda^\varrho / \lambda$ jump risk, starting with a premium of jump risk equal with zero: $\lambda^\varrho / \lambda = 1$. For every fixed level of the jump risk, we will always adjust the coefficient η for the premium of the diffusion risk so that the total premium of risk of the stock to be of 8% per year. The analyzed quantitative analysis is encountered in Table 1. We chose an option *put out–of–the–money* at 3 months as a stock derivative so that the investor includes it in his portfolio. Known as being very sensitive to big negative jumps of the actions, such options *put out–of–the–money* are among the most efficient transactions derived in the aim to separate the jump risk from the diffusion risk.

For an investor with various grades of aversion for risk γ, Table 1 shows the most favourable values of the portfolio ϕ^* and ψ^* on the risky stock, and respectively, on the *put* option. The table express the optimal portion of risky assets in the portfolio.

Table 1. Optimum strategies with/without options

Jump cases			μ = − 10% every 10 years				μ = − 25% every 50 years				μ = − 50% every 200 years		
				Stock & put				Stock & put				Stock & put	
γ	λ^Q/λ	Just stock	ϕ^*	ψ^*	Just stock	ϕ^*	ψ^*	Just stock	ϕ^*	ψ^*
0,5	1	6.74	9.34	0.0433	4.00	8.52	0.0228	2.00	8.38	0.0185
	2	6.74	6.25	− 0.0067	4.00	7.59	0.0140	2.00	7.94	0.0154
	5	6.74	1.95	− 0.0563	4.00	5.88	0.0085	2.00	7.10	0.0153
3	1	1.17	1.56	0.0072	1.12	1.42	0.0038	0.99	1.40	0.0031
	2	1.17	0.82	− 0.0066	1.12	1.22	0.0012	0.99	1.31	0.0021
	5	1.17	− 0.44	− 0.0338	1.12	0.85	− 0.0034	0.99	1.13	0.0009
5	1	0.70	0.93	0.0043	0.68	0.85	0.0023	0.62	0.84	0.0018
	2	0.70	0.48	− 0.0043	0.68	0.73	0.0006	0.62	0.78	0.0013
	5	0.70	− 0.35	− 0.0228	0.68	0.50	− 0.0025	0.62	0.67	0.0004
10	1	0.35	0.47	0.0022	0.34	0.43	0.0011	0.32	0.42	0.0009
	2	0.35	0.23	− 0.0023	0.34	0.36	0.0003	0.32	0.39	0.0006
	5	0.35	− 0.21	− 0.0124	0.34	0.24	− 0.0015	0.32	0.33	0.0001

For comparison, they have also represented the values of the optimal portfolio for the case in which the investor does not have access to derivatives (only stocks). In order to put the results in perspective, for all the considered cases in the table, the total market volatility is always fixed at 15% per year, and the total premium risk of the stock is always considered as being of 8% per year. If the price of jump risk would not exist, the options could have been redundant, and the optimum value of the investor's stock could be of $0.08/0.15^2/\gamma$. This is translated through an optimum position in stock of 7.11; 1.19; 0.71 and 0.36 for an investor with $\gamma = 0.5$; 3; 5 and 10.
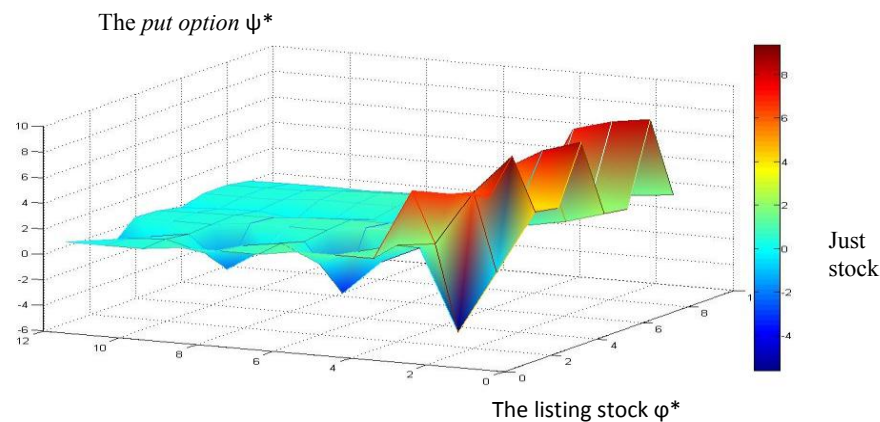
The *put option* ψ*

The listing stock φ*

Figure 1. Optimum strategies with/without options

The introduction of the jump composition in the table affects the most favourable positions in stock in important modes. As we have mentioned anterior, the investor that invests only in stocks becomes relatively more precautious in the presence of jump risk. More important, because the investor that invests only in stocks does not have the ability to separate the jump exposition from the exposition to price diffusion, this is indifferent towards how it is rewarded the jump risk towards diffusion risk: all that matters is the total premium of the action, which is fixed at 8% per year. This is not available for an investor that can close a transaction both for a risky stock and the *put* options. In particular, its position depends now on how the jump risk is rewarded towards the diffusion risk. If the jump risk was not compensated $(\lambda^Q / \lambda = 1)$, the investor sees the exposition at jump risk as a calamity. This sees the risky stock just as an opportunity to achieve the optimum exposition to diffusion risk. By investing in a risky action, this also exposes himself to a negative jump risk. In order to polish up his

exposition, this buys *put* options. In this sense, the *put* options play their traditional role to cover against the negative jump risk. In the table, as we have grown the value of $\lambda^\varrho / \lambda$, also the premium jump risk has grown. In the same point, there is an inversion between the relative attractiveness of the jump and diffusion risks. So, instead of buying *put* options, the investor starts to write *put* options $\left(\psi^* < 0 \right)$ in order to win the biggest premium associated with jump risk. In the same time, the possession of risky stocks decreases as the diffusion risk attractiveness decreases.

Well, it is interesting to notice that, for some of the cases in the table, this inversion in relative attractiveness never happens, indifferent of the magnitude of $\lambda^\varrho / \lambda$. For example, we saw that the *put* option continues to play it cover role for the last case of the price jump for the investor with $\gamma = 0.5$. Using what we have shown anterior regarding the condition of "equal attractiveness", this implies the fact that the magnitude of the price jump in this case is so bigger than $1 + \mu \eta / \gamma < 0$ for the given value of η and γ.

3.3. Improvement of the portfolio

In this section we buy the certain benefit equivalent of an investor with access to the market of derivatives to that of an investor that invests only in stocks. Let's suppose that, in the 0 moment, the investor starts with the initial capital W_0 and has a horizon of time of the investment of T years. With access to derivatives, the certain equivalent of the benefit is:

$$W^* = W_0 \, exp\left(rT + \left[\frac{\gamma}{2}\left(\frac{\eta}{\gamma}\right)^2 + \frac{\gamma}{1-\gamma}\lambda^\varrho\left(\left(\frac{\lambda}{\lambda^\varrho}\right)^{\!\!\gamma} + \frac{1}{\gamma}\left(1 - \frac{\lambda}{\lambda^\varrho}\right) - 1\right)\right]\overline{\upsilon}T \right) \qquad (3)$$

The indirect utility for this special case can be solved in many modes. One is through derivation, similar to the one that leads at Sentence 1 with the simplified condition that $V_\iota \equiv \overline{\upsilon}$. Alternatively, an investor can use the advantage of the existent solution, especially of the ordinary differential equations for h and H, and to take the limit for the constant volatility case.

Without having access to the derivatives, the certain equivalent of the investor's benefit is:

$$W^{*\,without\,op} = W_0 \, exp\left(rT + \left[(\eta - \lambda^\varrho \mu)\phi^* - \frac{\gamma}{2}\phi^{*2} + \frac{\lambda}{1-\gamma}\left((1 + \phi^* \mu)^{1-\gamma} - 1\right)\right]\overline{\upsilon}T \right) \qquad (4)$$

where: ϕ^*, anterior solved is the optimum position in stocks of the investor that invested only in stocks.

The investor with access to the stock derivatives cannot make any bad move than the investor that invests only in actions. Therefore, $W^* \geq W^{*\,without\,op}$. The equality is valid when the condition of "equal attractiveness" is valid, that is when the investor has no incentive to separate his expositions at the two risk factors.

A quantitative analysis to improve the portfolio resulted from the introduction of the derivatives is synthesized in the table. Adopting the notations developed anterior, we have used R^W in order to measure the improvement in the terms of the annualized income, continuously composed in the certain equivalent of the benefit. The table can be best understood by comparison of the optimum strategies from Table 1. When the derivatives are used to cover the exposure to price jump risk, the most aggressive investor benefits more from the access to the derivatives market. This is due because, in the absence of price jump risk, the more aggressive investor typically would wish to have positions in bigger actions. The presence of the price jump risk inhibits the positions with bigger lever. With the help of the derivatives, the investor is again free to choose his optimum exposition at the diffusion risk. From the same reason, the improvement from the inclusion of the derivatives decreases when the premium of the price jump risk grows and the premium of the diffusion risk decreases.
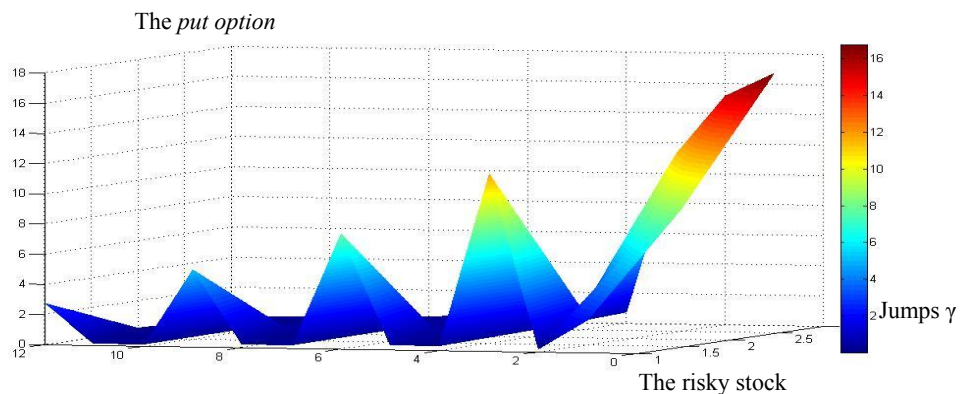
Table 2. Improvement of the portfolio through the inclusion of the derivatives

Jump cases		$\mu = -10\%$ every 10 years	$\mu = -25\%$ every 50 years	$\mu = -50\%$ every 200 years
γ	λ^Q / λ	R^W (%)	R^W (%)	R^W (%)
	1	2.11	8.62	16.74
0,5	2	0.13	5.97	15.14
	5	11.78	1.84	11.28
	1	0.26	0.43	0.71
3	2	0.28	0.06	0.46
	5	7.68	0.46	0.09
	1	0.15	0.24	0.37
5	2	0.19	0.02	0.22
	5	5.12	0.36	0.02
	1	0.08	0.12	0.17
10	2	0.10	0.01	0.09
	5	2.77	0.22	0.003

For example, in the last case of price jump, the investor with $\gamma = 0.5$ buys *put* options to cover exposition to price jump risk. Its improvement in certain equivalent of the benefit is of 16.74% per year when the price jump risk is not compensated. When λ^Q / λ grows to 5, its improvement in the certain equivalent of risk decreases with 11.28%.

This is not the case when the relative attractiveness of the two risk factors is reversed, and the investor starts to use the derivatives as a modality to obtain a positive exposition to the price jump risk. For example, in the case of the first jump, the investor with $\gamma = 3$ starts to write *put* option when λ^Q / λ grows to 2. The improvement of the certain equivalent to benefit is of 0.28% per year. When λ^Q / λ grows to 5, this writes more *put* options, and the improvement of the certain equivalent of benefit grows to 7.68% per year.

It will be taken as an example the stock course of the Transilvania Bank in the period 02.04 – 29.06.2007. The evolution of the closing price for the TLV stocks is represented in Table 3.

Figure 2. Improvement of the portfolio for the inclusion of the derivatives
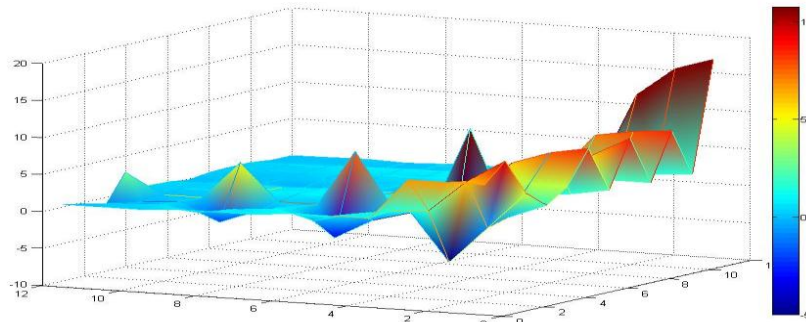
Figure 3. Comparison of the optimum strategies

Table 3. The evolution of the closing prices for the TLV stocks 02.04 – 29.06.2007

Data	Stock's closing price	Var	$r_i \times p_i$	$(r_i - \bar{r})^2 x p_i$
02.04	1.0400	– 0.0189	0.0472	0.1610
03.04	1.0500	0.0096	0.0240	0.0024
04.04	1.0400	– 0.0095	0.0237	0.0638
05.04	1.0500	0.0096	0.0240	0.0024
06.04	1.0600	0.0095	0.0237	0.0001
10.04	1.0500	– 0.0094	0.0235	0.0630
11.04	1.0800	0.0286	0.0715	0.1222
12.04	1.0700	– 0.0093	0.0232	0.0622
13.04	1.0800	0.0093	0.0232	0.0019
16.04	1.0900	0.0093	0.0232	0.0019
17.04	1.1000	0.0092	0.0230	0.0018
18.04	1.0900	– 0.0091	0.0227	0.0607
19.04	1.0800	– 0.0092	0.0230	0.0615
20.04	1.0900	0.0093	0.0232	0.0019
23.04	1.1000	0.0092	0.0230	0.0018
24.04	1.0800	−0.0182	0.0455	0.1523
02.05	1.1000	0.0185	0.0462	0.0360
03.05	1.1200	0.0182	0.0455	0.0343
04.05	1.1100	−0.0089	0.0222	0.0591
07.05	1.0800	– 0.0270	0.0675	0.2803
08.05	1.0700	– 0.0093	0.0232	0.0622
09.05	0.9100	– 0.1495	0.3737	6.0828
10.05	0.7100	0.2198	0.5495	11.3758
11.05	0.7250	0.0211	0.0527	0.0533
14.05	0.7400	0.0207	0.0517	0.0505
15.05	0.7350	– 0.0068	0.0170	0.0441
16.05	0.7200	– 0.0204	0.0510	0.1887
17.05	0.7250	0.0069	0.0172	0.0000
18.05	0.7300	0.0069	0.0172	0.0000
21.05	0.7400	0.0137	0.0342	0.0130
22.05	0.7400	0.0000	0.0000	0.0105
23.05	0.7500	0.0135	0.0337	0.0123
24.05	0.7450	– 0.0067	0.0167	0.0434
25.05	0.7450	0.0000	0.0000	0.0105
28.05	0.7350	– 0.0134	0.0335	0.0988
29.05	0.7500	0.0204	0.0510	0.0484
30.05	0.7500	0.0000	0.0000	0.0105
31.05	0.7600	0.0133	0.0332	0.0116
01.06	0.7700	0.0132	0.0330	0.0112
04.06	0.7850	0.0195	0.0487	0.0423
05.06	0.7900	0.0064	0.0160	0.0000
06.06	0.7800	– 0.0127	0.0317	0.0920

Data	Stock's closing price	Var	$r_i \times p_i$	$(r_i - \bar{r})^2 x p_i$
07.06	0.7800	0.0000	0.0000	0.0105
08.06	0.7650	− 0.0192	0.0480	0.1649
11.06	0.7600	− 0.0065	0.0162	0.0421
12.06	0.7700	0.0132	0.0330	0.0112
13.06	0.7500	−0.0260	0.0650	0.2638
14.06	0.7600	0.0133	0.0332	0.0116
15.06	0.7350	− 0.0329	0.0822	0.3877
18.06	0.7600	0.0340	0.0850	0.1892
19.06	0.7600	0.0000	0.0000	0.0105
20.06	0.7650	0.0066	0.0165	0.0000
21.06	0.7750	0.0131	0.0327	0.0109
22.06	0.7700	− 0.0065	0.0162	0.0421
25.06	0.7800	0.0130	0.0325	0.0106
26.06	0.8000	0.0256	0.0640	0.0915
27.06	0.8050	0.0063	0.0157	0.0000
28.06	0.8250	0.0248	0.0620	0.0838
29.06	0.8450	0.0242	0.0605	0.0784

On the base of the available data, there have been identified the following indicators:

$$\bar{\mu} = \frac{1}{T} \sum_{i=1}^{n} r_i x p_i = 0.5574\%$$

$$\sigma^2 = \frac{1}{T-1} \sum_{i=1}^{n} (r_i - \bar{r})^2 x p_i = 0.6602$$

$$\sigma = \sqrt{\sigma^2} = \sqrt{0,6602} = 0.8125\%$$

$$\upsilon = \frac{\sigma}{\bar{\mu}} = \frac{0,8125}{0,5574} = 1.4576\%$$

It has been considered that all the values from the series of data have the same probabilities of appearance (0.025%). So, we can say that the mathematical hope of profitableness of the TLV stocks is of 0.5574%, while the risk that real values call off from this average is of 0.6602% and the volatility characteristic to the TLV titles is of 1.4576%.

The static indicators determined by the individual personal values has of course their importance, but according to the modern financial theories, a bigger efficiency of the investments is obtained through their diversification, in this sense have been elaborated a whole series of models that try to surprise the evolution of titles in the context of the capital markets.

It is obtained a dynamic system whose solution is determined with the help of the soft Maple 8. For certain initial values, both for volatility and for the price of the stock, we have found the following values:

> **deq1 := diff(g(t),t)=−5*g(t)+0.108*(g(t)^1/2)+0.038;**

$$deq1 := \frac{d}{dt} g(t) = -4.946000000\, g(t) + 0.038$$

> **ic1 := g(0) = 0.083:**
dsol1 := dsolve({deq1,ic1}, numeric, range=0..1);

$$dsol1 := \mathbf{proc}(x\_rkf45) \ ... \ \mathbf{end\ proc}$$

> **dsol1(1);** $[t = 1., g(t) = 0.00821860184567780629]$
> **dsol1(2);** $[t = 2., g(t) = 0.00768677551474298334]$
> **dsol1(3);** $[t = 3., g(t) = 0.00768300214849089274]$
> **dsol1(4);** $[t = 4., g(t) = 0.00768297542984246186]$

> **deq1 := diff(f(t),t)=4*f(t)*0.083+0.6602*f(t)*sqrt(0.083);**

$$deq1 := \frac{d}{dt}\mathrm{f}(t) = 0.2234017753\,\mathrm{f}(t)$$

> **ic1   := f(0) = 0.91:**
dsol1 := dsolve({deq1,ic1}, numeric, range=0..1);

$$dsol1 := \mathbf{proc}(x\_rkf45)\ ...\ \mathbf{end\ proc}$$

> **dsol1(1);** $[t = 1., \mathrm{f}(t) = 1.13779374774468112]$

> **dsol1(2);** $[t = 2., \mathrm{f}(t) = 1.42260939051602353]$

> **dsol1(3);** $[t = 3., \mathrm{f}(t) = 1.77872083142967408]$
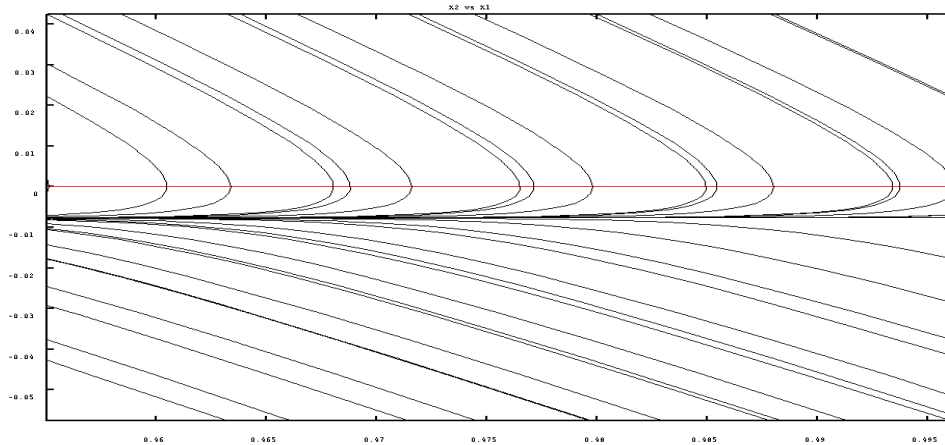
Figure 4. Detail of the phase portrait in the plane (V,S)	**Figure 5.** Systems' evolution in the space (V,S, t)
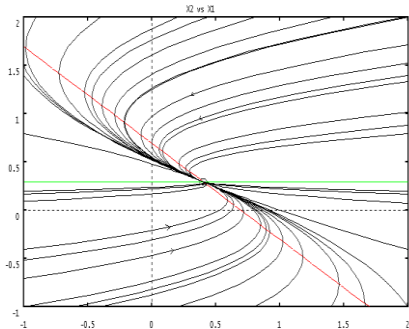
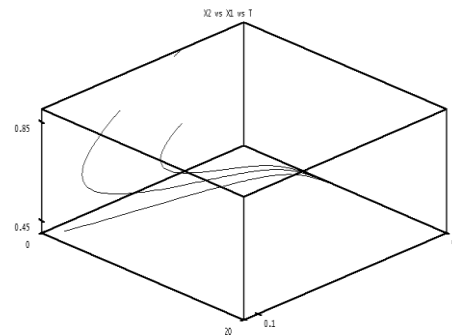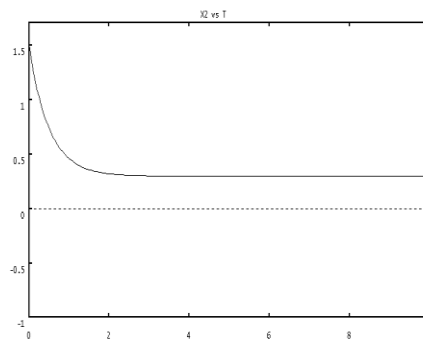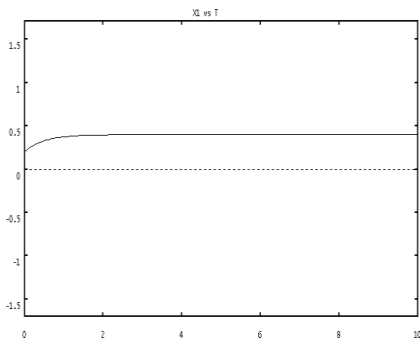| **Figure 6.** The evolution of S in the space (S, t); $X_1 = S$; $X_2 = V$	**Figure 7.** The evolution of V in the plan (V, t)

Using the data of Table 3, J. Liu and J. Pan's system, applied to TLV stock, becomes a stable dynamic system whose equilibrium point is attractive–knot. In Figure 4 is presented both the phase portrait in the space (S, V), and their evolution in time, the way it results from Figure 5, and in Figure 6 and Figure 7 the space (S, V, t).

4. Conclusions

Studying the optimum investment strategy of an investor that can have access not only to the stock and bond market, but also the derivatives market, our results prove the importance of the inclusion of stock derivatives as an integral part of the optimum decision of investment. The analytic nature of the found solutions also helps to establish the direct relations between the demand for derivatives and their economic sources.

As a vehicle of the additional risk factors, and also the stochastic volatility and the price jumps on the stock market, the stock derivatives play an important role in the extension of the dimensions of renunciations in benefit and investor's risk. In addition, by offering the access to the volatility risk, the derivatives are used by investors in order to profit by the nature advantages of variation in time of their opportunities. In a similar mode, by offering the access to the price jump risk, the derivatives are used by investors to separate the expositions to jump and diffusion risks on the stock market.

Far from the quantitative differences, the jump risk differs from the diffusion risk in an important qualitative manner. Specifically, in the presence of big negative price jumps, the investor has aversion for the possession of a too big jump risk regarding its premium. Intuitively, this because in contract to the diffusion risk that can be controlled through the continuous transaction sudden nature, with a great impact of the jump risk annuls the investor's ability to continuously closes a transaction from a position of big lever to avoid the loss. As a result, without having access to derivatives, the investor avoids to take position with a too big lever for a risky stock. The same investor is free to choose when the worse scenario associated with the jump risk can be avoided through the transaction of derivatives.

In our quantitative example, this thing is possible by taking a bigger position in the risky stock and buying *put out–of–the–money* options to cover the negative jump risk.

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THE PROBLEM OF MONEY ILLUSION IN ECONOMICS

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Abstract

Money illusion in economic theory has been an assumption rejected by academic economists for quite some time. However, with the gradual diffusion of behavioural economics based on experimental research this has changed. Now, it has become a respected fact to accept money illusion as a stylized fact of human behaviour. However, it still needs a better understanding why monetary phenomena especially related to financial markets play an important role in understanding the real economy, the production, consumption and exchange of commodities and services. Financial markets in comparison to goods markets are particular engaged in intertemporal valuation problems which are common to any kind of economic activity. Since money is the unit of account, accounting problems related to the uncertain nature of future economic development makes a continuous readjustment of valuations in money units necessary. However, as Minsky has pointed out financial markets are imperfect. Because of these imperfections even significant long–lasting valuation problems emerge. One reason is that in mainstream economic reasoning the problem of intentional cheating of market participants is ignored causing false valuations. Furthermore major innovations like e.g. the ICT revolution with the Internet or the introduction of securitization as a means to redistribute risk as general purpose innovations make valuations of long term to medium term impacts of these innovations on the economy extremely difficult. Recent financial market bubbles are significantly related to such general purpose innovations. If monetary policy fails to control for irrational exuberance of investors about the future benefits and profits of such innovations, this inherently embodies the risk of a financial market shock, if expectations of the general public have suddenly to adjust after overoptimistic prediction about the future economic development.

Keywords: money illusion, imperfect financial markets, regulatory failure, behavioural finance

JEL Classification: G01, G17, G18, G28

1. Introduction

In economic theory and analysis one key assumption in mathematical models is the assumption that there is no money illusion, i.e. economic agents can successfully dissect real and money values appropriately. This gives the opportunity to separate the economic spheres of real goods and services from those of the monetary valuation of such goods and services, i.e. asset markets. This dichotomy, however, contributes to a misunderstanding of the interdependencies between both spheres. Money is even considered in this analytical framework only to be another good which acts as a numéraire to standardize the valuation in a common accounting unit. Because of the convenience for analytical research it has become something like a principle for good and bad economics.

Theories excluding money illusion are good economic theories; those assuming money illusion are bad economic theories, because the latter lead to irrational behaviour and false conclusions about the fundamentals of a market oriented economic system. However, money illusion is an essential ingredient of financial markets that just reflects the intrinsic inconsistencies in the valuation process of financial market assets. Disregarding money illusion misleads the theoretical economists to believe in an ideal world of efficient financial markets and overlook the inherent financial instability of asset markets.

James Tobin (1972, 3), a Nobel laureate in economics, went as far, by making the statement that, "An economic theorist can, of cause (*sic*! G.E.), commit no greater crime than to assume money illusion." This is an expression of overconfidence by the economist profession in the validity of one central postulate of economic reasoning about markets as institutions to coordinate social interactions related to goods and services. With money illusion embodied in economic analysis there will be market failures in the sense that it cannot establish justice in a society based on the market exchange mechanism. False trading, i.e. accepting in the exchange process prices that are out of equilibrium and non–converging toward an equilibrium in a tâtonnement process à la Walras (1874), has the frightening consequence that most of the theoretical explanations common in current economic textbooks and theoretical economic models presented break down there.

Fundamentalism, i.e. dismissing some of the fundamental axioms of economic theories, in the economic profession is something that normally leads to exclusion from the profession. This, in particular, has the consequence that the person challenging these assumptions must be aware that they are facing professional ostracization and dismissal from the academy. It needed well–established top academic economists to change this situation. The incentive system of academic economics is more or less: "Please leave the basic axioms of our theoretical foundations untouched otherwise you could face excommunication from our discipline and will be outlawed from the career track".

Therefore opening the Pandora's Box of axioms in economic theory was, and still is, for most economists strictly forbidden. Those who did so were considered heretics in the religious sense and often dismissed from the economist profession. This attitude has much in common with religions that expect disciples to follow, unquestioningly, its tenets. If Jesus is not the Son of God, you cannot be a Christian, or if you believe that Mohammed is not the Prophet of God, you cannot be Muslim. If you dismiss the fundamental beliefs of economists that there is no money illusion, you cannot any longer be an academic economist. This is slowly changing with the advent of a more empirical evidence based economic research that led to the behavioural economics revolution starting in the early 1990s (*See* e.g. Thaler 1992).

The analytical separability of monetary and the real world economics, however, is more and more challenged in economic debate (*See* e.g. Fehr, and Tyran 2001). It is also no accident that the first area questioning the rationality assumption of no–money–illusion emerged in the area of finance, leading to the development of theories of behavioural finance (Akerlof, and Shiller 2009, Malkiel 2003). They directly attacked the efficient market hypothesis (EMH), which was canonized[2] by academic economists like Fama (1970). The schism between those who believe in EHM and those who do not remains.

Again, like religious schisms, both communities co–exist in academia, but each would like to drive the other out, where possible.

Financial markets are, in particular, challenging for believers in the EHM because there exist no natural frictions as in real world commodity markets. Contracts on financial markets are primarily executed via electronic computer networks on trading platforms that deliver instantaneous information around the globe and by this diminish transaction costs close to zero. Prices for financial assets are seemingly accessible instantaneously. If financial markets fail to be efficient, how much more others will do? One might therefore consider the invalidity of the EMH in the area of financial markets to be an experimentum crucis for the validity of the EMH for any kind of market.

Fiat money seems to be a particular challenge for economic analysis since it poses another significant valuation problem to a society. The most important is the inflation–deflation–nexus because it lacks any intrinsic value like e.g. gold.

From a behavioural point of view general excess supply or demand for money needs then to be explained by institutional failures like a central bank creating too much or too little liquidity (*See* e.g. Friedman, and Schwartz 1971). This means that not the rational decision making based on money values is flawed, but the institutions like a central bank is flawed by following wrong monetary policies.

Closely linked to the inflation–deflation–nexus is the central issue of macroeconomics related to wage setting. Wages are set in money values but based on the assumption of the purchasing power of money which defines together with the nominal wage level the real wages. Wage adjustments in labor markets have become as well a standard example for downward stickiness of nominal wages creating since Keynes (1936) a whole bunch of literature about strategies to accomplish a better employment situation by taking into account the empirical finding of wage–rigidities. This, however, implicitly assumes money illusion in the labour market. Agreements are based on assumed implicit perceived real wages. If labour unions discover that their nominal wage contracts are not in line with the

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[2] The efficient–market hypothesis was developed by Professor Eugene Fama at the University Of Chicago Booth School Of Business as an academic concept of study through his published Ph.D. thesis in the early 1960s at the same school. It was widely accepted up until the 1990s, when behavioral finance economists, who were a fringe element, becames mainstream.

perceived real wages they tend to renegotiate higher nominal wages. Furthermore there is a high resistance to nominal wage reductions, the so called wage–stickiness.

In a perfectly rational environment of homo oeconomicie contracting instantaneously and independently from each other this should lead to price adjustments in market prices with respect to an increase in the general price level or full–employment in the labour market. The observable inertia in the delayed adjustment to this result was simply explained by information problems or adjustment costs of price adjustment.

Institutions which distort this free market equilibrium are generally considered harmful and damaging the social welfare. Therefore deregulation, i.e. liberalization from regulations, or self–regulation has always been the war cry of orthodox market liberals in academia. To avoid institutional failures by any kind of collective market regulation the solution suggested by market radicals is always like a Buddhist mantra – let markets work it out by themselves or in French laissez–faire or laissez–aller. That what you finally get if you keep to this simple rule is the social welfare optimum. Any interference via regulation to set prices or quantities leads to harmful results, i.e. welfare losses.

2. From harmonia mundi of a general equilibrium in economics toward an evidence based economics supported by empirical experiments

When asking for the origin of the general equilibrium principle and the idea of perfectness one should be aware that in the time when Adam Smith worked on his principles of economics in the second half the 18th century, in natural science the idea of harmony hidden as a godly secret was common in science of its time. Astronomers like Nicolas Kopernicus (1473 – 1543), Galileo Galilei (1564 – 1642) , Johannes Kepler (1571 – 1630) and Isaac Newton (1643 – 1727) had shown that with the heliocentric cosmology fundamental general laws of simplicity seemingly govern the planetary movements following the law of gravity. Revealing these intrinsic harmonies of the world was extended to other more mystic theological interpretations. This idea of a harmonious world dates even back to Greek philosophers like Phytagoras. The invisible hand Smith invented to explain the hidden harmony behind the chaotic surface of everyday market processes is just an extension of this kind of thinking.

Additionally Gottfried Wilhelm Leibniz, the famous German mathematician and philosopher, expressed the belief that using differential calculus the future of the world is totally determined by a set of differential equations. He summarized his fundamental beliefs about the state of the world by the following seven principles:

▪ Identity/contradiction. If a proposition is true, then its negation is false and vice versa;

▪ Identity of indiscernibles. Two things are identical if and only if they share the same and only the same properties. Frequently invoked in modern logic and philosophy. The "identity of indiscernibles" is often referred to as Leibniz's Law. It has attracted the most controversy and criticism, especially from corpuscular philosophy and quantum mechanics;

▪ *Sufficient reason*. "There must be a sufficient reason [often known only to God] for anything to exist, for any event to occur, for any truth to obtain";

▪ *Pre–established harmony*. "[T]he appropriate nature of each substance brings it about that what happens to one corresponds to what happens to all the others, without, however, their acting upon one another directly." (Discourse on Metaphysics, XIV) A dropped glass shatters because it "knows" it has hit the ground, and not because the impact with the ground "compels" the glass to split;

▪ *Continuity*. Natura non saltum facit. A mathematical analog to this principle would proceed as follows: if a function describes a transformation of something to which continuity applies, then its domain and range are both dense sets;

▪ *Optimism*. "God assuredly always chooses the best;

▪ *Plenitude*. "Leibniz believed that the best of all possible worlds would actualize every genuine possibility, and argued that this best of all possible worlds will contain all possibilities, with our finite experience of eternity giving no reason to dispute nature's perfection".

Following this line of thought economics just applies these to the system of markets. Even Albert Einstein expressed skepticism against the new discipline of quantum mechanics built on plenty of violations of Leibniz principles claiming that God does not play dice. For many scientists it is inconceivable that we live in an imperfect world where a high degree of arbitrariness and indeterminacy rules. The market system has to be – at least in principle –perfect. Any economic theory

violating this belief is a violation of the principle of good science. Market failure is therefore for most economists until nowadays not intrinsic, but caused by external intervention from outside.

In astronomy and cosmology the belief that there is a cosmos governed by eternal laws has crumbled under the empirical evidence collected over the past two centuries. So nowadays cosmologists like Stephen Hawking claim that God must have played dice. The probabilistic nature of the universe, the uncertainty principle in quantum physics and Gödel's proof (Gödel 1931) that mathematical deductions cannot generally be decidable have changed the principles of good science quite a bit from those of Leibniz.

However, it took and still takes the economics profession much pain to accept the imperfection of market systems. While perfect planning was ruled out as impossible for a whole economy, the capability of the market mechanism to deal with the coordination problems by the price mechanism was defended against all kinds of empirical refutations. The problem of intrinsic fallibility of free markets is up to now beyond the willingness to accept such possibility as a starting point for economic analysis. The painstaking efforts of theoretical mathematical economists to root out contradictions of their mathematical models about the perfect market system, however, ended all to often in dead ends where an axiomatic formulation of the market mechanism cannot be completely justified on the basis of pure mathematical logic.

Therefore it is not surprising that the pure logic approach has now more and more be replaced by the empirical evidence based approach of experimental economics (*See* e.g. Smith 1976). If pure logic is insufficient to give truth about the human market behavior than only market experiments to test human behavior might get better insight into the problem of market behavior and dynamics.

The problem with this research agenda is that it delivers much more counter evidence against the traditional efficient market model that it becomes difficult to derive a general model of human behavior opposite the previous model of a market mechanism. Even if a human behavior is reproducible, i.e. by changing the individual participants of the experiment without getting significantly deviating results, the expected common behavior is not easily transferable to the uncontrolled environment of real markets.

However, this conceptual change in the economics approach might help in the future to get more appropriate assumptions for economics as an empirical founded theory with the possibility to derive from these results predictions with a higher degree of reliability. Not market optimism à la Leibniz should rule economics as a science but reproducible evidence from repeatable experiments.

Allowing for all kind of market imperfections helps us to better understand the current financial market crisis. To control unfettered markets so that booms and busts are less likely and less severe would be a major progress for the future of our financial market system. If money illusion just is a catch phrase for the inability of market participants to derive from financial markets equilibrium prices one should not expect that financial markets could be an efficient and perfect mechanism. Instead one would – like Minsky – suggest one should better hedge against such imperfections and failures to avoid the dramatic fall out, when a crisis happens. Accepting market failures could lead to the design of mechanism provisions against such market failures. Insurance markets are such precaution mechanisms. Individual risks of false trading against unpredictable price changes are hedged by insurance contracts to compensate for such price prediction failures. Derivatives markets are just created for this purpose to deal with imperfect foresight on future market prices.

Imperfect financial markets need to built in shock absorbers. Without such built–in stabilizers the economic system as a whole is at risk. It is a long way from the belief in a perfect harmonious economic system toward one with significant imperfections and instabilities as an alternative research agenda in economics. The current financial market crisis, however, shows that systemic risks of financial markets have not become manageable as individual risks before. Non–market institutions like governments had to step in to cover the risks by state guarantees. But this state intervention as lender of last or even first resort is insufficient to overcome the market failures per se. Without creating a regulatory framework which takes care of the incentive structure of market participants to initiate false trading patterns and Ponzi schemes, the ability of the state as the alternative social institution to compensate for market failures will not be sufficient in the long–run to keep the economic system stable. Surveillance of market participants to stop all kinds of cheating and mechanisms to distribute gains and losses fairly if they occur unexpectedly is essential to reestablish a sustainable financial market system. The current financial market crisis therefore told the people –

hopefully – the lesson that without a sufficiently strict regulatory framework unregulated or weakly regulated financial markets could endanger the whole economic system. The implementation of such a regulatory framework as well has to empirically stress test its validity as an adequate safety system has become essential.

3. The problem of cheating in economics

Intentions of all individual market participants to cheat about the correct pricing are excluded from the analytical framework of academic economic analysis. Because by assumption every market participant is as clever as any other the ability to successfully cheat – at least in the long–run – is controlled by the competitive mechanism. Those who are discovered as cheating others will be punished by being stigmatized by the other market participants. Reputation of an honest business person is therefore always considered as something like an intangible asset.

This symmetry assumption of reciprocity in behavioural possibilities is justified by the postulate of equal rights enshrined in the sovereignty of consumers and producers to act independently and on a level playing field. Individual freedom is represented by freedom of individual choice without taking disabilities in the knowledge and capabilities to act of real world people into account. What psychology knows as a fundamental property that people are different in their capabilities as a matter of fact is simply ignored by academic economists as a relevant factor to be considered in economic theories. Market failure in this sense – legal contracts based on misconceptions about the promised services and goods – is therefore beyond the scope of academic economic theory. This might be a severe short–coming in Western economic theory, because wisdom in the Chinese sense of embodying strategems (*See* e.g. von Senger 1993), i.e. cunningness, in human behavior play a central role in successful business plans in China. It is also present in everyday business practice but not a subject in Western economic analysis.

Cheating customers, business partners and employees of the implications of their contracts is common practice at the real market place – one example is the Enron case[3] –, but it has no place in economic theory. Discovering the intentions of human behaviour is reduced to a simple nominalism. What people express as their intention is their true intention. There is no possible hidden agenda. The same nominalism is found in the theory of money values which excludes money illusion. However, in particular accounting is a crucial element to give transparency about the state of a business company. Bad accounting practices with the intention to hide bad assets and related losses from the public viewing are an essential element in the process of creating money illusion. Off–balance sheet operations is particular harmful because it hides risks for a company to its shareholders. The current banking crisis is not understandable if one neglects these methods of transferring dubious financial operations into special purpose vehicles (SPVs), conduits etc. (*See* e.g. Roubini, and Mihm 2010). A shadow banking system which rapidly grew to a size endangering the whole financial services industry and evading supervision of regulatory authorities have become integral elements of the current financial industry and there is no end to this perceivable. But creative accounting practices have always been an origin of financial market crisis when they become known to the public and cause a crisis of confidence into single institutes or even in the whole industry. Money illusion of the public is therefore closely linked to the possibility of avoid transparency with regard to its shareholders, the regulators and the public in general.

To establish methods for discovering inconsistencies in the financial accounts of companies will be increasingly in high demand. Sometimes simple heuristics about fundamental relations help to

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[3] Enron Corporation was an American energy company. Before its bankruptcy in late 2001, Enron employed approximately 22,000 staff and was one of the world's leading electricity, natural gas, communications and pulp and paper companies, with claimed revenues of nearly $101 billion in 2000. Fortune named Enron *America's Most Innovative Company* for six consecutive years. At the end of 2001 it was revealed that its reported financial condition was sustained substantially by institutionalized, systematic, and creatively planned accounting fraud, known as the "Enron scandal". Enron has since become a popular symbol of wilful corporate fraud and corruption. The scandal also brought into questions the accounting practices and activities of many corporations throughout the United States and was a factor in the creation of the Sarbanes–Oxley Act of 2002. The scandal also affected the wider business world by causing the dissolution of the Arthur Andersen accounting firm.

understand or reveal dubious financial statements and discover fraud (*See* e.g. Gigerenzer, and Todd 1999). Offering free lunches or extraordinary high returns on investments are always warning signs that there is a possibility of fraud related to this. So common sense often might help to avoid to be lured into a Ponzi scheme by cunning business people. One potential heuristic that makes us smart would be somewhat paradoxical to take the EMH as a benchmark. The theory states that there is no arbitrage possibility if financial markets are efficient. If rates of returns are higher in one investment than in another that could be only the result of different risk premiums, i.e. higher returns imply higher implicit risks of failure. Therefore risk–averse investors should choose assets taking into account the different risk–premiums. This should raise suspicion about the hidden agenda of potential cheats which are tempting people to buy a safe assets with exceptional high returns. From the perspective of EMH therefore someone who promises exceptional high riskless profits is something impossible. To believe in these financial miracles is part of the overconfidence of many market participants that they consider they could outsmart the market, i.e. they have deeper insights than the ordinary market participants. That this is an ability is not the norm but a rare exception is obvious. Furthermore many people always neglect that insider trading is much more often together with market maker capabilities the origin that constitute the basis for exceptional high profits from single investments, i.e. such environment violates the principle of fairness. (*See* e.g. Malkiel 1996).

A good example is the Goldman Sachs/John Paulson fraud case. Goldman Sachs, the largest Wall Street investment bank, sold a securitized asset, Abacus. What they did not tell the public, was that Paulson's company was involved of selecting the assets which later on was securitized under the Abacus mortgage backed security (MBS). Because Paulson knew about the internal weaknesses of the underlying assets, Paulson's company later on bet on the default of the MBS–fund huge amounts against using credit default securities (CDS) in the derivative market, causing in a sense a self–fulfilling prophecy. Those institutional investors like Industrie Kredit Bank (IKB) in Germany and Royal Bank of Scotland (RBS) in the UK had to face dramatic losses. Goldman Sachs paid in a legal deal with the Security and Exchange Commission (SEC) 550 million US–Dollars to avoid a further investigation and prosecution in an official court case. IKB and RBS defaulted during the last global financial market turmoil and had to be saved by their respective governments.

Similarly the hedge fund investors Raj Rajaratnam (Van Voris 2010) and Sir Allen Stanford (Watts 2009) were taken into remand by the FBI in June 2009 and October 2009 respectively because both are accused of massive insider trading and fraud charges by the SEC. The court cases against Raj Rajaratnam and Sir Allen Stanford on similar fraud charges are still pending. Both examples illustrate that tacit knowledge about companies and their future strategies or the underlying valuation problems of securized assets are sometimes an essential ingredient for huge profits earned in financial market speculation.

Cheating about the willingness to repay debt, untrue promises about the potential returns of an investment, cooking the books in the accounting system, etc. are all empirical valid observations about human behavior in economic environments, but they have no place in economic theory. Such behaviour is considered irrelevant in economic theory construction. They are therefore simply ruled out by assumption.

It took quite a while to make the study of imperfect markets a topic of the profession (*See* Robinson 1933, Chamberlain 1933) with the exception of the pure monopoly studied by Cournot (1838), and Bertrand (1883). Unfair price setting behaviour expressed through market power of suppliers which significantly deviate from the perfect competitive equilibrium prices which assume that prices are determined by the equality to the marginal cost of production have a role in the area of industrial economics (*See* e.g. Tirole 1988), but has always been considered as the exception from the rule of perfect competition. The oligopoly problem[4], i.e. the way a small number of suppliers establish

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[4] In Economics, an oligopoly is a market form in which a market or industry is dominated by a small number of sellers (oligopolists). Because there are few sellers, each oligopolist is likely to be aware of the actions of the others. The decisions of one firm influence, and are influenced by, the decisions of other firms. Strategic planning by oligopolists needs to take into account the likely responses of the other market participants. This makes the fable of the invisible hand à la Adam Smith unconvincing. Coordination of few sellers in a market usually is only successful if it collectively puts the buyers at a disadvantage and the profits earned are

a market equilibrium is still an unsolved topic in economic since than. There is no oligopolistic equilibrium which is a welfare optimum for a society. Due to scale and scope effects leading to economic of scale size of companies matter (Chandler 2004). This contributes to a higher market concentration in numerous markets. Furthermore network effects (*See* e.g. Farrell, Klemperer 2007) additionally support higher market concentration and a risk of diminished competition.

However, as part of competition policy the degree of imperfection is always still measured by the benchmark of the perfect market equilibrium, i.e. the respective perfect equilibrium prices. Again there is a wide gap between a competition policy based on the orientation on perfect markets on the one hand and on the reality of competition policy on the other. On the latter pragmatism rules often derived from the legal profession and much less from economic theory. Any attempt to establish economic theories of perfect markets as the principle of legal decisions in competition law suits have been rejected or been unsuccessful when tried out in some exemplary cases.

The legal profession which have to deal with issues of civil and public crimes, i.e. violation of laws, on a daily basis are much more familiar and willing to address this issue of cheating, rip–offs, swindle, etc. which is totally neglected in academic economic research. Deviant economic behaviour like those of Ponzi schemes[5] practised by people like Bernard Madoff[6] are considered just as freaks of the system not the common everyday species we face in everyday day life in the economic sphere. They have to be considered a significant part of human nature in economic theory as well.

At the macroeconomic level the belief in EMH has also as a consequence that by this implicitly the existence of financial market bubbles is ruled out. Because of that most academic professionals in financial market analysis have very little to say if they are facing the phenomenon of financial market bubbles (see e.g. Roubini, Mihm 2010). Contrary to those who disbelieve the EMH – like economists like Minsky (1982, 2008) who has early on pointed out that financial markets in particular have an inherent tendency of instability leading to recurrent financial markets crisis – the pre–dominant mainstreams at academia rejects this instability of financial market hypothesis (IMH.)

Tricks and cheats used by economic agents in the everyday market process are from the perspective of most academic theorists just noise and a veil created to fail to discover the fundamental laws of the true market systems. This kind of framing however is misleading theoretical analysis by leaving key elements of financial market failure out of sight. So it is common practice not to study any kind of deviant economic behavior as a research topic in economics. However, the impact of such deviant behaviour can even cause on the macro level of whole economies or even the global economy is too important to be ignored as an ancillary factor in the whole economic system. The selection bias to focus on behaviour which guarantees market efficiency outcomes leads to severe problems to assess and predict real world market events governed by booms and busts. What Minsky was well aware of, is that fraud and cheating is common practice in a market economy. If regulatory oversight is to negligent or even regulatory capture takes hold in the supervisory institutions the incentive to create

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share in a way which all side of the seller's cartel accept as fair. This is hard to accomplish and price fixing is illegal due to anti–trust laws.

[5] A Ponzi scheme is a fraudulent investment operation that pays returns to separate investors from their own money or money paid by subsequent investors, rather than from any actual profit earned. The Ponzi scheme usually entices new investors by offering returns other investments cannot guarantee, in the form of short–term returns that are either abnormally high or unusually consistent. The perpetuation of the returns that a Ponzi scheme advertises and pays requires an ever–increasing flow of money from investors to keep the scheme going. It is one potential origin for an investment bubble where asymmetric information between creditors and the debtor who set–up the Ponzi scheme attract a cumulative number of investors who believe in the validity of the business model of exceptional high returns. However, this promise is impossible to fulfil so that at some time the payout of the revenues to the investors collapse. When the investors discover that they are cheated its often to late to recover the money in invested in this kind of business. There is ample evidence that again and again Ponzi–schemes have been successfully implemented at a large scale at different times and countries causing major financial market crisis if the financial system was severely damaged (*See* e.g. Kindleberger 1978, Roubine, Mihm 2010).

[6] Bernard Lawrence "Bernie" Madoff is an American former stock broker, investment adviser, non–executive chairman of the NASDAQ stock market, and the admitted operator of what has been described as the largest Ponzi scheme in history.

high personal income through financial market manipulation takes overhand. So contrary to the free marketers or radical market liberals Minsky suggested a strict system of effective oversight and rules which makes these kinds of activities at least more risky if not impossible. To have more efficient financial markets one has to accept that inherent inefficiency of self–governing markets. This kind of perception of Minsky is also more in line with actual economic theories of crime (*See* e.g. Eide, Rubin and Shepherd 2006). If human nature is to a large extent driven by greed to get rich, than it needs a Leviathan to keep this greediness under control especially in financial markets. One central element of a governance structure has to be proper accounting rules and transparency of financial markets. Furthermore it needs credible punishments for violating the regulations of good financial market governance. Crime without punishment to deter misbehaviour is an essential element of the economic of crime analysis.

In this sense economic theory based on the EMH is a Neo–Platonic philosophy where the pure idea about markets should not be spoiled by the impure evidence in the real world of market processes. The market ideal is the essence or true nature of all observable empirical markets. Those who fail to see the beauty of the essence of the market system are just ignorant and infidel about the fundamental truth about a market economy. They are puzzled by the surface of everyday market events with all kinds of imperfections and ignorant about the essence of the market process, the ideal market system. This dogmatism resists any kind of open debate according to counterfactual evidence.

4. Human behaviour in economic interactions

The further fundamental fallacy in the theory of individual economic behaviour rests on the assumption that it is restricted to simple behavioural rules of a market exchange game. This makes the analytical treatment easier, but excludes many behavioural possibilities which are common to human practice.

Standard economic theory is based on maximising or minimising continuous differentiable functions under constrains, e.g. utility, cost or profits. It neglects information uncertainty problems associated with the functional structure and parameterisation. Instead of using at least probabilistic distributions to catch the uncertainty about the state of an economic system one reduces this problem via the certainty–equivalence–principle (CEP) by using rational expectations as a sufficient indicator for economic analysis and reduces the randomness of economic processes to a simple error or noise process. Under the CEP the traditional analytical results are easily transferred beyond their traditional framework of deterministic analysis using the classical calculus as its analytical instrument together with the expectation value operator.

What often is designed in the Marshallian tradition of partial analysis (Marshall 1890) is extended as well into the general equilibrium analysis which deals with a simultaneous multi–market equilibrium in the tradition of Léon Walras (Walras 1874). However, this raises the problem of multiple–equilibria which was ruled out for quite some time as inadequate in theoretical economic analysis until it finally get its academic acceptance in the economic literature (*See* e.g. Diamond 1987). This is another challenge of indeterminacy of an economic system. Before the general equilibrium literature was obsessed to establish conditions of a unique general equilibrium. Multiple equilibria were considered degenerated cases where artificial restrictions imposed on the market system led to such perverse results. The political treatment is to remove the unwarranted restrictions and the unique and perfect general equilibrium prevails. Again it was a major financial market crisis in the emerging economies which stimulated research on the possibility of multiple–equilibria (*See* e.g. Masson 2001). It seems crisis in economic reality is always a good teacher to dismiss long hold prejudices enshrined into axioms used in economic theory. If the dominant theory fails to explain and predict a current economic event the willingness to accept more "exotic" theory elements increases significantly. The unpredicted real world crisis by economic theories induces a reform in the theoretical framework in economic theories, at least sometimes.

In the simplest market clearing bargaining game the assumptions are set in way that only prices or quantities offered matter and a contract has to be done by both parties. In a sequence of bid and rejections of different offers the bargaining process converges toward a bargaining equilibrium a contract where a certain amount at the final bargaining equilibrium price is exchanged. Of cause the logic of such a simple bargaining game is convincing, but it does not ask questions of changing the bargaining framework conditions.

As Akerlof has demonstrated in his market for lemons example (Akerlof 1970) if there is uncertainty on the buyers–side about the quality of the product the seller–buyer–equilibrium will fail to meet the conventional equilibrium price setting rules. So the problem in economic analysis is to define the rules of a game properly to match those of possible human strategic behaviour. If one omits possible actions of an economic agents just to get a simpler and mathematical easier tractable model one runs the high risk to fail human actions because it will extent the rules of the game by changing the rules itself. One stratagem in the lemon market case is the lack of the buyer to know sufficiently well about the quality of the product, e.g. a used car. If the seller is unwilling to reveal his information advantage and there is a lack of trust in the honesty of the salesman, than the bargaining fails even if the simpler standard model of efficient bargaining would predict a successful trade at an equilibrium price.

So the lesson to be learned is that many economic theories are based on assumptions which cannot be matching the real world environment. Reality refutes assumptions in many dimensions to invalidate the theory based predictions. Theories and mathematical models cannot match the real world outcome because they ignore important behavioural possibilities of the respective agents. False prediction of behaviour is the outcome of false and too narrow restrictions about the possible human behavioural space. If one bases its predictions on the validity of fair play rules ignoring the willingness of agents to break these rules when they perceive a potential benefit from it, theoretical predictions become invalid.

So the thorough explicit listing on the assumptions necessary to obtain analytical results should be an essential ingredient for academic scientific research in economics, but this is far less common practice as one should expect. Often essential restricting axioms are not revealed with the intention to give the theory the impression of a high degree of generality which for the well trained academic economist if obviously not the case. Limited validity of a theory together with seemingly generality communicated to the less well trained public often severely bias decisions in favour toward a theoretical model which cannot stand the test of reality. What we need in economics are realistic assumptions about human behaviour to derive realistic conclusions.

Academic economists often cheat willingly the general public about their general understanding of economic phenomena under investigation. Because of their reputation as scientists who are experts to know much more than the general public they simply impose their prejudices based on imperfect models and analysis in the general political debate. Everybody knows about the willingness to cheat to obtain desired results from early childhood on. However, when we deal with economics as a theoretical discipline we simply ignore this important dimension of human behaviour. Another possibility is wishful thinking to construct a logical deduction omitting important alternatives from our decision tree.

A good example is the stagflation phenomenon. Until it emerged after the two oil price shocks in the late 1970s and 1980s, no economist trained in the Phillips–curve (Phillips 1958) would have considered the simultaneous coexistence of high inflation with persistent output recession or at least stagnation as possible. Reality told academic economists a lesson about possibilities of economic development which lay beyond their imagination based on a trade–off between unemployment and inflation. After the world economy recovered from stagflation the interest in studying the subject in academia veined and might probably become a hot topic in the near future because the current global recession policies of easy monetary and unsustainable fiscal policies are insufficient to establish a sustainable economic recovery.

If the reality refutes the predicted outcome there are a lot of ways to justify why one – the expert – could not know about certain circumstances enough to give a policy recommendation which results in the predicted outcome. We failed because we had in information problem, is s stratagem to justify ones failure. Insufficient consideration of potential outcomes is one key element in the self–excuse stratagem.

"We could not know that this could happen because it never happened before", is one way to excuse the inability to give reliable predictions.

"Something or someone has broken the rules of the game" is another way to justify failure to predict successfully the outcome by the academic profession in economics.

Taking the current global financial market crisis gives lots of examples for explaining away the failure to assess and predict the current catastrophic outcome.

5. Financial Markets, the Future and Uncertainty

In the simple illustration of general equilibrium or partial equilibrium models the efficient market equilibrium is simply determined as if only the present demand and supply matter. However, every economist would easily accept that this is a major oversimplification about the economic problem of production, allocation and consumption of goods and services using money as medium of exchange. It is the future that matters and the expectation about the future development is essential for what is going to happen on spot markets today. Without taking this interconnectedness between present and future into account most of the analytical results based on a pure spot market mechanism will fail.

However, one fundamental problem about the future is that it is more or less uncertain. Frank H. Knight (1921) was right when he clearly separated the problem of uncertainty from risk. Uncertainty includes not a randomness of events which can be represented by a random variable with a specific probability distribution but embodies the model uncertainty about the probability distribution itself. Classical parametric statistical methods however are based on the necessity that the underlying probability distribution is known and use estimation functions to determine the respective parameters to be able to make inferences about the riskiness of possible future events. Some well trained econometrician will claim that on the one hand the central limit theorem of inference[7] helps to avoid the exact knowledge the exact probability distribution because at least asymptotically the distribution of the expectation value converges against the normal distribution. If the random sample of a particular economic random variable is sufficiently large enough and the single observations are identically and independently distributed the particular distribution function does not matter if one wants to draw only inferences about the expectation value of the random variable. Furthermore one can use non–parametric methods of inferences (*See* e.g. Hettmansprenger, and McKean 1998). But this does not change the underlying fundamental problem that observations should be obtained from the same underlying distribution and that the single observations are independently distributed from each other. If the underlying distribution function constantly changes over time one has at least to make an assumption about this dependency structure before one can draw conclusions using estimation functions about the future outcome in particular of the expectation values. Not knowing about the changing risk interdependencies of financial assets in securitized papers was one cause why the whole securitized asset market finally collapsed. If the default of one real estate has significant impacts on another and this causes a contagion process, the simple independency assumption underlying the securitization models about the risk structure fails.

In economics one has become well aware that there exists a problem of path–dependency[8] in economic development (*See* e.g. Arthur 1994). Since the current state of a society is the result of past decisions the current state depends on a sequence of past choices so that the present state is not independent from the past or as a catch phrase says: history matters. But not only the past matters but the future expectation about future trends and developments matter as well. In particular in the area of investments into any kind of asset the expected rate of return is essential for the valuation of the respective asset. Present values are always calculated by using the expected rate of return to discount the future income stream of the asset. Since the expected rate of return is more or less uncertain the problem of uncertainty enters the market mechanism via this channel. Furthermore the discounting of future income streams of an asset causes a significant compound interest effect which becomes increasing dominant with the length of the respective time horizon of the asset under consideration. On top of this there is empirical evidence that humans tend to deviate from the standard discounting procedure and follow more a hyperbolic discounting approach (Thaler 1961, Aisnlie 1975). This, however, leads to time inconsistent decision making.

The information problem someone has to solve under such circumstances is tremendous. To get a reasonable outcome one has to know the complete income stream in advance together with the

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[7] In probability theory, the central limit theorem (CLT) states conditions under which the mean of a sufficiently large number of independent random variables, each with finite mean and variance, will be approximately normally distributed.

[8] Path dependency explains how the set of decisions one faces for any given circumstance is limited by the decisions one has made in the past, even though past circumstances may no longer be relevant.

correct expected rate of return and take into account that the realisation of all this variables faces some degree of uncertainty in its realisation. If the predictions are incorrect the market mechanism has to adjust for this miscalculation. The larger the biased forecast has been the more dramatic the adjustment which after a certain threshold level might be considered an adjustment shock. If major unpredicted events in the near future or perceptions about future developments afterwards happen, this has significant consequences on the present value of the respective asset. This makes asset markets much more fragile with regard to the volatility of the asset prices than ordinary commodity markets. Since investments into a real asset like a machine or real estate also has as a consequence a lock–in effect, it cannot be converted to another form into a liquid assets or only at significant costs, this makes those markets most vulnerable to revaluation problems. The new financial innovation of asset backed securities just created easy liquidity without risk to assets which are intrinsically illiquid. The intrinsic riskiness of the underlying assets like real estate or entitlements on the future income stream of debtors like households, however, face the revaluation problem under uncertainty depending on conditions of the overall economy not under the individual control of the people who sign the contracts.

This problem becomes even more significant if we take into account the Schumpeterian view (Schumpeter 1911) that economic development is a process of creative destruction through innovations. Since the predictability of innovations is highly limited, any major innovation, i.e. a general purpose innovation (GPI)[9], causes major revaluation shocks in the asset markets. Therefore it is no accident that innovations like the rapid developments in information and communication technologies and in particular of the internet with its network effects or the innovation of securitization as a mean to distribute risk have become a source of huge volatility in the associated asset prices in particular and changed the economic growth and income expectations of the whole global society. If the visionary expectations would have been correct the social income stream of the future would have increased dramatically (*See* e.g. Jorgenson, and Stiroh 2000).

At the centre is always an event, a certain type of major innovation. The general public starts to speculate about the high positive impacts this innovation, e.g. a discovery of a new continent like the South Sea, a new general purpose technology (*See* e.g. Helpman 1998) like the Internet or securitization as mean to disperse risk. Those involved in this type of activities start to act as visionaries who promise extremely high revenues from this new kind of activity. Since they often lack the money to finance endeavours to internalise the perceived high profits exclusively they offer others the one time opportunity to participate and earn a significant share of these high perceived profits. People who otherwise have to work hard to make their money become attracted by such easy–to–get–rich–opportunity and often use large amounts of their savings to spend them on the seemingly safe bet of some investors. The latter highly advertise their too good to be missed opportunity. If they are crooks they take a hit and run stratagem to flee with all the money they got before the stupid financiers discover the fraud. Sometimes it might even happen that the one that runs the doomed business is so much convinced about its success that they become their own victim.

Venture capital financing is all about this problem. After all the perspective to get effortless rich is a common feature of all major scams. Money lies around and you only have to pick it up. This mirage of financial market prophets is a key driver for building–up communities of believers which create a financial market bubble. The symptoms of this kind of irrational exuberance are well known (*See* e.g. Kindleberger 1978, Greenspan 1996, Shiller 2000).

However, it has become a stratagem for policy makers responsible for financial market supervision to claim that financial market bubbles are unpredictable. There might be some truth to it, if one expects unconditional prediction which matches the real outcome perfectly. Of cause there is intrinsic uncertainty about the future, so that it is impossible to make the claim that the nearer or further off future the state of an economy might be predicted with certainty.

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[9] I prefer the term general purpose innovation instead of general purpose technology because it includes all kind of major innovations which not necessarily have to be technology based. Securitization is not a technological innovation in the narrow sense, but it had a dramatic impact on the financial market system and by this on the economic as a whole.

After all, there are often indications which make the claim sufficiently reasonable that there is a financial market bubble emerging which are reasonably safe to take early action on (*See* e.g. Shiller 2000, Roubini, Mihm 2010, Chap 1 and 2.). People who have kept their animal spirits alive know that certain financial market trends are unsustainable and a correction to break an unsustainable trend is needed. But there is a difficulty to give an exact plan how and by how much policy intervention a bubble can be deflated in a way to assure a soft landing.

Even more so it is too much to expect a perfect bubble deflation policy based on a perfect model about the financial market bubble currently emerging. It this simply this overblown expectation at policy makers to justify their policy actions that leads to a laissez–faire attitude in the end. One refrains from doing something because one fears the blame game when market participants will proclaim that this action was unnecessary and harmful.

Those who are making a fortune as long as the bubble expands will always be those who can't see the dark clouds on the horizon emerging. As long as the party is rolling they say they just have to be opportunistic because otherwise their shareholders would make them responsible for lost incomes if their prediction were wrong. This kind of harmful herding behaviour creates a kind of vicious circle of ruthlessness even if one already knows that things will collapse sooner or later. Pre–emptive bubble pricking is therefore something monetary policy makers have declared as a taboo on their policy agenda. John Paulson and many other speculators are less scrupulous when they learn about an unsustainable financial position; *see* e.g. the recent Greek sovereign default crisis.

Facing the dilemma of too early too much opposite too little too late, those responsible for financial market supervision have decided for the second option. Pre–emptive bubble pricking is still a taboo. This end–of–pipe attitude – first let the bubble burst and than fix the failing system again – might be the worst choice taking the opportunity costs of both strategies into account. This is a harmful attitude which cost the society dearly in the end as the enormous amounts of tax payer's money spent for bailouts illustrate.

Probably the truth lies between the two extremes of the white (Roubine, and Mihm 2010) and black swan. (Taleb 2007). Our knowledge about emerging bubbles is sufficiently large enough to know that it is a light grey swan and the longer the bubble grows the darker the grey swan becomes until it is pitch black.

6. Uncertain future developments, false predictions and cheap talk

As we have seen in the previous two sections future developments affecting market valuations embody a prediction error problem plus the possibility of cheating about the seriousness of the predictions presented to the public. This creates an identification problem. Can you trust the predictions made by some business people or political institutions that are stakeholders in the respective businesses or have for the latter a hidden agenda for example re–election?

In economics one is aware of the possibility of cheap talk (*See* e.g. Farell, and Rabin 1996, Crawford, and Sobel 1982) as a means of signalling something different than the actual wording given in the statement himself. Furthermore as false prophets often do the predictions are sufficiently vague to give room for interpretation. Talk of politicians addressing the public often intentionally gives only highly imperfect predictions but in a way that their constituency fill in the information gaps with their own hopes and aspirations. The audience reads between the lines by confabulation what they wish to hear. So the dissemination of information through the media might be highly biased in many respects. Newspapers and news services are often as well not impartial in the presentation of information (*See* e.g. Herman, and Chomsky 1988).

Therefore the issue of credibility of information is another critical issue in the valuation problems of markets. Since financial markets are heavily dependent on information in particular about the future, i.e. prediction markets, the constant stream of contradictory information spread needs a high capability to filter relevant from irrelevant or false information and propaganda. Since the ancient Greek philosophy the art of rhetoric[10] has been in high esteem. A well trained speaker in rhetoric could

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[10] Rhetoric is the art of using language to communicate effectively. It involves three audience appeals: logos, pathos, and ethos, as well as the five canons of rhetoric: invention or discovery, arrangement, style, memory, and delivery.

accomplish to convince a greater audience with his arguments even if they are misleading from the rational choice principles. Sophism[11] – in the interpretation of Plato – has become a way to influence peoples thinking into a desired direction, not to help them understand the real state. Instead rhetoric is used to trick them into common fallacies for a specific advantage. Often in financial markets sophists tend to convince people by their cunning rhetoric into to their faulty businesses. This phenomenon of mass psychology contributes significantly for developments in financial markets crisis und financial bubbles. Ponzi schemes tend to use those peoples with this special talent again and again. This however shows that the symmetry assumption about ability to make rational choices differ in the population. The smart guys trick the stupid ones often using again and again the same tricks.

The same is sometimes true for economic policies. Theories are invented out of the blue to justify irresponsible economic policies. A good example is the Laffer curve[12], which state that tax income losses to the government by lowering tax rates would be overcompensated by the increase in taxation due to higher taxable private incomes. This spontaneous suggestion about the working of an economy became a lynch pin of the Reaganomics policy of the 1980s. Later on the budget director, David Stockman (Stockman 1988), called this approach *Vodoo Economics*. This insider–outsider–problem of those who know that what they are doing is pure propaganda for a false policy design is another essential element for misguiding public policy opinion by experts who know better. Stockman disbelieved the strategy of the Reagan administration but as long as in office he used his rhetoric capabilities to convince the public that it might work wonders. It didn't as we now know, but at the time being it worked to cheat the public. The current unsustainable public deficit position of the US government just continues the bad fiscal policies of the US governments of the past 30 years (*See* e.g. Erber, Weber, and Rudoph 2009). There can be no doubt about the fiscal unsustainability of the US federal budget planning for the coming years.

If the general public gets increasingly doubtful that previously believed predictions or scenarios about future developments are still valid, this could cause an information cascade of revaluations[13]. These reflect themselves in the financial market prices often quite dramatically. The financial market panics observed when a bubble bursts is just this kind of contagion effect created by the spread of new true or false information. This changes the valuation of assets accordingly.

7. Fiat money and seignorage

Fiat money has different meanings. It is any money declared by a government to be legal tender, but since there is no intrinsic value associated to it anymore it can be created without any real valued assets like gold or silver in the past.[14] Therefore it even does not need a creation of money by the printing bank notes or coins to circulate as means of payment. It is just sufficient that the central bank decides to accept other assets in exchange for offering a virtual amount of legal tender on the central bank account. A commercial bank exchanges other assets which lack this legal tender property with

[11] Sophism can mean two very different things: In the modern definition (from Plato), a sophism is a specious argument used for deceiving someone. In Ancient Greece, the sophists were a category of teachers who specialized in using the tools of philosophy and rhetoric for the purpose of teaching aretê — excellence, or virtue — predominately to young statesmen and nobility.

[12] The story of how the Laffer curve got its name begins with a 1978 article by Jude Wanniski in The Public Interest entitled, "Taxes, Revenues, and the 'Laffer Curve.'"1 As recounted by Wanniski (associate editor of The Wall Street Journal at the time), in December 1974, he had dinner with me (G.E. Arthur Laffer then professor at the University of Chicago), Donald Rumsfeld (Chief of Staff to President Gerald Ford), and Dick Cheney (Rumsfeld's deputy and my former classmate at Yale) at the Two Continents Restaurant at the Washington Hotel in Washington, D.C. While discussing President Ford's "WIN" (Whip Inflation Now) proposal for tax increases, I supposedly grabbed my napkin and a pen and sketched a curve on the napkin illustrating the trade–off between tax rates and tax revenues. Wanniski named the trade–off "The Laffer Curve."
See http://www.heritage.org/Research/Reports/2004/06/The–Laffer–Curve–Past–Present–and–Future

[13] An information (or informational) cascade occurs when people observe the actions of others and then make the same choice that the others have made, independently of their own private information signals. Because it is usually sensible to do what other people are doing, the phenomenon is assumed to be the result of rational choice. Nevertheless, information cascades can sometimes lead to arbitrary or even erroneous decisions. (*See* e.g. Bikhchandani, Hirshleifer, and Welch 1992).

[14] The Song Dynasty in China was the first to issue true paper money, jiaozi, around the 10th century.

the central bank and obtain central bank money instead. This they can use to make any payments to other customers. Similarly a government can swap government bonds in exchange for fiat money of the central bank. Since the central bank by issuing fiat money has in principle an obligation opposite the holder of such money it has to take care to be able to offer the holder of fiat money another asset in exchange on demand. However, the value of the fiat money is unfixed with respect to the potential assets. Money illusion simply emerges if people would expect that the value of money is stable, i.e. the purchasing power is not affected in particular by high inflation. By keeping inflation under control the fiat money is accepted as a reasonable store of value. A central bank losing their credibility for keeping inflation under control is putting their fiat money holdings as store of value at risk. This would find its empirical expression in a higher velocity of circulation of fiat money because people dismiss this kind of money as inadequate as a proper store of value. So fiat money has the intrinsic problem that its function as a store of value is only possible if inflation is kept under control. Fiat money has therefore a higher risk to end up in hyperinflations if governments and their central banks use this as a means to fulfill debt obligations to the public (*See* e.g. Cagan 1956).

If central banks change their commitment on price stability somewhere in the future people will tend to adjust for this loss of functionality by using other assets in exchange for this purpose. So money illusion emerges as a fact in the perception of the public, when the central bank does not uphold their commitment of price stability. Since the information about this policy shift might dissipate unevenly to the public this process will not happen instantaneously. Insiders might adjust more rapidly than outsiders so that distributional effects cannot be ruled out, putting outsiders at a disadvantage.

Since most of the central bank money created is needed by the financial markets fiat money is similar to a permanent loan of the public to the central bank. Because of this limited obligation money creation gives the central bank a surplus which is also called seignorage. Seignorage is the interest earned on the assets acquired in exchange for the fiat money. These revenues are similar to a tax for the supply of liquidity of fiat money paid by the private sector. If bank notes or coins are issued these costs have to be subtracted from the overall seignorage of the central bank for the public. Since the central bank is an institution of the government at least some parts of the seignorage is transferred to the government as transfer payment. Since central banks who buy assets in exchange for paying with fiat money they have to value these assets according to common accounting principle like least value principle as used for foreign currencies or gold to hedge against potential losses and built up reserves in the case there is demand in particular high demand for foreign currencies as has happened during the recent Euro–crisis in 2010. By using mark to market valuation the central bank could face a higher volatility in their assets valuations depending on the market situation for these assets. To constrain these negative effects the central banks like the ECB usually accepted assets with a high triple AAA rating which are considered the most safe assets hedged against high market volatility in their asset prices. However, this behavioral rule has been temporarily abolished during the current global financial crisis putting the balance sheet of central banks at risk to end up with huge losses or even could face insolvency when the central bank assets are devalued that the own capital is not covering the losses of buying bad assets from the commercial banks to stabilize the financial sector.

Up to now this has not endangered the credibility of major central banks of the Fed, ECB, the Bank of England or the Japanese central bank to guarantee price stability; however, this might change if governments get more and more highly indebted. Fears of sovereign debt failures are significant triggers for the change of the public perception about the solidity of the respective fiat money issued by the central bank of that country or respective currency union like the Eurozone.

8. Seignorage under international financial market integration

In an international financial market integration regime – i.e. under a regime without capital market controls – seignorage incomes not only emerge from the domestic private sector but as well from the foreign countries, if they hold currency reserves of the fiat money of a particular country like the US or the Eurozone as a currency union. These global reserve currencies earn significant benefits from the willingness to hold huge currency reserves of these currencies to hedge against a major currency crisis to avoid insolvency, *see* e.g. the case recent of Island, where insolvency could only be avoided through financial life lines given by the IMF and foreign governments. The insolvency risk of in particular small countries which lack the ability to finance foreign debt in their own currency

denomination includes the currency illusion if a major financial crisis emerges in the international financial markets. Therefore the loss of credibility of a domestic government and its central bank to maintain sufficient price stability tends to drive their population toward other currencies as a more reliable store of value. This kind of Dollarization or Euroization transfers the Seignorage revenues of the countries holding the reserve international currencies to the respective foreign countries in particular the US as the still dominant global reserve currency (*See* e.g. Feige, and Dean 2002).

Figure 1. Official Global Dollarization and Euroization
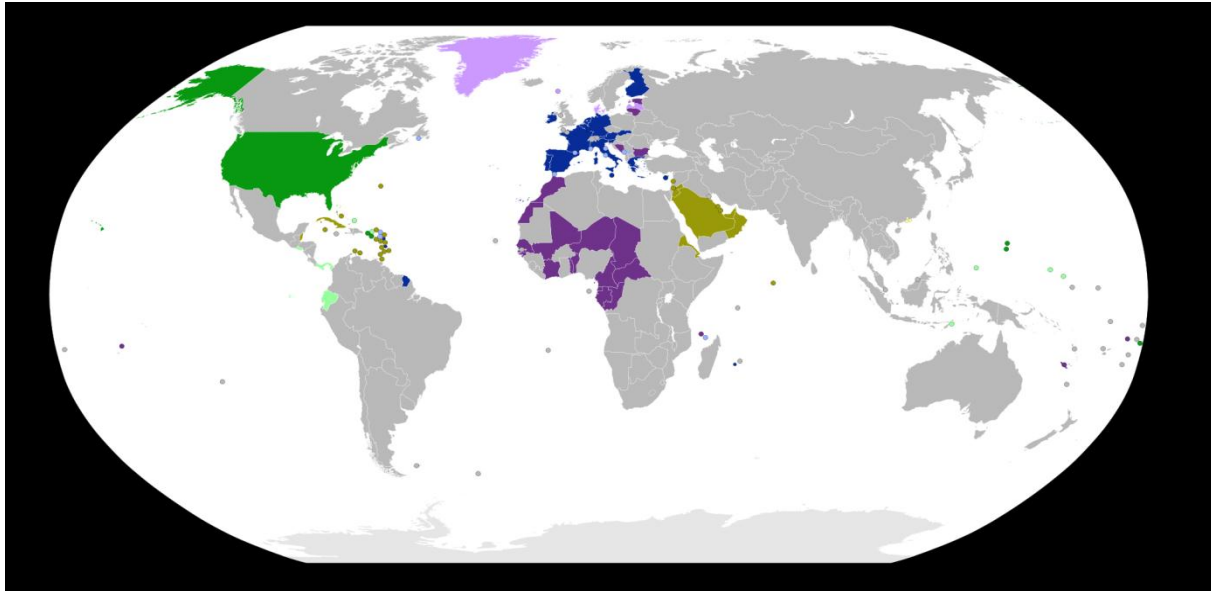
Worldwide use of the U.S. dollar and the euro:
United States
External adopters of the US dollar
Currencies pegged to the US dollar
Currencies pegged to the US dollar within narrow band
Eurozone
External adopters of the euro
Currencies pegged to the euro
Currencies pegged to the euro within narrow band

The huge amount of dollar exchange reserves accumulated in particular in Asian countries like the PR of China, Japan or oil producing countries like Saudi Arabia over the past decade has become a very expensive hedge against the potential risk of a currency crisis (*See* Table 1). These few holders account for more than 60% of total world foreign currency reserves.

If the US would lose its credibility to maintain monetary stability domestic and even more so foreign currency holders might rush for an exit and by this defuse the currency illusion with regard to exchange rate stability very quickly. Exchange rate volatility is therefore an indicator for credibility problems between different countries. Up to now the US–Dollar has profited from such developments as a safe haven for international investors under periods of global financial crisis. If the US–Dollar would lose this extraordinary privilege because of increasing doubt in the solvency of the US–government it could trigger major turbulences in the global financial market system (*See* e.g. Roubini, and Mihm 2010, Chapter 10). Especially after the current global financial market crisis which has had its origin in the securitization of huge amounts of dubious assets like mortgages for subprime customers (*See* e.g. Shiller 2008), but also in many other areas which heavily used consumer credit later collateralized in CDOs (collateralized debt obligations) as a mean for stimulating and financing an excessive consumer demand (*See* e.g. Roubini, and Mihm 2010, Chap. 4), have created a huge legacy of toxic assets which led to the bailout of major investment and commercial banks in particular in the US and Europe.

Table 1. Major countries official holdings of US–Dollar currency reserves

Rank	Country		Billion USD (end of *month*)
1	People's Republic of China (China) note 1	June 2010	2,454.3
2	Japan	June 2009	1,019.0
	Eurozone	Oct 2009	716.0
3	Russia note 2	Apr 2010	456.0
4	Republic of China (Taiwan)	Apr 2010	357.6
5	India note 2	Mar 2010	277.0
6	South Korea	Nov 2009	270.9
7	Switzerland note 3	May 2010	262.0
8	Brazil note 4	Jun 2010	253.5
9	Hong Kong	Nov 2009	240.0
10	Singapore	May 2010	203.4
11	Germany	Sep 2009	184.0

Source: IMF and national central banks.

Notes: 1. China updates its information quarterly; 2. Russia and India update their information weekly and monthly; 3. Swiss National Bank's currency reserves leapt more than 50 per cent from $145.6bn in April to $261.9bn in May 2010; 4. Brazil updates its information daily.

Easy credit helped to create money illusion by many debtors that they have not to face a restrictive budget constraint. Rapidly rising housing prices over many years contributed to the belief that in case of financial troubles house owners could easily obtain liquidity from their real estate without facing significant losses. When the housing bubble burst these expectations about a sound financing and manageable risk in case of liquidity problems to pay back mortgages lost its credibility and the investments in private housing ran into bankruptcy due to the contagion effects of fire sales to obtain at least some money back from the real estate under a scenario of rapidly sinking housing prices.

So money illusion has had in this case its origin in asset price inflation triggered by low interest rates. One origin was a loose monetary policy of the Fed in the US which under its previous Chairman Alan Greenspan helped to fight the negative impact of a previously burst new economy bubble. Another was the possibility to use financial innovations created in the investment and commercial banking sector to distribute risks of risky assets around the globe by cheating about this riskiness opposite naïve buyers believing in rating agencies like Standard & Poor's, Moody's or Fitch. Highly rated triple AAA securitized assets like mortgage backed securities (MBOs) did not reveal about the potential liquidity and valuation risks inherent in these papers.[15] Above normal market interest rates

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[15] *See* e.g. the newspaper articles "US credit rating agencies 'a colossal failure' in the Independent from October 23, 2008. The newspaper makes the quotation: "The rating agencies broke this bond of trust, and federal regulators ignored the warning signs and did nothing to protect the public," said Waxman, a California Democrat. "The result is that our entire financial system is now at risk." The statement of the rating agencies when the lawmakers criticised the three largest credit rating agencies for their role in the worst financial crisis in decades, that they claimed they didn't see it coming. Well this might be always true in the sense that people there spend little time to use their imagination to consider stress tests similar to the real events as a realistic assumption for their rating process. Again overconfidence in the stability of the financial markets was an essential ingredient to avoid a deeper questioning about potential risk scenarios. Putting the benchmark tests low, the models used in securitization did not reveal a significant risk that could make such papers toxic. Complacency based on past successful performances changed to willingness to accept risks into the false direction. Such false conclusions are common in human behavior when expectations about future risk are just based on a short–term of past performances (*See* e.g. Lowenstein 2000).

offerings for these assets attracted private and institutional investors who were blindfolded because they trusted the reputation of the issuers of such assets like e.g. Lehman Brothers and the quality of ratings of similarly well established rating agencies. Since there is now a lot of evidence available that insiders of this Ponzi scheme were well aware about the intrinsic vulnerability of the complexity financial products, it is ample proof that moral hazard has been a core element of the market failure in this segment of the financial markets. High bonus payments for sales of such assets for the investment bankers reduced any self–restraint to avoid a disastrous imbalance between the real value and the nominal value of such assets.

9. Conclusions

The lesson to be learned is that money illusion has many different causes all associated with the common fact that money as an accounting unit for market values cannot signal the information about the underlying value problems in a proper way. This is contrary to Hayek's belief that market prices are sufficient statistics to convey all necessary information needed to make a decision (Hayek 1945). If the pricing mechanism is flawed because it cannot signal in particular future valuation problem properly, the conversion of all valuations into an accounting unit of fiat money makes thing even worse. The exact numbers tend to mislead economic agents to give them a degree of certainty which cannot stand–up to the riskiness intrinsically embodies in the dynamics of markets where demand and supply driven adjustments are taking place without questioning the efficiency of market prices as a proper instrument to gear the production and allocation of resources.

If false trading is possible then even according to orthodox market liberals misallocation and wrong decision take place. Since this error is not immediately visible to the naïve observer or trader they draw wrong conclusions from the current outcomes. A lucky outcome of a speculation is reinterpreted as deep insight into the function of the economy or specific market trends. The belief to have learned a lesson how to play the markets changes the willingness to take risk because the risk awareness is numbed by the current lucky streak of favourable events. The subjective risk perception deviates more and more from the objective risk associated with the current market trend. Even if early on signs show–up that things could turn into the opposite direction in the near future, people often tend to develop a selective perception about the information available. One is looking for positive evidence that support the current prejudice and less for evidence which would falsify the maintained hypothesis how things are. So many critics of the high–risk and problems already visible in the financial system before the last global financial bubble burst were ignored and talked down (*See* e.g. Roubini, and Mihm 2010, Chap. 1). Contrary to Taleb (2007) who used the catch word black swan to claim that financial crisis are a very rare events, Roubini calls the current financial market crisis a white swan. It has nothing which went beyond common knowledge about how financial market crisis developed in the past. Same, same but different – a Thai saying – could be said about the stylized facts of a major financial market crisis.

What the author hopes to have illustrated by the present paper is that the two extreme beliefs, i.e. that there is a possibility of perfect planning or that there is the possibility of perfect markets to solve the coordination problem of economic activities are definitely wrong. They are both ideological constructs which emerged at a time when socialist and capitalist ideologists fought each other in the past two centuries. Both approaches are highly imperfect because they always have to deal with the uncertainty problem of future developments which are never under the complete control of planners or market participants. Market is therefore more or less second best solutions. Market failures are because of the intrinsic information dilemma with regard to future developments the rule and not the exception. People get it always wrong, they are imperfect in their abilities to process complex information and especially to predict the collective behaviour of societies. Preferences and ideas about the future change constantly. Markets are just institutions which adjust to these constant changes according to the revealed information to the public and its spread to the respective decision makers. Financial markets are the essential lynch pin between the present and the future. Money as a mean to express valuations and as a universal mean to give access to all kinds of assets and resources becomes the focal point were all these imperfections get visible in the market prices. They never represent an equilibrium state to a steady state of the economy. Since to quote a Greek philosopher Heraklit πάντα ῥεῖ, everything is moving, the degree of turbulence governing the economic development causes always some degree of mismatch between the real economy and the monetary sphere as its virtual

representation of the human valuation of the state of the economic system. A one to one correspondence is impossible to accomplish.

However, it is at least possible to detect exceptional developments in the financial market valuations of financial assets and ask for their underlying foundations with sustainable economic developments. If there is insufficient support to believe that these valuations make any sense in the long–run, if one detects all kinds of human irrational exuberance in the market place about the future possibilities to earn exceptionally high returns than it should be time to act for those responsible for monetary policy and financial market supervision to counterbalance these developments in a timely manner to keep things under control.

Even if there occur some losses in the ex post evaluation of the action taken because an optimal timing is not feasible due to unsolved information problems this is no justification for inaction. If there is any lesson to be learned from the recent two bubbles at the beginning of this century it is that. Don't be complacent with regard to global financial market turbulence. Act according the fundamental rules of sustainable economic development and give seemingly short–term benefits much less weight in your decision making. Robust rules for sustainable development in the financial sector should counter the current catastrophic trend of casino capitalism. (*See* e.g. Stange 1986).

Do we face a super bubble? There is some evidence that the current sequence of bubbles since the mid–1990ies has the scary tendency that overcoming the last bubble (new economy bubble) has triggered an even bigger bubble (financial market bubble caused by securitzation). So the ongoing debt swap from the private banking sector to the public finances on most countries of the developed world is most worrying. Up to now we experienced sovereign debt failures in some countries in the past, but now a global sovereign debt failure becomes imaginable.

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ESTIMATION AND DECOMPOSITION OF TOTAL FACTOR PRODUCTIVITY GROWTH IN THE EU MANUFACTURING SECTOR: A LONG RUN PERSPECTIVE

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Abstract

In this paper the Stochastic Frontier approach was used for the estimation and decomposition of manufacturing TFP growth in 14 EU member countries, drawing upon the EU–KLEMS database. This study identifies some key issues: in the period 1970–2005, the TFP rate of change in the EU manufacturing sector constantly decreased, mainly due to the reduction in technical efficiency and, to a lesser extent, to the decline in the rate of growth of input factors and allocative efficiency. In the same period, the sector recorded considerable technical progress, which, nonetheless, did not offset the negative forces which pulled the EU TFP growth down, especially in the last decade of the sample period.

1. Introduction[16]

After a prolonged period of catching–up, which started after the Second World War (WWII) and lasted until the mid–'90s, EU member countries experienced an anaemic rate of economic expansion, particularly compared to the United States. In the latter country, GDP growth accelerated in both absolute and per–capita terms at a time when EU countries started to show a slowdown. Plenty of studies confirm that the different economic growth rates recorded in these areas stem from the gap in the production and adoption of ICT related technology, and in the amount of R&D and human capital investments, which directly affect labour and total factor productivity (TFP).

In recent years, the issue of low EU countries' productivity gained wide attention among both academic and national and international institutions. In 2000, the European Council adopted the Lisbon Strategy, recognizing the central role of knowledge, information technologies and R&D in enhancing productivity, but the ambitious goals highlighted therein are far from being achieved.

According to Havik *et al.* (2008) two different views distinguish the EU slowdown: the optimistic view and the pessimistic one. The "optimistic view" belongs to Blanchard (2004), according to whom differences in productivity growth between the EU and the US are not so wide if one considers the higher preference for leisure which characterizes the EU and the possible lag between the adoption in Europe of the latest market reforms and their effect on future economic growth. The "pessimistic view", supported by the Sapir report[17] and by Aghion, and Howitt (2006), suggests that the EU might be unable to boost its growth rate because its institutions are not suitable for promoting a shift of resources towards sectors with high productivity growth prospects. In their study Aghion, and Howitt (2006) point out that economic growth depends on either innovation or imitation. In the former case, growth relies on the resources devoted to innovation (i.e. R&D and human capital) and on the stock of existing knowledge (knowledge spillovers), while in the latter growth depends on the adoption/diffusion of state–of–the–art technologies. Countries that are close to the technology frontier will grow mainly thanks to the introduction of new technologies which imply an upward shift of the frontier, whilst follower countries will derive the largest share of their TFP growth from the adoption of better, but already existing, technologies which are available at the frontier.

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[16] I am grateful to Luigi Benfratello, Luigi Giamboni, and Carlo Milana for the very useful comments and suggestions. The remaining errors are the author's sole responsibility.

[17] Sapir report (2003).

In this "Schumpeterian" world, institutions and policies play a key role in determining the relative position of countries in the global innovation race. The authors conclude, with the support of empirical evidence,[18] that while EU institutions were supportive in the post–WWII process of adoption/diffusion of technologies at the frontier, from the mid–'90 onwards they were unable to revitalize EU growth through innovation favouring policies. Havik *et al.* (2008) reach the same conclusion and suggest, for stimulating TFP and growth in the EU, the adoption of policies which favour competition, education, and R&D.[19]

In comparing the labour productivity trend in the EU and the US, van Ark *et al.* (2008) show that in the US the emergence of the knowledge economy and the acceleration of TFP played a key role in boosting economic growth, especially in the market services sector. In Europe, instead, lower investment in ICT, smaller share of ICT producing industries, tighter regulations[20], and slower TFP growth contributed to the anaemic dynamics of the overall economy.

The aim of this paper is to analyze TFP growth and its components in the manufacturing sector of 14 out of the 15 European countries that founded and joined the EU in the earlier period, using the Stochastic Frontier Production Function approach (SFA). This method allows obtaining TFP growth as the sum of four components: technical change, technical efficiency change, scale and allocative efficiency. In particular, the first component is a measure of innovation (shift of the frontier) while the second a measure of imitation (movement towards the frontier).

Besides SFA, which is a parametric method, two other non–parametric methods are widely used in estimating TFP growth: the Solow–type Growth Accounting (GA) technique and the Data Envelopment Analysis (DEA). The advantage of SFA is that it allows for the presence of idiosyncratic shocks and measurement errors and can be used to investigate the determinants of technical (in)efficiency and, therefore, those of TFP. Furthermore, SFA is suitable for the analysis of TFP in the Aghion, and Howitt (2006) framework that is to distinguish, among others, the influence of innovation (technical change) and imitation/adoption (technical efficiency change) in the dynamic of TFP. The drawback is that a specific functional form has to be specified and the efficient production frontier is the same for all the decision units.

In this paper, the classical SFA approach was firstly used to estimate technical (in)efficiency. Successively, estimation results were utilized to calculate the trend of TFP and of its components: technical change, technical efficiency change, scale and allocative efficiency. Moreover, relying upon the EU–KLEMS database guaranteed data homogeneity, particularly with respect to capital contribution, and hence comparability of the results.

The SFA bottom–up approach differs from the Aghion, and Howitt top–down approach[21] since in the latter TFP growth is obtained as a Solow residual and then the influence of explanatory variables on TFP growth is estimated using various econometric techniques. In the SFA TFP growth is the result (algebraic sum) of the various components directly obtained estimating a production frontier which is not, in addition, restricted to be homogenous of degree one.

The SFA method, which was developed by Aigner, Lovell, and Schmidt (1977), and Meeusen, and van der Broeck (1977), was principally adopted for the analysis of micro–level data, but more recently it was used at a higher level of aggregation. For example, Sharma *et al.* (2007) utilized SFA for decomposing TFP growth in United States; Wu (2000) used it to examine Chinese regions; Gumbau–Albert (1998, 2000) used SFA to explain inefficiency and convergence in the Spanish regions; Osiewalski *et al.* (2000) analysed the TFP growth gap between Poland and Western countries using Bayesian SFA.

Some key findings emerged from our analysis: in the period 1970–2005, the TFP rate of change in the EU manufacturing sector constantly decreased, mainly due to the reduction in technical

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[18] Evidences came principally from Aghion *et al.* (2004).

[19] The same policy conclusions were reached by Nicoletti, and Scarpetta (2003), and Aghion *et al.* (2005), but with only partial results. While the former stated that TFP is driven by the imitation process, the latter considered innovation as the main force.

[20] On the role of regulation in slowing down TFP *See* also Nicoletti, and Scarpetta (2003).

[21] Most of the recent paper uses this last approach. For a review of the literature, but even more for a systematic analysis of the relation between competition and growth, *See* Aghion, and Griffith (2005).

efficiency and, to a lesser extent, to the decline in the rate of growth of input factors and allocative efficiency. In the same period, the sector recorded considerable technical progress, which, nonetheless, did not offset the negative forces which pulled the EU TFP growth down, especially in the last decade of the sample period.

The rest of the paper is organized as follows: Section 2 briefly reviews the specific econometric theory behind the SFA model used in our analysis; Section 3 describes the EU–KLEMS database; Section 4 contains estimation and test results; Section 5 shows the decomposition of the trend in TFP; lastly, Section 6 presents the conclusions.

2. Stochastic Frontier Approach

Following Battese, and Coelli (1992), we considered a stochastic frontier production function with an exponential specification of time–varying country effect for an unbalanced panel of EU members countries. The general specification is:

$$Y_{it} = f(x_{it}; \beta) \exp(V_{it} - U_{it}) \tag{1}$$

where Y_{it} is the output of country i at time t, x_{it} are factor inputs, β is the vector of parameters to be estimated, and V_{it} is an *i.i.d.* random error such that $V_{it} \square N(0, \sigma_V^2)$. The idea behind SFA is that firms/industries/sectors are not fully efficient and, given the level of technology, there is always a waste of resources in the production process. This inefficiency is captured by U_{it} which is modelled according to the following:

$$U_{it} = \eta_{it} \cdot U_i = \left\{ \exp\left[-\eta \cdot (t - T) \right] \right\} \cdot U_i \tag{2}$$

where U_i is assumed to be an independent and identically distributed non–negative truncation of $N(\mu, \sigma^2)$. Given (1) and (2), technical efficiency, $TE_{it} = \exp(-U_{it})$, increases at a decreasing rate if $\eta > 0$, decreases at an increasing rate if $\eta < 0$, or remains constant if $\eta = 0$; in the latter case the model comes down to a time–invariant specification.

For estimation purposes we chose a Cobb–Douglas specification of the production function

$$\ln Y_{it} = \beta_0 + \beta_t \cdot t + \beta_K \cdot \ln K_{it} + \beta_L \cdot \ln L_{it} + V_{it} - U_{it} \tag{3}$$

where t is a time trend which captures the Hicks–neutral technical change.

We decided not to use a translog specification because of the multicollinearity problem[22] which is exacerbated in the Battese, and Coelli (1992) specification. In the Battese, and Coelli (1995) formulation, this problem is less severe but we didn't find a wide enough set of variables/indicators useful to explain the dynamic of TE since 1970.[23] For this reason we preferred to use a less flexible time–varying specification in order to analyse the full sample period covered in the EU–KLEMS database. The costs of this choice is that the changes in TE for all countries are restricted to be monotonic, smoothed through the whole sample period, and changes in rank efficiency ordering over time are not allowed: the n–*th* ranked country at time t_0 will remain n–*th* ranked until T.

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[22] Preliminary analysis (VIF, Tolerance and conditioning number) showed that a translog specification would be seriously affected by multicollinearity.

[23] For example the Schumpeterian empirical literature uses observation on patents, mark–up, market share, trade barriers, price controls, and more in general, proxies of market competition/regulation. All these data are rarely available for the '70 and '80s. A Battese, and Coelli (1995) formulation is currently under scrutiny, but restricted to more recent years. For a review of the relation between competition and growth *See* Aghion, and Griffith (2005), and the recent survey of Scopelliti (2010).

3. The EU–KLEMS database

In the estimation and decomposition of TFP the EU–KLEMS database was used.[24] The database is the result of a research project performed by a consortium of 14 European institutions, funded by the European Commission. Its aim was to "*create a database on measures of economic growth, productivity, employment creation, capital formation and technological change at the industry level for all European Union member states from 1970 onwards. This work will provide an important input to policy evaluation, in particular for the assessment of the goals concerning competitiveness and economic growth potential as established by the Lisbon and Barcelona summit goals. The database should facilitate the sustainable production of high quality statistics using the methodologies of national accounts and input–output analysis*"[25]. The database contains observations on output (Gross Output and Value Added) and input (capital – decomposed into ICT and non–ICT related capital– , labour – decomposed into high, medium, and low–skilled labour–, energy, materials, and services) for 27 EU member countries, plus the US and Japan, for the period 1970–2005. Data are disaggregated at NACE Rev. 1 classification level. A further advantage of the EU–KLEMS database, with respect to using data from different sources, relies on the fact that a single method of estimation of capital services is used.

Since the database is far from being complete[26], we concentrated our attention on 14 out of the 15 older EU member countries[27]. In addition EU countries operate in the same environmental set–up because of the common regulatory regime. We focused on the manufacturing sector because: *i)* it is more complete with regard to data availability; *ii)* it is a market goods producing sector, thus sharing the same technology in all countries. All these elements should prevent the common production frontier hypothesis from being too binding.

We used value added, capital and labour quantity indices, along with a time trend variable, which is a proxy for technological change, to estimate a standard Cobb–Douglas stochastic frontier production function with time–varying technical efficiency (Equation (2) and (3)), according to Battese, and Coelli (1992).

Table 1. Sample Period

	T_0	T
Austria	1980	2005
Belgium	1980	2005
Denmark	1980	2005
Spain	1980	2005
Finland	1970	2005
France	1980	2005
Germany	1970	2005
Ireland	1988	2005
Italy	1970	2005
Luxembourg	1992	2005
Netherlands	1979	2005
Portugal	1992	2005
Sweden	1993	2005
United Kingdom	1970	2005

The database also contains TFP estimates obtained using growth accounting techniques. Figure 1 shows the TFP dynamics in the manufacturing sector according to this technique, along with the trend obtained using the Hodrick–Prescott filter. [28] The original series is very erratic, but some evidence comes from the trend. A clear negative path emerged from Spain, Italy and Ireland during the

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[24] March 2008 release.
[25] www.euklems.net.
[26] The panel is strongly unbalanced.
[27] Greece was not included because of lack of data.
[28] We did not report the figures for Luxembourg and Portugal in order to display the other countries' dynamics more clearly. The additional Figures are available from the author upon request.

entire period. In Belgium and Denmark, after a sharp deceleration during the '80s, TFP growth stabilised around 0. Finland was the only country which showed an increasing growth path during the entire sample period, while the trend in the UK recorded oscillating movements. The other countries did not show any significant change in the underlying long–run dynamics of TFP. Results of filtering have to be interpreted with caution because the symmetric nature of this filter does not produce a very reliable description of the trend towards the extremes of the sample period.
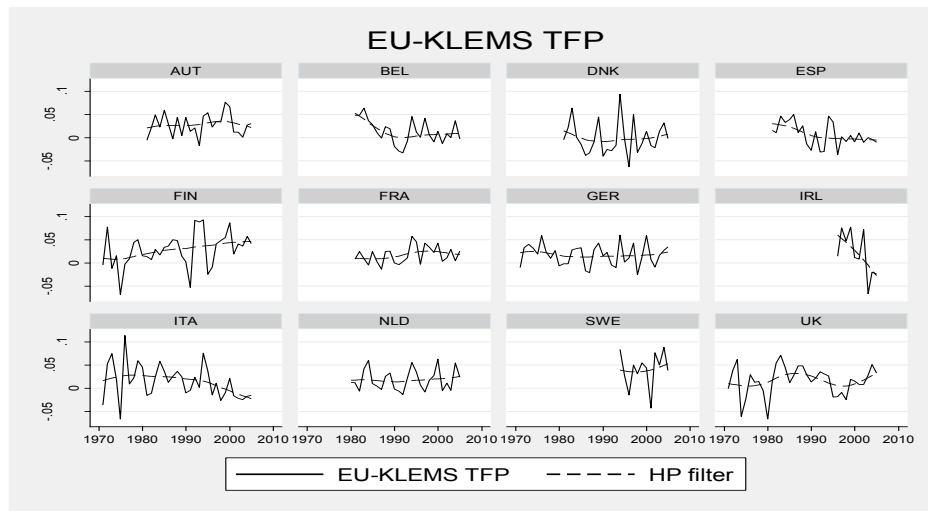

Figure 1 – EU–KLEMS TFP Growth Rate and HP filters

4. Estimation and test results

Estimations are carried out using the maximum likelihood method. One of the main problems with stochastic frontiers is that, given the high non–linearity of the log likelihood function, the optimization process can converge to a local maximum. In order to make sure that parameters represent the argmax of the likelihood function, we used different starting values[29]. A further check was the adoption of another software, which uses a different searching method and optimization algorithm.[30] Almost every time, the best results, in terms of likelihood, were obtained using OLS parameters as starting values, and the alternative software confirmed the results obtained with the main one. Just in few and particular cases the model did not converge at all.

Table 2 shows estimation results for different stochastic frontier production function models, while Table 3 reports tests of hypotheses of different models compared to the base model.[31] The specifications of the various models are the following:

Model 0: Equation (3) and $U_i \overset{iid}{\sim} N^+(\mu, \sigma_\mu^2)$ – Truncated Normal (Base model)

Model 1: $\beta_t = 0$ – No Technical Progress

Model 2: $\beta_K + \beta_L = 1$ – Constant Return to Scale

Model 3: $\mu = 0$ – Half Normal

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[29] OLS, pooled frontiers and using the parameters obtained in models M0 to M6 as a starting value in a different model.

[30] In particular, we used Frontier 4.1 to check the results.

[31] Estimations and tests were performed using Stata10. The maximum likelihood estimator of stochastic frontier in Stata was implemented in terms of the inverse logistic of gamma. We reported in the table both the latter value and the value for gamma, where $\gamma = \dfrac{\sigma_u^2}{\sigma_v^2 + \sigma_u^2}$. γ is bounded between 0 and 1. If $\gamma=0$ there is no inefficiency and we can estimate the production function. If $\gamma=1$ all the variation is due to inefficiency and we must use the stochastic frontier.

Model 4: $\beta_K + \beta_L = 1$ and $\mu = 0$ – Constant Return to Scale and Half Normal
Model 5: $\eta = 0$ – Time Invariant Efficiency
Model 6: $\gamma = \eta = \mu = 0$ – No inefficiency

Table 2. Models Estimate

	M0	M1	M2	M3	M4	M5	M6
β_K	0.2720***	0.3323***	0.2297***	0.3238***	0.2863****	0.3533***	0.4145***
β_L	0.9093***	0.8741***	0.7703***	0.8596***	0.7137***	0.8164***	0.7137***
β_t	0.0256***		0.0260***	0.0138***	0.0144***	0.0165***	0.0147***
Constant	–1.1436***	–0.0811	–0.6180***	–1.1614***	–0.3327***	–1.1675***	–0.9800***
μ	–0.3288	0.7267	–0.0892			–0.1222	
η	–0.1650***	0.0178**	–0.1572***	0.0479***	0.0519***		
inv.lgt(γ)	2.5878	–2.0813***	2.082	–2.0362**	–2.4604***	0.0334	
γ	0.9301	0.1109	0.8891	0.1155	0.0787	0.5083	
N.obs.	360	360	360	360	360	360	360
log–likelihood	334.72	311.94	329.27	321.74	317.88	309.46	289.48
χ^2	1862.53 (0.0000)	369.03 (0.0000)	2339.41 (0.0000)	725.42 (0.0000)	738.38 (0.0000)	1675.72 (0.0000)	1659.53 (0.0000)

* p<0.05, ** p<0.01, *** p<0.001

In the base model (**M0**) the production function exhibits increasing returns to scale (1.1813), with a robust LR test (Table3 – Test 3). The yearly growth rate for technical progress is 2.56% and is highly significant (Test 2). Model **M3** and the corresponding LR test (Test 4) show that the greater flexibility of the Truncated–Normal *versus* the half normal specification of inefficiency is worthwhile, and this is also true for the model which incorporates both the CRS and the half normal hypothesis (Test 5).

Table 3. LR Tests

	H0	d.f.	lr–test
Test 1	$\beta_K = \beta_L = \beta_t = 0$	3	309.48 (0.0000)
Test 2	$\beta_t = 0$	1	45.56 (0.0000)
Test 3	CRS ($\beta_K + \beta_L = 1$)	1	10.89 (0.0010)
Test 4	$\mu = 0$	1	25.97 (0.0000)
Test 5	CRS & $\mu = 0$	2	33.68 (0.0000)
Test 6	ti *vs* tvd	1	50.52 (0.0000)
Test 7	No inefficiency $\mu = \gamma = \eta = 0$	3	90.48* (0.0000)

(*) Mixed χ2 distribution

The further hypothesis of time–invariant technical inefficiency (**M5**) against a time–varying one is rejected, favouring the latter specification for efficiency (Test 6). The negative value of η in the base model (–0.1650), which is also known as *technological catch–up rate*,[32] implies that technical efficiency decreases over time at an increasing rate; i.e. it shows a negative technological catch–up.

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[32] Kumbhakar, and Wang (2005).

With respect to this parameter, the last and most important test (Test 7) checks if the EU manufacturing sector is fully efficient, so that all countries are at the production frontier and the OLS techniques can be used to estimate the (unique) production function. The null hypothesis is strongly rejected in favour of the stochastic frontier production function paradigm.[33] This conclusion is also supported by the high value of γ in **M0**. Since all tests favour model **M0**, this model was chosen for all further analyses.

To check for parameters' stability a country jack–knife estimate over the full sample was performed. Figures A1 and A2 in the appendix show the differences between the coefficients of the base model (M0) and those obtained leaving, at each step, one country out of the estimation (the one showed near the marker). The average difference, in percentage, is: 0.67% for capital; 0.10% for labour; –0.14% for the trend; 0.31% for η. In conclusion, parameters can be considered quite stable with respect to country exclusion.

Figure 2 shows the dynamics of Technical Efficiency (TE) for 12 out of 14 EU countries[34]. It is possible to divide the countries in four groups according to the size of the TE reduction: from 1970 to 2005, Italy, Spain, and Denmark recorded a reduction in the TE greater than 3 tenths of a point; UK registered a reduction between 2 and 3 tenths; for Belgium, Germany, and the Netherlands the TE declined by 1 to 2 tenths; Austria, Finland, France, Ireland, and Sweden showed a decrease in the TE of less than one tenth of a point.
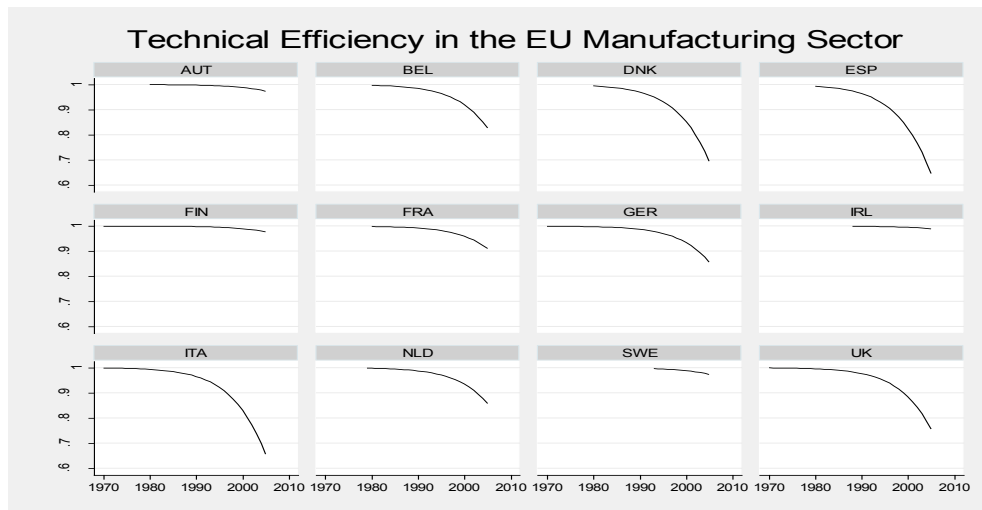

Figure 2– Technical Efficiency

Table 4 reports estimation results for two sub–periods: the period of relatively fast growth and the period of a slowdown in EU productivity. Estimations do not seem to lead to very satisfactory results, in particular because of strong decreasing returns to scale and parameter instability.[35] This can be the consequence of the small size of the sub–samples. Anyway, two facts are worth noting: *i)* the rate of technical change in the 1970–'95 period (1.45%) was more than three time lower than the rate in the 1995–'05 one (4.89%); *ii)* technical efficiency showed a decreasing pattern in the latter period ($\eta = -0.14$), but an increasing pattern in the former one ($\eta = 0.05$). These results seem to be consistent with the interpretation that in the former period the EU countries' manufacturing sector grew

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[33] In this special case, the LR test was performed according to Kodde, and Palm (1986), because of the mixed χ^2 distribution of the test.

[34] *See* note 11.

[35] Also in these cases we used country jack–knife estimates. Figures A3 to A6 show the results. The percentage difference between the base model and the jack–knife averages for the 1970–1995 sub–sample is: 96.33% for capital; –0.08% for labour; –19.72% for the trend; –13.46% for η. For the 1995–2005 sub–sample: 3.17% for capital; –0.96% for labour; 2.08% for the trend; –1.56% for η.

principally through technological catching–up, i.e. moving production towards the frontier, and, to a lesser extent, via innovation. In the latter period, the manufacturing sector's growth was determined by technical change, i.e. by the upward shift in the frontier production function, in parallel with a reduction in efficiency. This is probably due to the fact that, in periods of deep changes, it is more difficult to manage all inputs in an efficient way.

Table 3. LR Tests

	1970–'95	1995–'05
β_K	0.0747	0.3319**
β_L	0.6483***	0.3537*
β_t	0.0145***	0.0489***
Constant	0.9741**	0.2600
μ	0.1030***	0.4315***
η	0.0505***	–0.1402***
inv.lgt(γ)	–0.4125*	3.2470***
γ	0.6017	0.9626
N.obs.	206	154
log–likelihood	298.42	242.86
χ^2	120.62 (0.0000)	1317.21 (0.0000)

(*) Mixed χ2 distribution

5. TFP growth decomposition

According to Kumbhakar, and Lovell (2000), in the primal approach, when price information is available, total factor productivity changes can be split in 4 components[36]:

$$\dot{TFP} = \underbrace{\Delta T}_{\text{Technical change}} + \overbrace{(\varepsilon - 1) \cdot \sum_b \left(\frac{\varepsilon_b}{\varepsilon}\right) \cdot \dot{x}_b}^{\text{Scale component}} + \underbrace{\Delta TE}_{\text{Technical efficiency change}} + \overbrace{\sum_b \left[\left(\frac{\varepsilon_b}{\varepsilon}\right) - s_b\right] \cdot \dot{x}_b}^{\text{Allocative inefficiency}} \tag{4}$$

The first component of the above equation is technical change, which captures the upward shift in the production function. The second term is the scale component, which accounts for TFP changes due to variations in the scale of operations. If the production function exhibits constant returns to scale ($\varepsilon = 1$) this term disappears. The technical efficiency change, or technological catch–up, measures the changes in TFP as a consequence of a movement towards the frontier. The last term of (4) is allocative inefficiency. It measures the deviation of each input share cost s_b from its elasticity ε_b, or, to put it differently, the deviation of each input marginal productivity from output normalized cost. In an allocative efficient sector $\left(\frac{\varepsilon_b}{\varepsilon}\right) = s_b$, so that this component disappears.

In our simple Cobb–Douglas production function specification, once the model **M0** has been estimated, the calculation of the four components is straightforward:

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[36] We omitted subscript *i* and *t* whenever this does not generate confusion.

$$\Delta T = \beta_t$$

$$(\varepsilon - 1) \cdot \sum_b \left(\frac{\varepsilon_b}{\varepsilon} \right) \cdot \dot{x}_b = \left[(\beta_K + \beta_L) - 1 \right] \cdot \left[\left(\frac{\beta_K}{\beta_K + \beta_L} \right) \cdot \Delta \ln K + \left(\frac{\beta_L}{\beta_K + \beta_L} \right) \cdot \Delta \ln L \right]$$

$$\Delta TE = u_i \cdot \eta \cdot \exp\{-\eta(t - T)\} = \eta \cdot u_{it}$$

$$\sum_b \left[\left(\frac{\varepsilon_b}{\varepsilon} \right) - s_b \right] \cdot \dot{x}_b = \left[\left(\frac{\varepsilon_K}{\varepsilon} \right) - \left(\frac{\dfrac{\omega_{Kt} \cdot K_t}{\omega_{Kt} \cdot K_t + \omega_{Lt} \cdot L_t} + \dfrac{\omega_{Kt-1} \cdot K_{t-1}}{\omega_{Kt-1} \cdot K_{t-1} + \omega_{Lt-1} \cdot L_{t-1}}}{2} \right) \right] \cdot \Delta \ln K +$$

$$+ \left[\left(\frac{\varepsilon_L}{\varepsilon} \right) - \left(\frac{\dfrac{\omega_{Lt} \cdot L_t}{\omega_{Kt} \cdot K_t + \omega_{Lt} \cdot L_t} + \dfrac{\omega_{Lt-1} \cdot L_{t-1}}{\omega_{Kt-1} \cdot K_{t-1} + \omega_{Lt-1} \cdot L_{t-1}}}{2} \right) \right] \cdot \Delta \ln L$$

were ω_{ht} is the price of factor h at time t.

Figure 3 shows the dynamics of total factor productivity according to (4) with (tfp) and without both allocative efficiency and scale components (tfp1). Since $\eta < 0$ we observe a negative and increasing catch–up rate, and hence a reduction in TFP growth. Without the two above mentioned components the decreasing path of the TFP rate of change appears quite smooth. Looking deeper inside the scale component (Figure 4) we can see that during the period of observation the capital growth rate is positive almost always and for each country, while we observe, on average, a negative growth rate for labour utilization, indicating a capital/labour substitution in the manufacturing sector during the four decades. The allocative efficiency component is negative almost always and for each country.
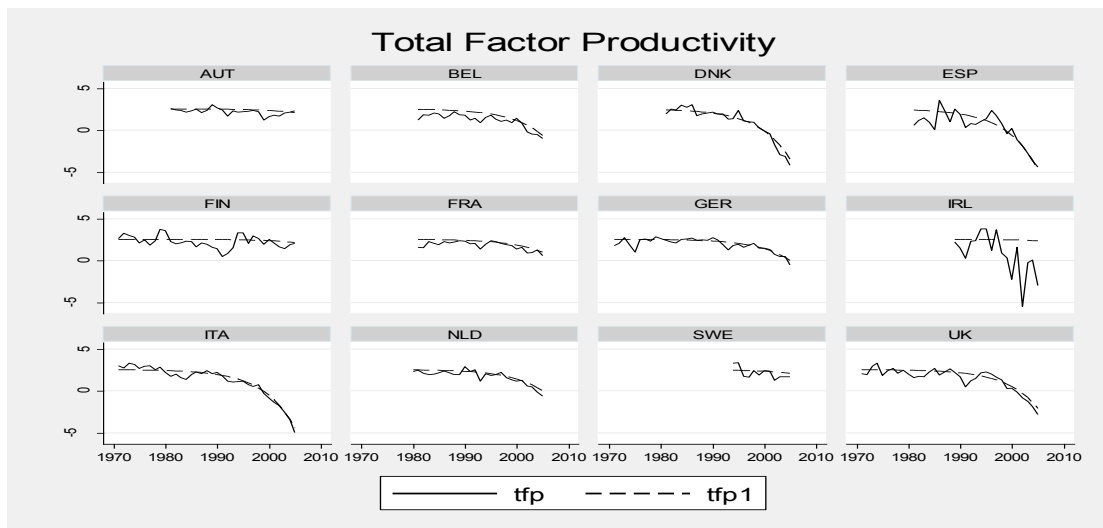

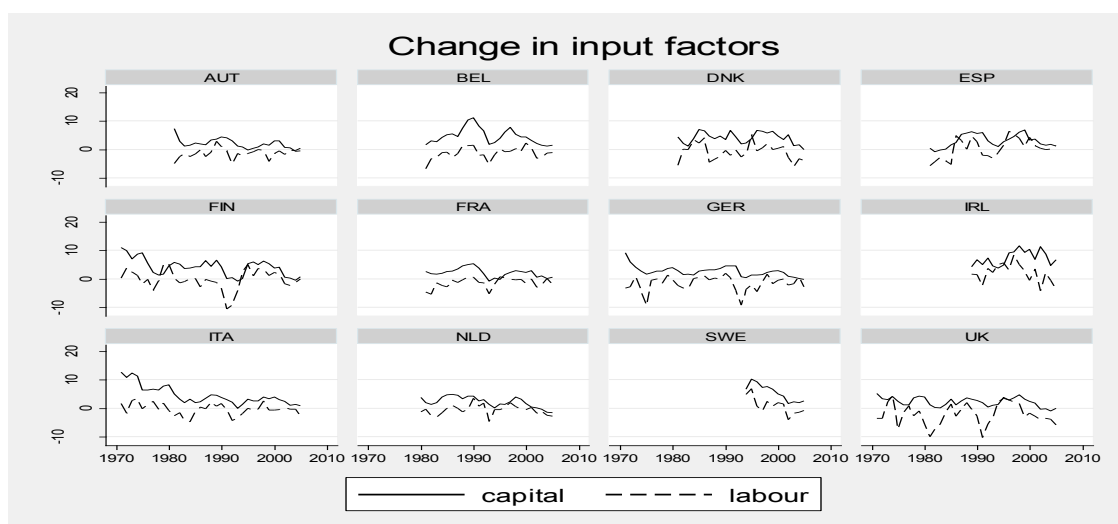**Figure 3.** Total Factor Productivity Growth

Figure 4. Change in input factors

Table 5 reports average TFP growth and its components for the 14 countries ranked in decreasing order of TFP. For Finland, Austria, Sweden, and Ireland, allocative efficiency is the main negative component of TFP growth, while technical (in)efficiency change is the most important for the remaining countries. The scale component is negative just for 4 countries, i.e. Austria, Germany, France, and the UK. In no country, on average, is TFP growth greater than technical change.

Table 5. TFP Growth Ranking and Components

	Rank	TFP growth	Tech. change	Scale component	Tech. efficiency change	Allocative efficiency
FIN	1	2.24%	2.56	0.15	−0.07	−0.40
AUT	2	2.22%	2.56	−0.09	−0.11	−0.14
SWE	3	2.13%	2.56	0.35	−0.20	−0.57
GER	4	1.93%	2.56	−0.11	−0.47	−0.04
FRA	5	1.81%	2.56	−0.10	−0.39	−0.24
NLD	6	1.71%	2.56	0.01	−0.61	−0.23
LUX	7	1.50%	2.56	0.07	−0.89	−0.19
UK	8	1.46%	2.56	−0.21	−0.85	−0.02
PRT	9	1.29%	2.56	0.01	−0.86	−0.38
ITA	10	1.19%	2.56	0.14	−1.27	−0.20
BEL	11	1.19%	2.56	0.01	−0.79	−0.57
DNK	12	0.94%	2.56	0.06	−1.50	−0.12
IRL	13	0.78%	2.56	0.58	−0.06	−2.30
ESP	14	0.44%	2.56	0.19	−1.80	−0.45

Note: Components of TFP growth are expressed in percentage points.

Figure 5 displays the average rate of TFP growth during four sub–periods. The decreasing trend is rather clear for all the countries in the sample, but for some of them it appears more marked: Denmark, Spain, Ireland, Italy, and the UK lost 3 to 6 percentage point (pp) of productivity growth from 1970–'80 to 2001–'05. A second group, composed by Belgium, Germany, Luxembourg, and the Netherlands, posted a TFP growth reduction of between 1 and 2 pp. For Austria, Finland, France, Portugal, and Sweden the decline was limited to less than one single pp. Italy is the country, among those observed in the early '70s, that showed the most dramatic deterioration in TFP growth: a reduction of 5.7 pp. In particular, it is worth considering the case of Ireland. In the first year of observation (1988) Ireland had a labour–capital cost share (s_L/s_K) equal to 1, while at the end of the period (2005) this ratio amounted to 0.41. Since the elasticity ratio $(\beta_L/\beta_K = \varepsilon_L/\varepsilon_K)$ is equal to 3.34, the largest part of the reduction of TFP growth in this country was due to allocative inefficiency, which accounted for 4.1 pp in the period 2000–'05. Without this component, Ireland's TFP change in

the manufacturing sector would have been 2.7%. The consequence was that even though Ireland is ranked number 1 for TE, it is last but one in TFP growth rank. In the others countries, allocative efficiency accounted for just a few tenths of a point.
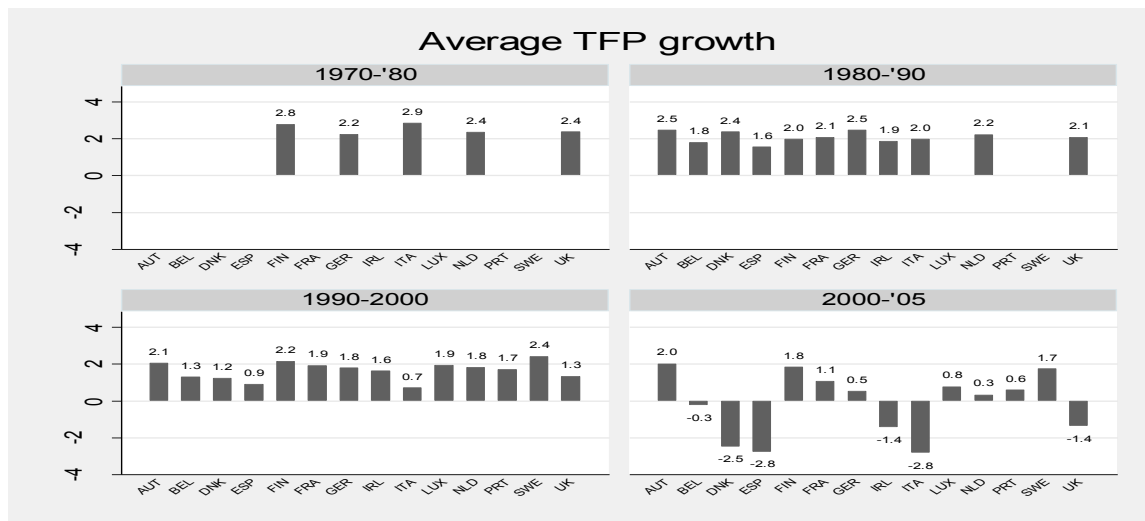

Figure 5. Average TFP Growth in 4 sub–periods

6. Conclusions

In this paper the Stochastic frontier approach was used to estimate and decompose manufacturing total factor productivity growth for 14 countries out of the 15 founding members of the EU. The results show that in the period 1970–2005 these countries recorded a dramatic fall in the TFP rate of change, due principally to the decline in technical efficiency and, to a lesser extent, to the reduction in allocative efficiency and input factor rates of growth. In the same period technical progress gave a positive contribution, although it did not reverse the TFP negative trend.

Even though these results are consistent with the general view, the rigidity of the model seems to exacerbate the dynamics of TFP at the end of the sample period. Better results, in terms of understanding the innovation–imitation debate, could be obtained splitting the sample period in two parts (1970–'95 and 1995–2005) and allowing for a more flexible functional form for inefficiency. The first of these two new steps could be achieved once the EU–KLEMS database is completed, while the second is more difficult to reach. Actually, to our knowledge, there is no useful data[37] available to estimate a model which also incorporates a model for technical efficiency, along the lines of Battese, and Coelli (1995), covering the whole sample period used in this paper.

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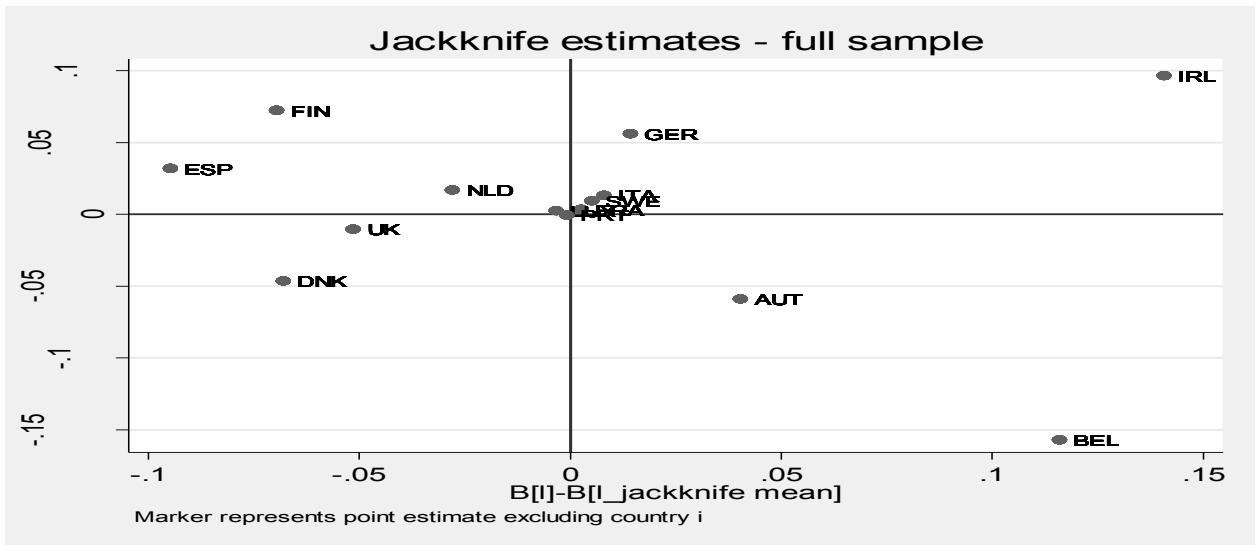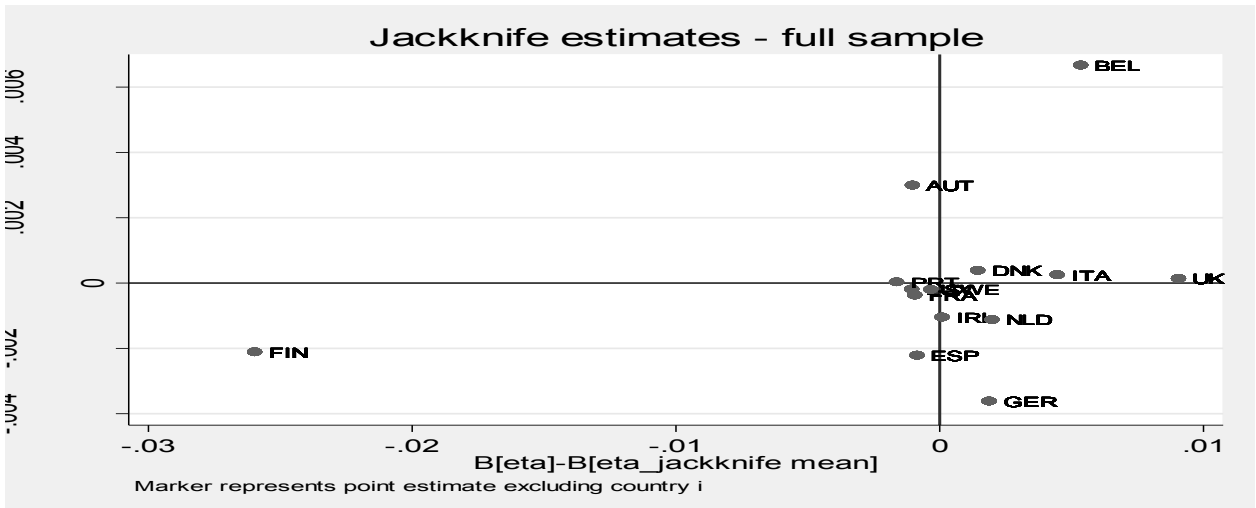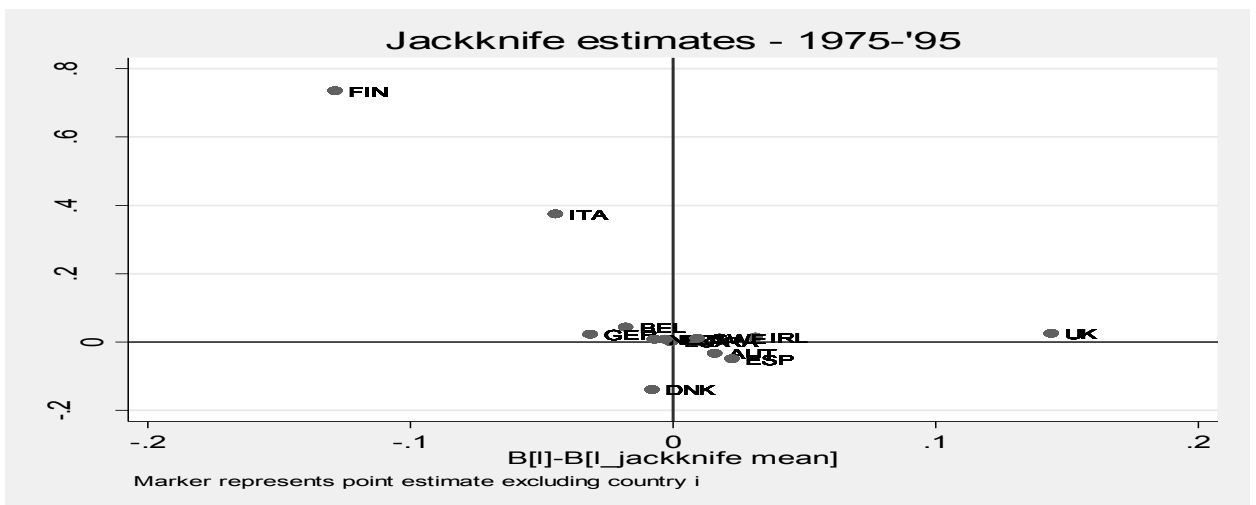
APPENDIX

Figure A1

Figure A2
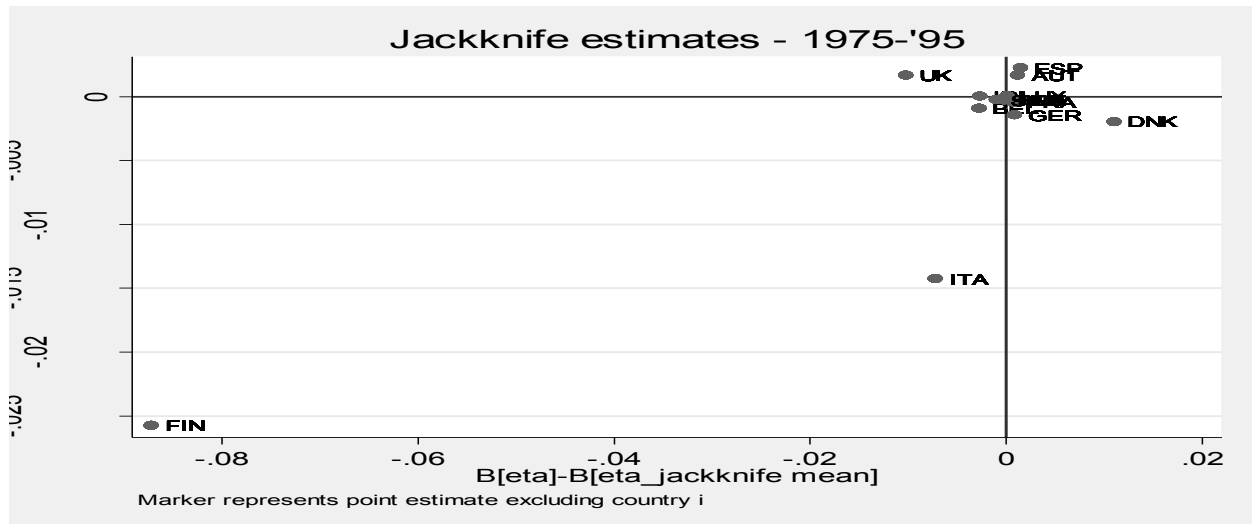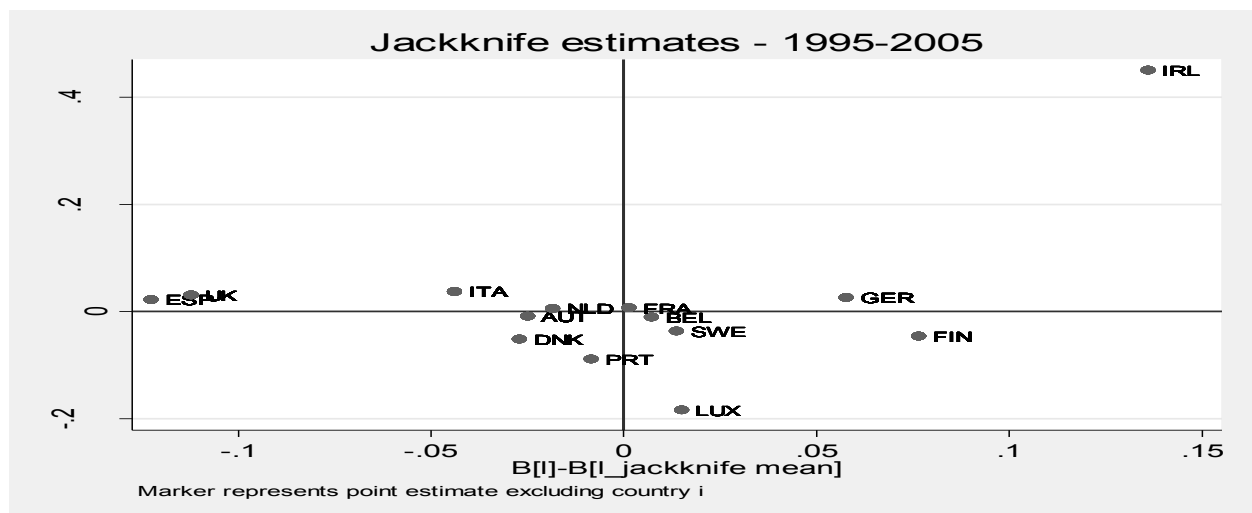

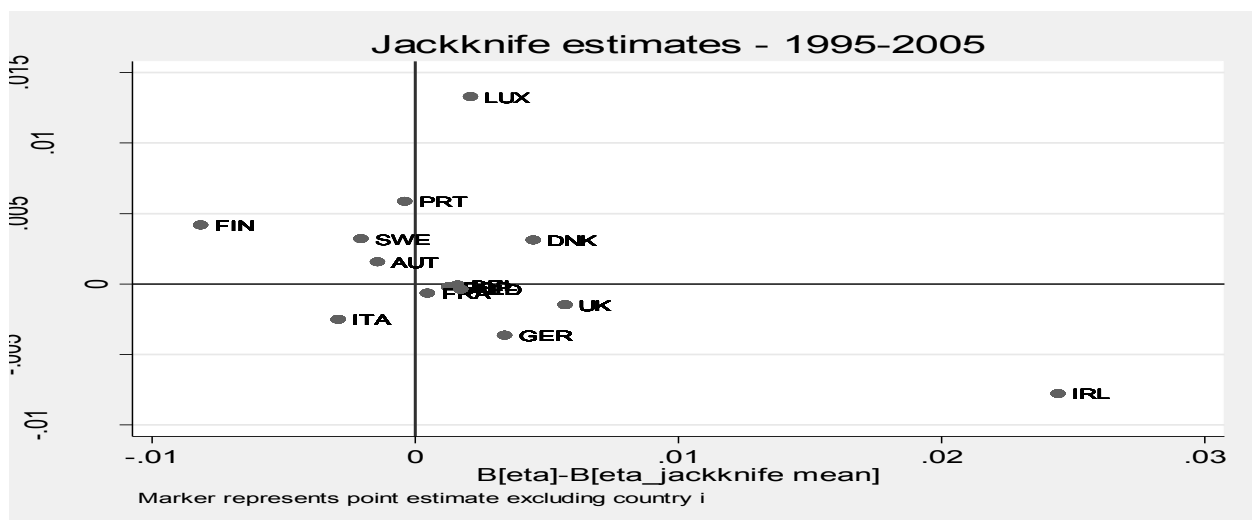**Figure A3**

Figure A4

Figure A5

Figure A6

FINANCIAL AND REAL SECTOR INTERACTIONS:
THE CASE OF GREECE

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Abstract

In this study we try to detect the relationship between financial and real sector employing in the estimation procedure the recent time–series techniques of co–integration, vector error–correction modelling and Granger multivariate causality. We contribute to the existing literature by using for the first time a number of financial and economic variables for the case of Greece for the time period 1960–2005. Our empirical results reveal that the linkage between financial and real development is relatively weak in Greece and real sector plays the major role in the evolution of the financial system. The latter seems to promote growth only by increasing its competitiveness.

1. Introduction

It is generally accepted that in Greece, banks have played a significant role in the accumulation of savings and its allocation to productive activities, in contrast with the capital market, which was till recently limited, due to low supply of small family oriented Greek enterprises.

Until 1980 financial restrictions were imposed, so as the problem of inflation to be encountered, caused mainly by large fiscal expenses. These restrictions concerned the amount of credit directed to the private sector so as the needs for credit to the public sector to be covered. The main characteristic of this period was also high interest rates necessary to cope with inflation as well as fiscal deficits taking into consideration the liberalization of capital flows.

But after the entrance of Greece in the Monetary European Union and the adoption of Euro, there was a need for a monetary as well as a real convergence. Consequently it became compulsory for interest rates to fall and there was liberalization in the allocation of credit. This was followed by the entrance of new financial enterprises, gradual mergers and acquisitions, a reduction in the portion of public banks in the financial market and a consequent increase in the portion of private ones. It is remarkable that from 1998 to 2003, the asset of Greek banks nearly doubled and in 2000 it exceeded GDP.

Taking the above conditions into consideration we try to define the interactions between the Greek financial and real sector, by capturing macroeconomic policies associated with economic growth. Our paper contributes to the existing literature by using for the first time a number of financial and economic variables for the case of Greece and by employing in the estimation procedure the recent time–series techniques of co–integration, vector error–correction modeling and Granger multivariate causality.

The structure of this study is the following. Section 2 presents a theoretical review regarding finance and growth. Section 3 describes the data used and the proxy measures of financial and real sector. Section 4 presents the empirical results and discusses the methodology proposed. Finally, the conclusions and their associated policy implications are presented in the last section.

2. Theoretical Review

During the last decades there has been a controversy of opinions, regarding the relationship between financial development and economic growth. From one hand and according to Robinson (1952), Gupta (1984), and Demetriades, and Hussein (1996), there is the *"demand leading*

hypothesis" (Patrick 1996), which supports that growth induces financial development. Conversely, the *"supply leading hypothesis",* which is consistent with Gerschenkron's view (1962), considers financial system to be the generating factor, trying to analyse the mechanisms through which finance affects growth (Levine 1997). Bercivenga, and Smith (1991) develop a model in which financial intermediaries influence growth rates, while de Rin, and Hellmann (2002) introduce banks into a 'big push model', showing that they may act as catalysts for industrialization. King, and Levine (1993) and Levine *et al.* (2000) among others give empirical supporting evidence, using cross country analysis. However, there are researchers, who support a two–way relationship between finance and growth (Thornton 1996), little relationship (Atindehou *et al.*2005; Mouawiya Al–Awad, and Narsi Harb 2005) or no relationship at all (Chang 2002).

Moreover, the supporters of the *"supply leading hypothesis"* have alternative views regarding the impact of financial liberalization on economic growth. According to the *"structuralism view"* proposed by Taylor (1983), Wijnbergen (1983), and Buffie (1984) financial deepening reduces the total real supply of credit available and hinders economic growth. On the contrary, McKinnon (1973, 1991), Shaw (1973), and Fry (1978) claim that liberalization of the financial system leads to the replacement of unproductive tangible assets with productive ones, positively influencing the quality and quantity of investment.

In this study, we explore which of these theories apply in the case of Greece. Specifically, as shown next, there is an application of a two–way relationship between finance and growth (Thornton 1996; Albulescu 2007), indicating that although real sector acts as a determining factor in the development of the financial market, finance is able to intrigue real sector, through increasing its liberalization and competitiveness.

3. Proxy measures of financial and real sector

In an effort to analyze the interactions between real and financial sector in Greece, we use bivariate models between financial variables on one hand and real sector variables on the other, as well as an augmented VAR model, using annual data from 1960 to 2005. The financial variables which are indicative of the depth of the financial system are total credit of banking institutions to GDP (TOTCREGDP) – Levine *et al.* (2000), total deposits of banking institutions to GDP (TOTDEPGDP) – Thornton (1996) and liquid liabilities to asset banks (LIQTOASE) – Beck *et al.* (2000).

The efficiency of the financial system is expressed by the ratio of total credit to the private sector to GDP (CPSGDP) – King and Levine (1993), total credit to the private sector to credit to the public sector (PRICREPUBCRE), short to long term loans which represents loans that have a year duration to loans of a longer duration (SHOLON), asset of monetary authorities to GDP (AMGDP), total credit of monetary authorities to total credit of banking institutions (MABAN) – King, and Levine (1993) and spread which is the difference between lending and deposit rate (SPREAD) – Eschenbach *et al* (2000). AMGDP and MABAN are used as measures of the degree of financial liberalisation and SPREAD of competitiveness (the lower the values, the more efficient the indicators).

Real sector is characterised by a certain monetary policy, which is expressed by lending rate (LR) or deposit rate (DR) and a fiscal policy which is weighed by the ratio of public consumption to GDP (PUBCONGDP) and fiscal deficit to GDP (DEFGDP). Proxies of real sector growth are Gross Domestic Product (GDP), real gross capital formation (GFCF), total investments to GDP (INVGDP) and saving rate (S). S is defined as the ratio of net disposable income minus consumption to net disposable income.

SHOLON, TOTDEPGDP, TOTCREGDP, MABAN and PRICREPUBCRE are derived from the "Long term statistical time series of the Greek economy" published by the Department of Economic Studies of the Bank of Greece for the years 1960–1991 and since 1991, from the "Monthly Statistical Bulletin" of the Bank of Greece (2004). LIQTOASE and CPSGDP are derived from the World Development Indicators Database. INVGDP is derived from the "Main national account aggregates of the Greek economy" published by the Ministry of National Economy. The rest of the data concerning macroeconomic and some financial figures comes from the database of the International Monetary Fund (IMF). All data is expressed in real prices as the ratio of nominal prices to the GDP deflator. GDP deflator is defined as the ratio of current prices to constant prices referenced to 2000 and is also taken from the IMF database.

4. Empirical results

Table 1 gives the descriptive statistics of the related variables. We observe that the mean and medium values are very close, implying stable time series of proxy measures, during sample periods covering from 1960 to 2005, while standard deviations are relatively high, due to the fact that we use proxies in levels.

Table 1. Descriptive statistics

Variables	Mean	SD	Median	Max	Min
Financial sector					
Financial depthk					
TOTDEPGDP	0,61	0,23	0,72	0,97	0,18
TOTCREGDP	0,46	0,11	0,47	0,63	0,75
LIQTOASE	13,30	4,28	17,00	18,00	3,00
Financial efficiency					
CPSGDP	0,44	0,13	0,43	0,85	0,26
MABAN	0,02	0,02	0,01	0,08	0,00
PRICREPUBCRE	5,97	2,09	5,90	11,67	2,09
SHOLON	1,47	0,35	1,34	2,34	0,99
SPREAD	4,99	2,22	4,91	9,23	2,00
AMGDP	0,29	0,10	0,28	0,55	0,11
Real secror					
GDP	276,48	112,7	255,28	526,49	96,51
GFCF	61,13	27,43	57,17	127,85	18,34
INVGDP	0,22	0,02	0,22	0,25	0,19
S	0,26	0,05	0,27	0,38	0,12
Monetary policy					
LR	15,49	7,23	12,89	29,45	6,79
DR	10,14	5,57	9,25	20,67	2,23
Fiscal policy					
DEFGDP	–0,06	0,05	–0,04	–0,01	–0,21
PUBCONGDP	0,15	0,02	0,15	0,20	0,11

Before we apply the Granger causality tests we have to test for stationarity of the time series into consideration. For this reason we employ Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) stationarity tests. To perform the ADF test we consider the following process of data generation

$$\Delta X_t = \quad \alpha + \quad \delta X_{t-1} \quad + \sum_{j=1}^{p-1} \delta_j \Delta X_{t-j} + \varepsilon_t \qquad (1)$$

$$\Delta X_t = \quad \alpha + \beta T + \quad \delta X_{t-1} \quad + \sum_{j=1}^{p-1} \delta_j \Delta X_{t-j} + \varepsilon_t \qquad (2)$$

Where Δ is the operator of the first–order difference; X_t is the variable under consideration; T is the linear time trend and t stands for time; p is the lag order; and ε_t is the white noise disturbance term with zero mean. The first of the process is with intercept, while the second is with trend and intercept. The null hypothesis is that H_0: $\delta=0$ against H_1: $\delta\neq0$ and the computed τ–values are compared with the MacKinnon's tables of critical values (MacKinnon 1996). If the computed τ–values are greater than

the MacKinnon critical values then H_0 is rejected and the variable is stationary. In the case that the τ– values are less than the critical values then the null hypothesis of non–stationarity is not rejected. Rejection of H_0 implies that the variable X_t is integrated of order zero [I(0)]. If the time series become stationary in first differences, then they are integrated of order one [I(1)]. Similarly and in order to perform the Phillips–Perron test we also rely on the previous regressions. This test controls for higher order serial correlation.

The optimal number of lags is determined by using the Akaike Information Criterion (AIC) and the Schartz Criterion (SC). Autocorrelation is explored using the Breusch–Godfrey test. Tables 2–3 present the unit root tests. According to the test results, all variables are I(1), with the exception of PRICREPUBCRE, which is I(2) at all significant levels.

Table 2. Unit root ADF test–Annual data 1960–2005

Variables	Deterministic	Levels	Probability	First difference	Probability
TOTDEP	intercept	1,2976	0,9983	–4,9741	0,0002
	trend and intercept	–1,7493	0,7123	–5,1697	0,0006
TOTDEPGDP	intercept	–1,5212	0,5139	–6,4029	0,0000
	trend and intercept	–1,3843	0,8522	–6,4800	0,0000
TOTCREGDP	intercept	–2,0935	0,2483	–4,0241	0,0033
	trend and intercept	–2,3205	0,4133	–3,9417	0,0192
LIQTOASE	intercept	–0,8523	0,7936	–6,2547	0,0000
	trend and intercept	–2,7036	0,2403	–6,2239	0,0000
CPSGDP	intercept	0,0061	0,9540	–3,3730	0,0174
	trend and intercept	–4,0875	0,0136	–3,5333	0,0481
MABAN	intercept	–1,8472	0,3532	–8,6176	0,0000
	trend and intercept	–2,0012	0,5833	–8,9790	0,0000
PRICREPUBCRE	intercept	–0,8985	0,7784	–2,2241	0,2012*
	trend and intercept	0,4971	0,9989	–3,2427	0,0909*
SHOLON	intercept	–2,0196	0,2776	–4,6988	0,0005
	trend and intercept	–1,7332	0,7176	–4,6917	0,0028
SPREAD	intercept	–1,3586	0,5935	–5,4115	0,0001
	trend and intercept	–1,0609	0,9239	–5,4517	0,0003
AMGDP	intercept	–1,6647	0,4419	–7,4285	0,0000
	trend and intercept	–1,3236	0,8691	–7,6267	0,0000
GDP	intercept	1,5026	0,9991	–5,8575	0,0000
	trend and intercept	–0,3336	0,9872	–6,1484	0,0000
GFCF	intercept	0,2354	0,9720	–5,0091	0,0002
	trend and intercept	–2,1940	0,4810	–4,9952	0,0011
INVGDP	intercept	–2,6580	0,0895	–6,8655	0,0000
	trend and intercept	3,3086	0,0782	–6,8425	0,0000
S	intercept	–2,3629	0,1585	–5,8498	0,0000
	trend and intercept	–1,6948	0,7346	–7,1389	0,0000
DR	intercept	–1,0464	0,7282	–4,2788	0,0015
	trend and intercept	0,3673	0,9984	–4,7189	0,0023

Variables	Deterministic	Levels		First difference	
			Probability		Probability
LR	intercept	−1,4916	0,5280	−3,2272	0,0253
	trend and intercept	−0,6431	0,9708	−3,5732	0,0445
DEFGDP	intercept	−1,9898	0,2899	−7,2016	0,0000
	trend and intercept	−2,6424	0,2649	−7,1810	0,0000
PUBCONGDP	intercept	−1,8289	0,3622	−9,5162	0,0000
	trend and intercept	−1,9555	0,6091	−8,4797	0,0000

*unit root at a 5% level of significance

Table 3. Unit root –Phillips–Perron test–Annual data 1960–2005

Variables	Deterministic	Levels		First difference	
			Probability		Probability
TOTDEP	intercept	1,2539	0,9980	−4,9814	0,0002
	trend and intercept	−2,1308	0,5152	−5,1750	0,0006
TOTDEPGDP	intercept	−1,5212	0,5139	−6,4029	0,0000
	trend and intercept	−1,3843	0,8522	−6,4800	0,0000
TOTCREGDP	intercept	−2,0935	0,2483	−4,0242	0,0033
	trend and intercept	−2,3205	0,4133	−3,9418	0,0192
LIQTOASE	intercept	−1,5043	0,5224	−10,0470	0,0000
	trend and intercept	−3,1491	0,1078	−9,9565	0,0000
CPSGDP	intercept	0,0061	0,9540	−3,3730	0,0174
	trend and intercept	−4,0875	0,0136	−3,5333	0,0481
MABAN	intercept	−3,4358	0,0152	−8,8632	0,0000
	trend and intercept	−1,6793	0,7424	−23,5585	0,0000
PRICREPUBCRE	intercept	−1,3166	0,6128	−2,0325	0,2723*
	trend and intercept	0,8377	0,9997	−3,1493	0,1093*
SHOLON	intercept	−2,6026	0,1006	−4,8006	0,0004
	trend and intercept	−1,9913	0,5886	−4,7305	0,0025
SPREAD	intercept	−1,4549	0,5465	−5,4187	0,0000
	trend and intercept	−1,3444	0,8629	−5,4517	0,0003
AMGDP	intercept	−1,6155	0,4665	−7,5242	0,0000
	trend and intercept	−1,3236	0,8691	−7,9842	0,0000
GDP	intercept	1,4745	0,9990	−5,8445	0,0000
	trend and intercept	−0,3990	0,9847	−6,1501	0,0000
GFCF	intercept	0,0436	0,9575	−4,9388	0,0002
	trend and intercept	−1,5865	0,7827	−4,8709	0,0015
INVGDP	intercept	−2,7048	0,0813	−6,8655	0,0000
	trend and intercept	−3,3086	0,0782	−6,8462	0,0000
S	intercept	−2,3923	0,1504	−5,8503	0,0000
	trend and intercept	−1,6173	0,7677	−7,5714	0,0000
DR	intercept	−1,0565	0,7247	−4,2788	0,0015

Variables	Deterministic	Levels Probability		First difference Probability	
	trend and intercept	–0,0373	0,9945	–4,7484	0,0021
LR	intercept	–1,2362	0,6500	–3,2272	0,0253
	trend and intercept	0,2322	0,9976	–3,5886	0,0430
DEFGDP	intercept	–1,7768	0,3861	–10,4491	0,0000
	trend and intercept	–2,8035	0,2047	–11,1500	0,0000
PUBCONGDP	intercept	0,8865	0,9944	–9,3038	0,0000
	trend and intercept	–1,6342	0,7633	–9,4964	0,0000

* unit root at a 5% level of significance

To consider dynamic causality, direction and timing between financial and real sector, we estimate bivariate vector autoregressive models, based on AIC and SC criteria and we conduct cointegration tests, according to Maximum Eigenvalue and Trace tests. Specifically, a VAR model can be presented as

$$
\begin{bmatrix} X_t \\ Y_t \end{bmatrix} = \begin{bmatrix} \alpha_{1,0} \\ \alpha_{2,0} \end{bmatrix} + \begin{bmatrix} \beta_{11}^{(1)} & \beta_{12}^{(1)} \\ \beta_{21}^{(1)} & \beta_{22}^{(1)} \end{bmatrix} \begin{bmatrix} X_{t-1} \\ Y_{t-1} \end{bmatrix} + \begin{bmatrix} \beta_{11}^{(2)} & \beta_{12}^{(2)} \\ \beta_{21}^{(2)} & \beta_{22}^{(2)} \end{bmatrix} \begin{bmatrix} X_{t-2} \\ Y_{t-2} \end{bmatrix} + \dots + \begin{bmatrix} \beta_{11}^{(p)} & \beta_{12}^{(p)} \\ \beta_{21}^{(p)} & \beta_{22}^{(p)} \end{bmatrix} \begin{bmatrix} X_{t-p} \\ Y_{t-p} \end{bmatrix} + \begin{bmatrix} u_t \\ v_t \end{bmatrix}
$$

If we define Z_t as $\quad Z_t = \begin{bmatrix} X_t \\ Y_t \end{bmatrix}$ then we have

$$
Z_t = \alpha + \beta_1 Z_{t-1} + \beta_2 Z_{t-2} + \dots + \beta_p Z_{t-p} + e_t \tag{3}
$$

Where Z_t is a vector that contains the system variables; $\beta_1, \beta_2, \dots, \beta_p$ are parameters; α is the deterministic element of the VAR model; e_t is the vector of random errors distributed with zero mean and Ω variance matrix. Using the maximum likelihood method and the Johansen cointegration strategy we are able to estimate the cointegrating vectors between the nonstationary variables.

Table 4 presents the extracted results, which show that the only cointegration equations are traced between SPREAD–INVGDP, DEFGDP–SPREAD, DEFGDP–TOTCREGDP and DEFGDP–AMGDP.

Table 4. Cointegrating vectors /Mag eigenvalue test and Trace test: Bivariare models

	Trace test	Max eigen test
invgdp spread (VAR lag=1)		
H_o: r=0*	16,7178	14,8014
H_o: r≤1	1,9164	1,9164
Defgdp spread (VAR lag=1)		
H_o: r=0*	17,5484	15,7774
H_o: r≤1	1,7635	1,7635
Defgdp amgdp (VAR lag=1)		
H_o: r=0*	16,9516	14,4538
H_o: r≤1	2,4978	2,4978
Critical value 0,05 (allow for linear deterministic trend in data)		
H_o: r=0	**15,4947**	**14,2646**
H_o: r≤1	**3,8415**	**3,8425**
Defgdp totcregdp (VAR lag=1)		
H_o: r=0*	11.4889	11.4838
H_o: r≤1	0.0049	0.0049

Critical value 0,05		
Hₒ: r=0	**12,3209**	**11,2248**
Hₒ: r≤1	**4,1299**	**4,1299**
r = number of cointegrating vectors		
Lags are defined according to AIC and SC		
*Rejection of Ho (Ho:There is no cointegration relation)		

Note: The rest of the cointegrating equations, which proved to be insignificant are available upon request.

In the above cases of cointegration we detect the existence of a short and long term relationship through Granger Causality tests and Vector Error Correction Model respectively.

The short–run Granger causality is tested by the joint significance of the coefficients of the differenced explanatory variables by using the F–statistics while the long–run causality is implied through the significance of the t–test(s) of the lagged error correction term(s). However the VECM indicates econometric exogeneity of the variables if both the t and F tests are insignificant.

According to Granger Causality tests, SPREAD seems to cause INVGDP, while DEFGDP doesn't seem to interact with SPREAD in the short run at a 5% significance level. On the other hand DEFGDP causes TOTDEPGDP and AMGDP causes DEFGDP at the same level of significance. With the exception of INVGDP–SPREAD, in all other cases there seems to be a long term relationship between all variables mentioned above, as all the adjustment coefficients towards long run equilibrium are statistically important.

Table 5. Vector Error Correction models

Explanatory Variables		
	d(invgdp)	**d(spread)**
Short run: F–statistic		
D(invgdp(–1))	–0,0271	1,7730
D(spread(–1))	–0,0011	0,2039
Ac–t statistic	0,0017	0,0220
ECT–t statistic	–0,3786*	–3,3636
	d(defgdp)	**d(spread)**
Short run: F–statistic		
D(defgdp(–1))	–0,0082	14,8074*
D(spread(–1))	0,0021	0,3116*
Ac–t statistic	–0,0012	0,0675
ECT–t statistic	–0,3464*	–13,3266*
	d(defgdp)	**d(totcregdp)**
Short run: F–statistic		
D(defgdp(–1))	–0,0678	–0,0468
D(totcregdp(–1))	0,2263	0,0131
Ac–t statistic	–0,0017	0,0040
ECT–t statistic	–0,2366*	0,2986*
	d(defgdp)	**d(amgdp)**
Short run: F–statistic		
D(defgdp(–1))	–0,1627	0,8492*
D(amgdp(–1))	–0,6372	0,1669
Ac–t statistic	–0,0009	0,0033
ECT–t statistic	–1,9862*	–2,1098*

*Statistically significant at a 5% level

Table 6. Granger Causality tests of bivariate models

Granger Causality tests	F statistic	Probability
Spread doesn't Granger cause Defgdp	3,6641	0,0636
Defgdp doesn't Granger cause Spread	1,1815	0,2810
Defgdp doesn't Granger cause Totcregdp	7,1278	0,0113
Totcregdp doesn't Granger cause Defgdp	1,8225	0,1854
Spread doesn't Granger cause Invgdp	11,9348	0,0013
Invgdp doesn't Granger cause Spread	0,0067	0,9352
Defgdp doesn't Granger cause Amgdp	0,9949	0,3252
Amgdp doesn't Granger cause Defgdp	9,0872	0,0047

In analyzing the results, attention is given on the impulse response functions and forecast error variance decomposition. Impulse response functions show how one variable responds over time to a single innovation in itself or another variable. Innovations in the variables are represented by shocks in the error terms in the equations. Specifically, we observe that for instance, after a 1% point increase in spread, the response of INVGDP is negative, reaching a peak of –0.02%, after seven years, indicating that the more the banks become competitive, which is expressed by a low spread, the more INVGDP is promoted.

After a 1% improvement of DEFGDP, SPREAD declines reaching a negative peak of –0.68%, in five years and then is stabilized at about –0.55%. On the contrary, TOTCREGDP reacts positively to a 1% shock of DEFGDP, meaning that an improvement of DEFGDP stimulates TOTCREGDP, which reaches a maximum of 0.03%, after 9 years. Finally DEFGDP is determined by AMGDP, negatively reacting to it, as a 1% increase in AMGDP, leads to a –0.017% decline of DEFGDP.
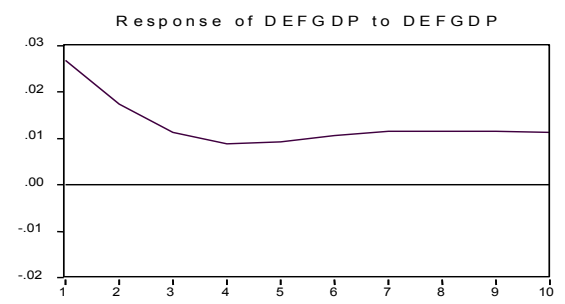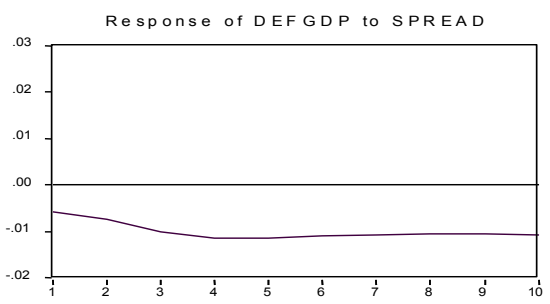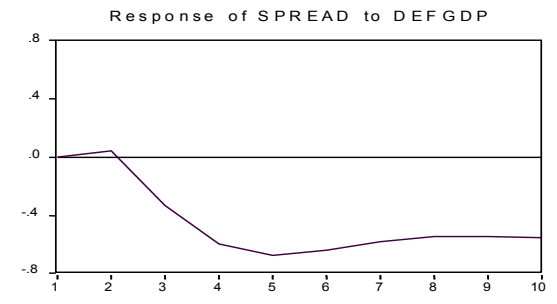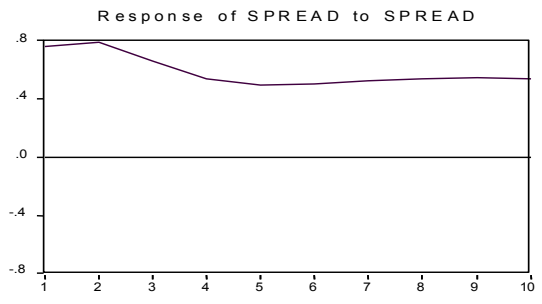
At the same time, we compute forecast error variance decomposition, which seem to reinforce the results of the impulse response functions, by determining the relative importance of each variable in generating fluctuations in other variables. According to Figure 2, the results show that SPREAD explains more than 69.37% of INVGDP fluctuations, while INVGDP doesn't seem to be important for SPREAD, after ten years ahead. Also, DEFGDP explains 42.08% of SPREAD, while SPREAD shocks explain 34.22% of DEFGDP.

Moreover, DEFGDP explains 30.05% of TOTCREGDP, while the reverse relationship is relatively weak. Also, AMGDP explains 66.03% of DEFGDP fluctuations, while there is a lower significance (20.6%), in the opposite direction.
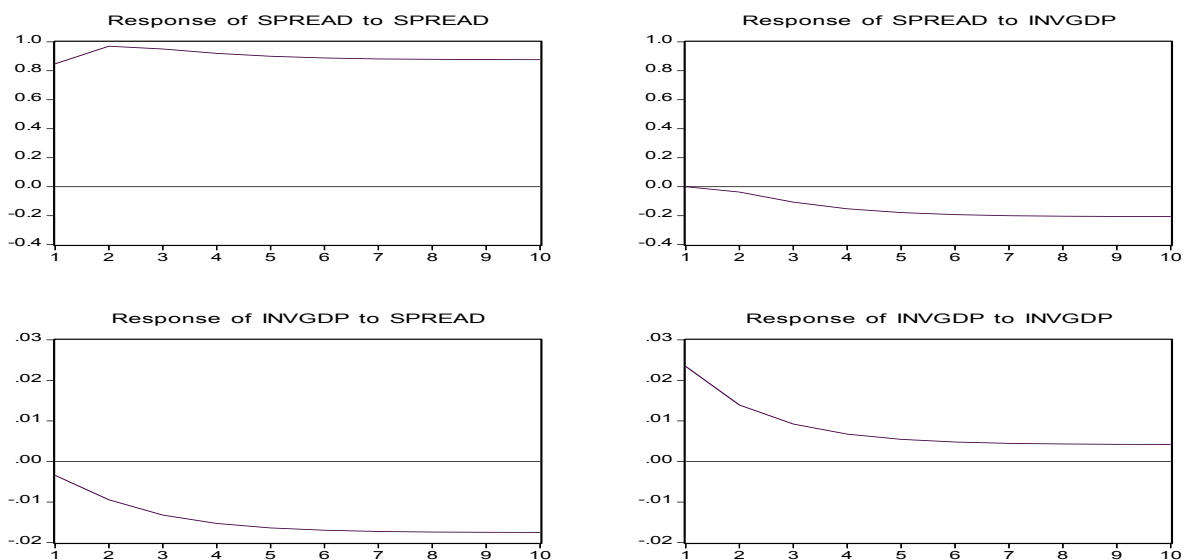
Response to Cholesky One S.D. Innovations

Response to Cholesky One S.D. Innovations

Response of SPREAD to SPREAD

Response of SPREAD to DEFGDP

Response of DEFGDP to SPREAD

Response of DEFGDP to DEFGDP

Response to Cholesky One S.D. Innovations

Response of TOTCREGDP to TOTCREGDP

Response of TOTCREGDP to DEFGDP

Response of DEFGDP to TOTCREGDP
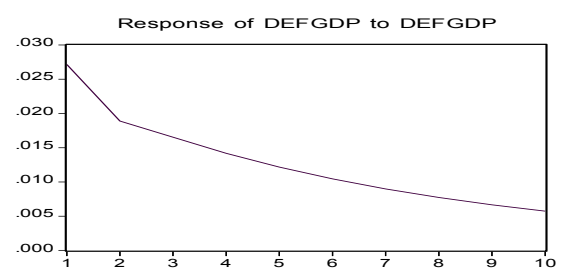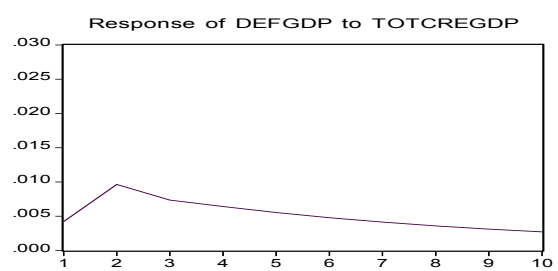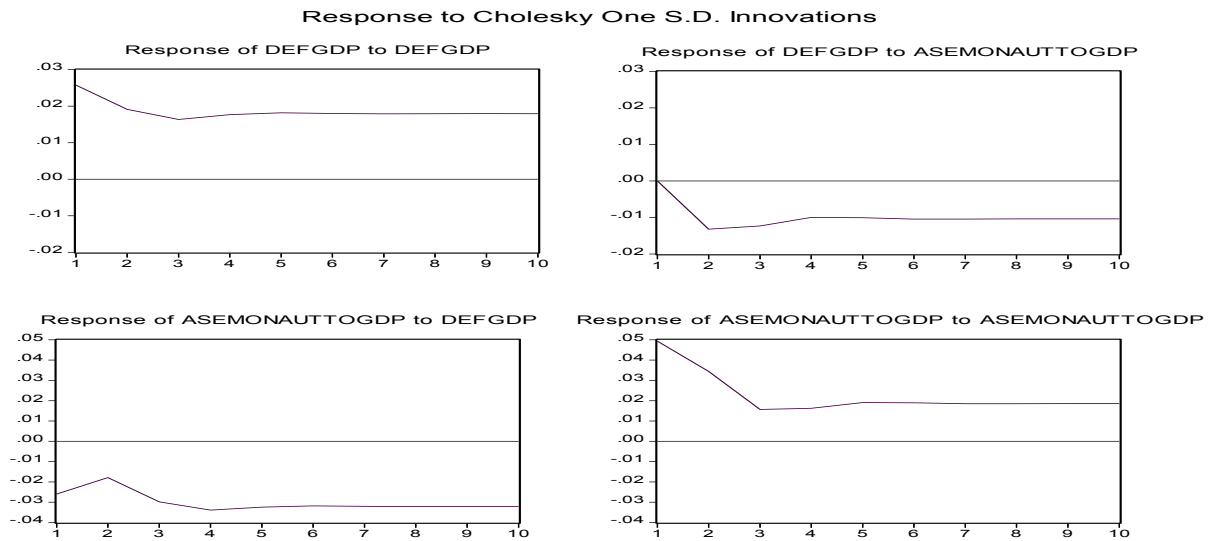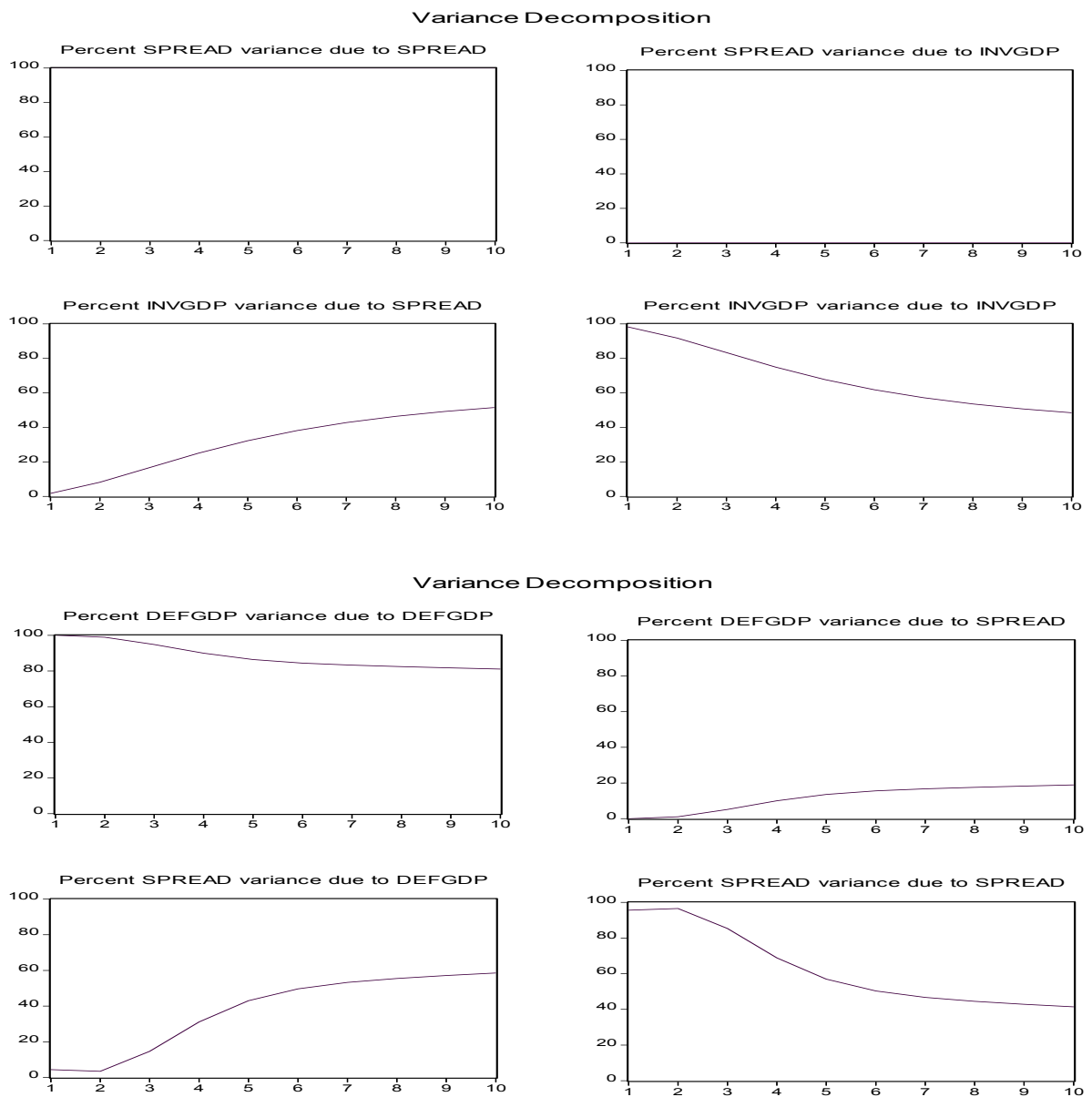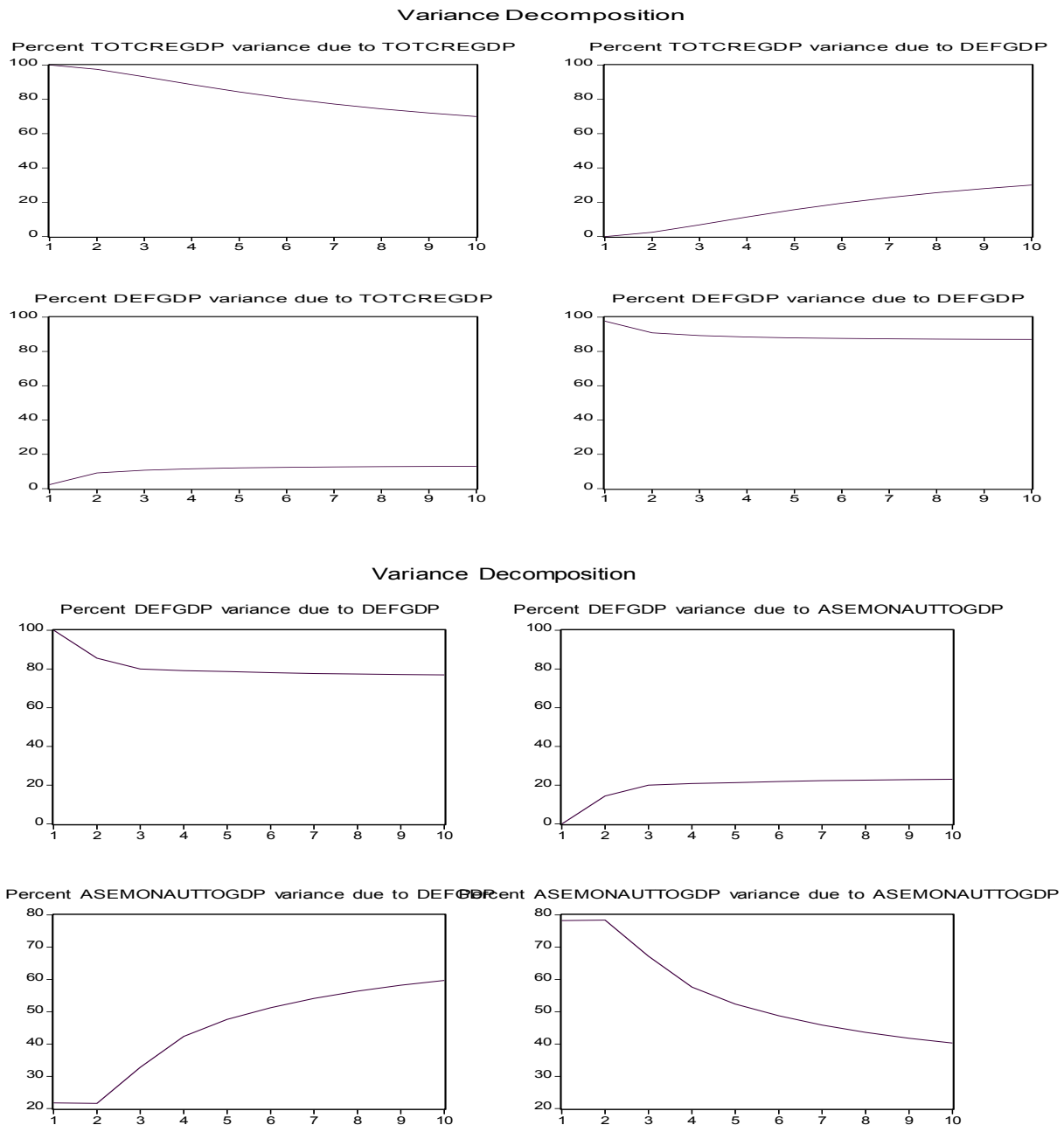
Response of DEFGDP to DEFGDP

Response to Cholesky One S.D. Innovations
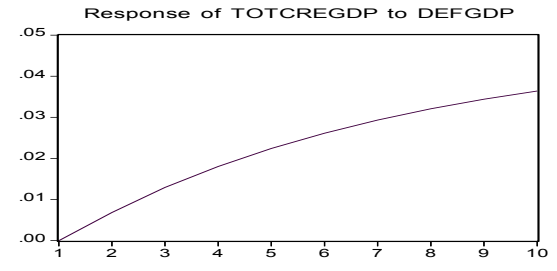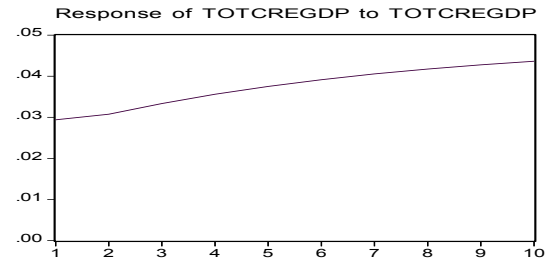
Figure 1. Impulse responses of biVARiate models

Variance Decomposition

Variance Decomposition

Variance Decomposition

Percent TOTCREGDP variance due to TOTCREGDP

Percent TOTCREGDP variance due to DEFGDP

Percent DEFGDP variance due to TOTCREGDP

Percent DEFGDP variance due to DEFGDP

Variance Decomposition

Percent DEFGDP variance due to DEFGDP

Percent DEFGDP variance due to ASEMONAUTTOGDP

Percent ASEMONAUTTOGDP variance due to DEFGDP

Percent ASEMONAUTTOGDP variance due to ASEMONAUTTOGDP

Figure 2. VARiance decomposition of biVARiate VAR models

Additionally, taking into consideration the break point of financial liberalisation in Greece, which was in the late 1980's and in order to test the stability of our results over time, we implemented the same methodology, by dividing our sample into two sub periods 1960–1987 and 1987–2005. The results indicated no cointegration relationships in the sub periods.

According to the above analysis, real sector variables tend to predict financial variables and vice versa, but cannot definitely be considered the cause of each other, as there can both respond to other changes of the economic environment. As there is a problem in the interpretation of VAR's, due to "observational equivalence" (Cochrane 1998), we use a multivariate model that also looks at the monetary sector of the economy, in an attempt to analyze the interactions between real, financial and monetary sector. The VAR model includes GDP and GFCF, as real sector indicators, DR as a

monetary indicator and TOTDEP and AMGDP as indicators of financial depth and efficiency respectively. Tables 7a, 7b and 7c present the results of the augmented VAR model formulation.

Table 7a. Results of the augmented VAR model –
Cointegrating vectors /Mag eigenvalue test and Trace test

gdp gfcf dr amgdp totdep (var lag=1)	Trace test	Max eig test
H_o: r=0	84,9796	42,6776
H_o: r≤1	42,3020	19,429
H_o: r≤2	22,8729	12,0771
H_o: r≤3	10,7958	8,3277
H_o: r≤4	2,4681	2,4681
Critical values 0,05		
H_o: r=0	69,8188	33,8769
H_o: r≤1	47,8561	27,5843
H_o: r≤2	29,7971	21,1316
H_o: r≤3	15,4947	14,2646
H_o: r≤4	3,8414	3,84146

R = number of cointegrating vectors
Lags are defined according to AIC and SC
[*]Rejection of Ho (Ho:There is no cointegration relation)

Table 7b. VEC model

Short run: F–statistic	d(gfcf)	d(gdp)	d(amgdp)	d(dr)	d(totdep)
D(gfcf(–1))	0,6594*	1,0577*	–0,0044	0,0416	–0,2765
D(gdp(–1))	–0,1247	–0,1794	0,0009	–0,0152	0,1334
D(amgdp(–1))	43,7843*	105,7071*	–0,2405	5,5314	–41,6785
D(dr(–1))	1,7169*	2,9989*	–0,0120	–0,0437	4,4327
D(totdep(–1))	0,0544	0,0049	0,0002	0,0209	0,0078
	1,6770	8,9917*	–0,0037	–0,1918	9,4375*
ECT–t statistic	–0,7762*	–1,3892*	0,0057*	0,1327*	–1,3344*

*Statistically important at a 5% level

Table 7c. Specification tests

Specification tests	
LM. Stat: 21,86	Prob. 0,64 (lag 2)
Chi.–sq: 204	Prob. 0,10

The Granger Causality tests show that GDP causes DR and TOTDEP, while TOTDEP causes DR at a 5% level of significance. According to the VEC model as well as the impulse response and variance decomposition analysis, there seems to be a long term relationship, as shown in Figures 3–4. We also note that AMGDP explains a significant degree of GDP (21.7%) and GFCF fluctuations (26.18%), which to some extent verifies the results of the bivariate models that financial liberalization promotes growth.

Figure 3. Impulse responses of the augmented VAR model

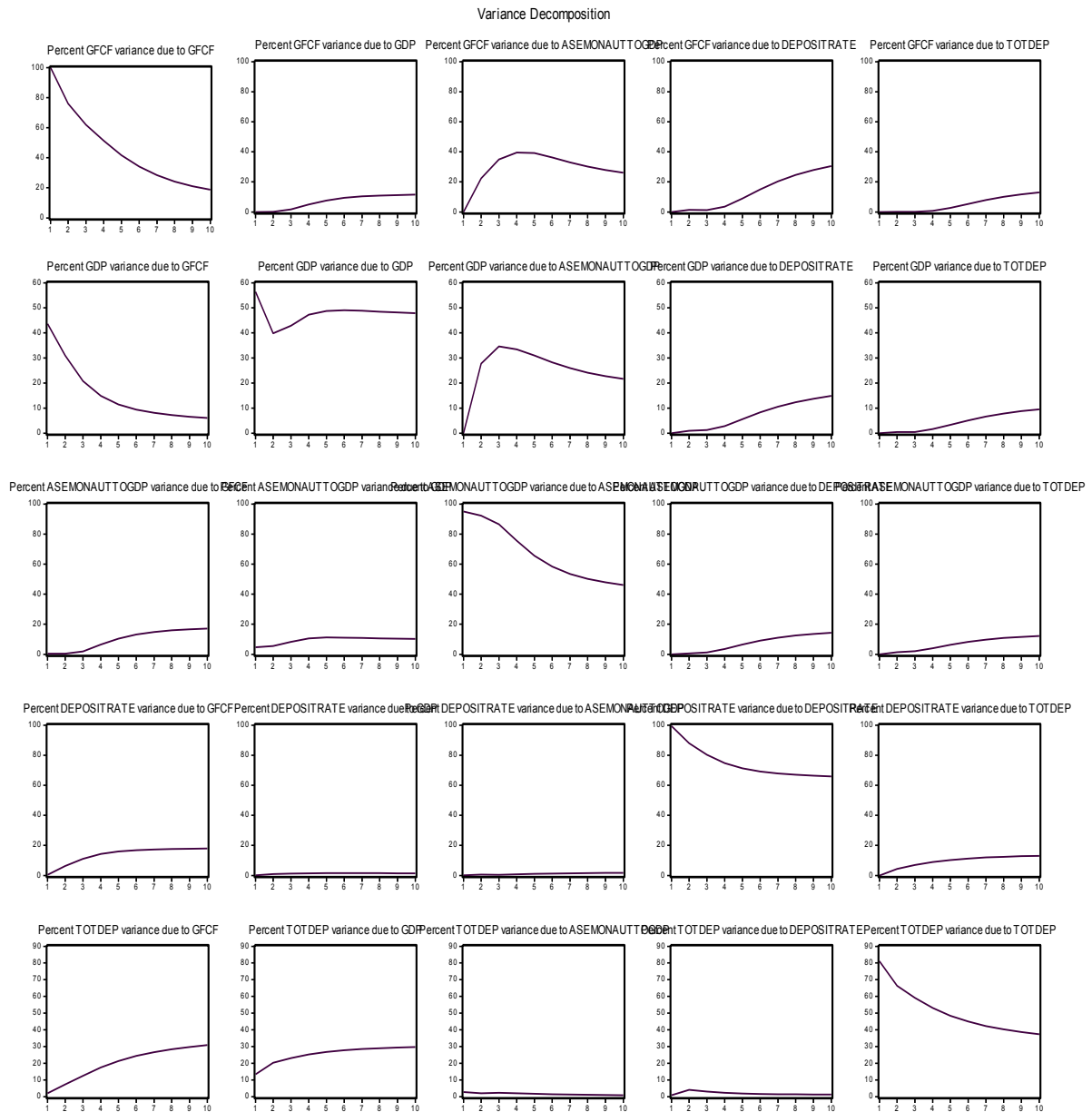Response to Cholesky One S.D. Innovations
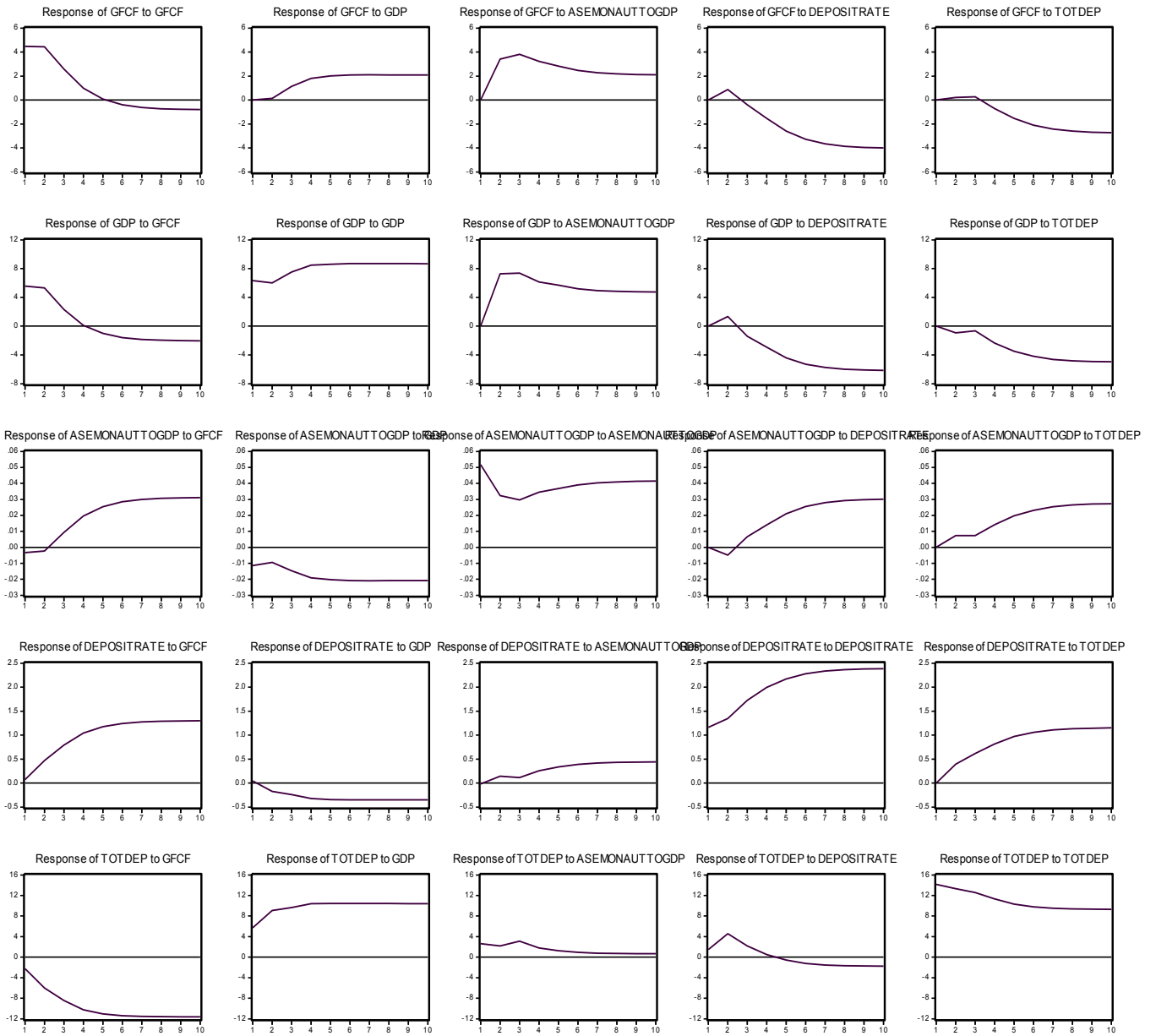
Figure 4. VARiance decomposition of the augmented VAR model

5. Concluding remarks and policy implications

From the results of our VAR analysis we see that the linkage between financial and real development is relatively weak in Greece as the only cointegration equations are between SPREAD – INVGDP, DEFGDP – SPREAD, DEFGDP – TOTCREGDP and DEFGDP – AMGDP. We also examine a multivariate VAR model, which includes monetary, financial and real variables among which we detect a cointegrating equation.

We observe that there doesn't seem to be a causal relationship leading from financial depth, but only from financial efficiency, as defined above, to the development of the real sector, through the impact of SPREAD on INVGDP and AMGDP on DEFGDP. It seems that the degree of financial liberalization expressed by the proxies SPREAD and AMGDP has a positive influence on the ratio of investments to GDP and public deficit, respectively.

On the other hand, the results indicate that real sector defines the role of finance, according to the "demand leading hypothesis" (Robinson 1952, Gupta 1984, Demetriades, and Hussein 1996). Specifically, through causality tests, impulse response functions and variance decomposition analysis,

we observe that DEFGDP is crucial for the evolution of TOTCREGDP and GDP for TOTDEP, which is in agreement with the restricted and government directed role of financial institutions.

An aggravation of public deficit creates a need for public lending, increasing deposit rates and consequently the ratio of liquid liabilities to asset banks. On the contrary, it leads to a decrease in TOTCREGDP, as lending rates are kept at high levels, in order to face inflation.

Taking into consideration the results of this econometric analysis, we conclude that the restrictions of the Greek financial system mitigated its role to the development of economy, although there is a sign of a two–way relationship between finance and growth (Thornton 1996), through efficiency measures of the financial system.

Spread, which is used as a proxy of the competitiveness of the banking system, was proved to be a stimulating factor. Consequently, it is important that Greek banks try to approach the spread of the average European banks, by improving the quality of their services, diversifying products and expanding their activities.

A promising path of research would be to use quarterly after 1987 data, in order to find out whether the liberalization of the financial system in Greece, which gradually took place after the late 80's, reinforced its role and made it capable of supporting a sustainable economic development.

For future extensions of our work, it would also be interesting to examine the relationships between financial and real sector, in economies which experienced similar macroeconomic characteristics, such as Ireland, Portugal and Spain, with the hope of finding similarities that would contribute to the implementation of relative effective policies. We may also examine the rethinking of business through reengineering that relies on the satisfaction of simple contemporary demands of quality, service, flexibility, and low cost (Stefanescu *et al*. 2007).

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GUIDELINES FOR PROMOTING SCIENCE, TECHNOLOGY AND TECHNICAL–SCIENTIFIC CREATIVITY, BY ANALYZING THE COMPANIES' PERFORMANCES, IN THE CONTEXT OF THE GLOBALIZED ECONOMY

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Abstract

On account of the way in which the technologies of the information society accelerate the scientific development, as well as the crucial importance of science for the development of the knowledge–based society, this article aims at enlarging upon the importance of science for the economic and social development. It is strong evidence the fact that the technical–scientific progress represents a priority for each country and for humankind, in general, as their future depends essentially on solving some fundamental problems, such as, creating new sources of energy, exploiting the huge resources of seas and oceans, the systematic modernization of techniques and technologies used, the protection of the population's health, the protection of the environment etc. Under these circumstances, it is necessary to study and know the guidelines for promoting science, technology and contemporary technical progress, as the first steps towards their engenderment, assimilation and embedment in the economic–social practice.

Keywords: globalization, new economy, technical–scientific progress, economic performance

JEL Classification: F00, O14, O30, M15, L25

1. Introduction

Globalization emerges as a factor that mustn't be ignored at all, growing more and more into a major phenomenon, posing new challenges and setting new performance standards for all actors in the economic field. Managers must reevaluate the companies' action skill both on the domestic market as well as on the external markets – marked by profound changes in the structure of competition, business partners, standards and norms regarding products, services, and consumer behavior.

An important topic of my paper is the development of science and technology of information and communication. This offers a great potential to create new goods and services, innovation being faster and faster. Managers should permanently think about the most ingenious way of creating and exploiting the assets of knowledge in order to provide competitive advantages, to develop productivity, and to be highly competitive.

Therefore, it is necessary that companies should be more flexible and more innovative, administrating the assets of knowledge in an effective way for having new sources of competitive advantages. Companies should cooperate more, and form networks, especially based on new technologies, and to strengthen their links with scientific and engineering base, sharing equipments and often people.

Hence, it should be given priority both to the processes generating new knowledge, as well as to the technical–scientific research. The general resultant of learning must be the irrefutable evidence of efficiency, in general, and of the economic one, in particular. Moreover, the problem of the adequate co–measurement of economic processes, including efficiency itself, arises, in order to gain more relevance and fidelity to those phenomena.

2. The importance of science and technology in the context of globalization

The companies had to cope with an unprecedented technological advance, characterized especially by the miniaturization of electronic equipment or the spread of wireless communication. All these changes are based on technology. In response to this, all companies and organizations are in need of technology, and in most cases, they are in need of that particular technology that they lack. We can say that the new global order is characterized by change. Those capable of adapting to this kind of world will be successful and will accept the rapid and continuous change, determined by technology.

The problem that arises is the lack of necessary time to acquire expertise in all technological fields necessary for a business. The pace of change doesn't allow a single company to afford the luxury of developing expertise in the needed technological diversity within its area of activity. It is difficult to believe that this would be possible even if the matter of time were not raised.

We already speak of the era of intellectual property and of a new existential model characterized more by a vital need for the creativity of the others than independence. The technologic management is focused already on the use of the existent technology to obtain the access to a new technology that is desired and necessary for the development of the company. The cooperation in the field of technology seems to be the key to success in the future. If in the past, technologies used to be commercialized by their developer, companies would get involved into research and orient towards promising discoveries, and the additional effort to obtain a new product or service was capitalized on, directly on the market by the person who made that effort, at present everything has changed (Audretsch, and Bozeman 2007). We witness situations in which small research companies are a source of innovation for big companies. Although the results of this new form of collaboration demonstrate the viability of the current tendency, a new challenge arises, concerning the way in which economic benefits resulted from the different contributions of those involved in collaboration are distributed.

The observations on the importance of the activities of development underline an additional characteristic of the increase in the technological knowledge, and that is, the special attention for the improvement and modification of already existent knowledge about the emergence of new creations. Although a clear–cut distinction between the two components is hard to realize, there is an obvious preference for the renewal of the already existent products to the detriment of some completely new. The present activities are strongly linked with the past technological knowledge, and internal pressures thus created play an important role in molding everyday knowledge. The development activities are focused on improvements, small retouches, which in individual terms may be insignificant, but in cumulative terms they add a substantial value. The discovery of an important innovation opens up a period that is beneficial for small improvements or creations that are focused on that major discovery (for instance the invention of the electric generator or the transistor). Every major invention represents the dawn of a series of activities dependent on course, over a few decades, whose subsequent developments cannot be understood but as a part of a historical process.

In general, we can observe certain logic in the sequence of some technological developments, a so–called determinism, in which a historical event doesn't strictly impose certain technological changes, but facilitates a sequence of technological improvements in a certain direction. Technological knowledge is cumulative by its nature (Rosenberg 1994), because major innovations represent, selectively, not randomly, the basis for future technologies. The capacity to generate and transmit electric current did not determine inevitably the creation of the transistor, but unquestionably, its concept would have been almost impossible without further developments of the capacity to generate electrical current. In this way, the technological research is conducted at present, through the past, as the technological legacy has a strong influence on the present and the future technological possibilities. The technological progress in any period is largely due to the expansion and exploitation of the ways of increasing the technological knowledge.

Way–dependence is an important concept for the complimentary sectors or on the border between science and technology.

Although we are tempted to recognize a direct dependence between scientific knowledge and the progress achieved in the technological field, in reality, the relation between technology and science is much more interactive than an imposed technological determinism. A decision to improve a certain class of instruments will reflect many times the determination to progress in a specific field of science, but also the prediction that the relevance of these instruments is decisive for the subsequent technological improvements.

The improvements in the observational skills were limited in terms of significance until concepts were developed and hypotheses formulated. Because the new scientific technology opens up new ways to follow, it creates at the same time discontinuities which are not influenced by the inheritance from the past. From this point of view, the scientific research doesn't fit the bill with respect to the way–dependence phenomenon generated by technology, which is true only partially, because the possibility of important discoveries doesn't eliminate the impact of way–dependent forces, or of the influence of technological legacy on the future economic performances.

The ability to explore the new scientific knowledge in an economic framework depends directly on the existent technological capacities in that economy, while the discovery of new products, their structuring into new forms, the testing of prototypes, their modification, the identification of new production technologies allowing the reduction of costs are constitutive parts of development (Chesbrough 2003). The most important lesson of the last decades has been the skill in exploiting, the new scientific knowledge for commercial reasons, regarding the social capacity, which involves extra skills in organization, management, and marketing than only technological ones. The technological capacities, due to the scientific advance dominate the commercial exploitation of new technologies. For this reason the economic and technological considerations are closely involved in the transformation of the new scientific discoveries into tangible benefits for the wide public. There have been situations when the understanding capacity of the new scientific knowledge was so small and its economic exploitation very improbable that it was necessary to build a new science or discipline to make it accessible (for instance chemical engineering).We can draw the conclusion that there are limits, very well defined, of the extent to which the scientific knowledge can "free" the economic performances of an economy from the inherited technological capacities, which have brought it to the present level.

The scientific research has become more and more dependent on the course of technological change. And this fact would have not been possible without the most important institutional innovation of the 20th century, and that is, the emergence of an impressive number of laboratories of industrial research, whose aim is to increase the efficiency of technologies that large companies depend on. The more these laboratories develop, not only do they use scientific knowledge for industrial reasons, but they generate also most of this knowledge (Godin 2004). Giving the Nobel Prize to some researchers who work in the laboratories of private companies proves the quality of the scientific research work done within the industrial field.

The technological changes and the scientific knowledge are sensitive to the economic variables if the finance for R&D activities is allocated in line with a predetermined and well established economic reason. Nevertheless, the uncertainty about the desired result following an R&D activity is an argument against an economic determinism. Even if, generally speaking, technological changes are determined by economic forces, the relation between the economic incentives and the quality of technological changes is not a simple one.

3. The implications of developing a strategy for the scientific knowledge of the companies' economic performances

Knowledge management has become, over the last years, an extremely interesting topic for those dealing with business strategies, offering the possibility for competitive advantages and long–term substantial increase in efficiency. Developing a knowledge strategy in accordance with the economic realities allows companies not only to survive but also their future development. Strategic alliances determined by knowledge, influenced by the characteristics of markets and companies, of the knowledge which represents the object of alliance, and last but not least of the contractual arrangements, are more and more prominent in the world economy.

The economic theory has evolved in time, as the specialists started to establish clearly those premises of the analyses concerning economic growth, which identify and explain innovation as the driving force of long–term economic development. The modern economic analysis admits the fact that the information on new production possibilities is not free or easy to access, and the direction of technological changes is not an exogenous factor of economic activity seen as a whole. Technology and science are accepted today as central elements of economic growth. The owners of intellectual creation have become aware of the power they have in their hands, by controlling and manipulating the inexhaustible creativity of the human mind (Grant 2002).

Knowledge management is a current topic, as the managers' challenge refers to the possibility to manage knowledge like any other available resource within a company. This recognition of knowledge as a company's resource has aroused a lively interest over the last years, as the evolution of the knowledge–based economy accentuates the importance of the process of knowledge creation within the companies.

The analytical processing of information by the company was carried not until quite recently in a passive and static manner of appreciation of its activity, totally inadequate for our times. The

knowledge management approach leads to the optimization of creation, the collaboration between knowledge creators and the balance of the knowledge assets market (Stefanescu 2008).

Knowledge management must focus on the cooperation instruments of the knowledge exchange program, on team work and knowledge portals, so that it can organize efficiently a great volume of information, filtrate the essential content and get access to corporative knowledge.

As the social interaction becomes the starting point for the emergence of new concepts, more and more questions are raised on the validity of traditional ideas of creation. The knowledge can be managed as long as the companies' leaders accept, understand and follow the dynamism of the knowledge process. The success of the knowledge creation depends on the principles assumed by the management regarding responsibility, justification, financial support and achievement. Because of the extension of the knowledge management concept and of the inclusion of more and more aspects within this new type of management, it is difficult to appreciate exactly its benefits within a company. The consultants specialized in this direction reuse the methodologies of the project management in which they include paths specific to knowledge – an insufficient method though – because the knowledge management needs specific competences.

The knowledge strategy harmonized with the organizational culture form together the business strategy. The latter defines the future of a company by using efficiently the accumulated knowledge. There many situations that require such a strategy. Many times though, different organizations elaborate a knowledge strategy only when they have to overcome the uncertainty of a market on which they carry out their activity, the increasing complexity of some products, the changes in technology or the market's competitors etc.

For the companies forced to innovate, diversify their products families or change the life cycle of products, the knowledge strategy leads to the efficient coordination of decisions and changes. Knowledge is no longer an attribute of the sectors which use top–notch technology and even for traditional companies it has become the essential element of *competition* but at the same time of *cooperation*. The true knowledge exchange has to start within the organization with systems reflecting the organizational needs.

In general, a business strategy aims at:
- *increasing the market share,* which will determine the need to innovate the offered products;
- *operational efficiency,* which will lead to the common use of knowledge within an organization and the conceptualization and implementation of a knowledge management, in order to use knowledge in a balanced way and to avoid the costs implied by the double invention of the same thing;
- *getting to know better the customers*, which will trigger both changes within the organization and innovations.

Usually, the knowledge strategy follows the business strategy while technology follows both. The technological investments can be planned as a part of the strategy, but there are certain processes concerning the changes within the culture and practices of the company.

If inside a company the knowledge strategy leads to the development of knowledge resources in order to support the business strategy, the *knowledge management* refers to both the focus on the differences between the current situation and future needs, as well as, the improvement of the process at local level and not at the organizational level (Jones 2004).

Organizational culture represents the result of a process in which the individual knowledge is transferred, extended and distributed upwards at all organizational levels. If we regard a company as a collection of interconnected resources, than the development of an adequate technology of information will lead to the increase in the interactions between these resources and the creation of a new technology. The possibility to generate both new knowledge and informational resources will influence the structure adopted by the company to cope with the uncertainty of the business environment and to generate innovation.

The phenomena noticed in the companies' behavior, both in the economic environment as well as in the social one, can be explained if we take into consideration their limited abilities to understand completely the causes and effects of their actions. The companies will have to pay special attention to the changes in the processing capacity of information of the economic actors. The economic literature concerning the behavior and performances of companies starts from the premise that any company is first of all, an information processing system (Galbraith 1977). It is clear the fact that an advanced

information technology influences decisively the company's resources and the structure that the company adopts to facilitate a continuous process of innovation. A company's capacity to process data and make decisions is supported directly by an advanced information technology.

The unprecedented development of technology and especially of transportability of information (Sampler 1998) makes possible the combination of resources within the same company or different companies, without taking into account the organizational or national barriers.

Research conducted in the field of company strategy underline the fact that possessing new technologies is an important factor so that a company can be successful. Nevertheless, not all companies can create technology within the limits imposed by their existential universe (Teece 1982) and, moreover, even those who succeed in creating knowledge under certain circumstances, appeal many time to the knowledge generated outside their organization. These external sources help the companies to get access to new technologies, which are valuable because of their performances and which are not accessible within the organizational framework of a company. The problem which arises here is that regarding the experience of a company in the commercialization of external new technologies.

The attempts to measure the effort of a company when acquiring outside knowledge take into consideration the following:

▪ *dependent variables,* such as the commercialization of an innovation by obtaining a first sale of the product or service resulted from that innovation;

▪ *independent variables,* such as the endogenous factors of the new technology;

▪ *control variables,* such as the technical field in which that innovation can be applied, the year when the patent was obtained, the number of licenses, the company's previous experience in obtaining licenses or in licensing in its turn, and last but not least, the creation of the company in order to exploit that particular innovation (Nerkar, and Shane 2002).

There are two primary sources for the process of commercializing new technologies, the first one – internal – and the second one – external (Hippel 1988). A first explanation for the initiation of a company into the commercialization of technology, from external sources, resides in the role of both the environment and the community in which it acts. The capacity of a company to trade new technologies, more exactly those skills which allow this company to repeat successfully such an action represents another decisive factor of the technology trade process. This explanation is fostered by the companies' efforts to support an innovative product, by the studies that demonstrate the importance of a company's skills in getting the innovation successful.

There have been several attempts to identify those specific or endogenous characteristics of a new technology which, independently of the environment or a company's competences, influence its way of transmission to other users: the codification degree of a technology, the affiliation degree to a system, the distinction between the private and public character of an intellectual creation etc. Most of the studies and analyses have in view four of these characteristics: *aim, novelty, exclusivity and age of a new technology* – characteristics which, in fact, derive from the general definition accepted for an invention.

Acquiring general technology is essential for making experiments and for the correction of errors when developing a new product, and at the same time, for the multiplication of successful applications which derive from the same basic technological information (in this respect we can give as representative examples the pharmaceutical industry and the computer industry). The general objective of the patented technology offers an additional reason for the protection of the newly formed intellectual property, and implicitly this fact gives a stimulus to the commercialization of such a product. When all other influence factors remain unchanged, the more the goal of a new technology is more general, the more its commercialization is stimulated. This factor can be quantified by the number of patents referring to this innovation.

The high degree of novelty carried by an invention stimulates its commercialization because "pioneering" technologies offer substantial competitive advantages in certain fields, despite the high degree of stolen knowledge, both in the academic field and industrial field.

On the other hand the income from innovation is much higher when we talk about inventions that are really new and which stimulate the company to make great efforts in its attempts to exploit it at maximum capacity. Inventions with a high degree of novelty offer the possibility of a more effective protection of intellectual property rights, as they have lesser connections with information

already protected by the law. The novelty degree of a technology is directly proportional with the efforts made by a company for its commercialization and can be quantified by the number of patents, already existent, to which the new innovation makes reference. The commercialization of an innovative technology creates advantages both for the company offering it, as well as, for the form buying it outside its own organizational borders. That is why, the protection system of intellectual property and copyright plays an important role in its commercialization.

On the other hand, if the source innovation is available also for other companies or it belongs totally or partially to the public domain, it can engender real sources of knowledge with a negative effect on commercialization, by increasing the competition between companies, cutting down their profit, creating uncertainty with respect to the position on the market or imposing restrictions on the entry into a market. But we cannot overlook the positive effect, created by such a situation, for the society in general. The higher the *exclusivity* of the source innovation the more the company is stimulated to trade it. The quantification of this characteristic regards the existence of the exclusivity clause in the patent license contract concerning the invention/innovation.

The more technologies reach maturity, the more the performances of the company possessing them, are reduced. In the initial phase, the new technologies require a lot of work to be developed to the extent to which they can be traded. Moreover, the high degree of uncertainty in this phase determines the potential customer companies to be cautious. Only in time a technology can be developed and improved so that it can reach a maximum level of the performances that it can offer. The more a technology resists in time, the more the possibility to discover new solutions of substitution is higher. Under certain circumstances, a technology can be capitalized on if it is purchased by a group of renowned companies on a market that can turn it around because of their fame. At the same time, the protection of intellectual property rights is ensured for a limited period of time and constraints companies to maximize their profits within that interval of time. The relation between the trading and age of an innovation can be quantified by the period of time necessary for patenting a new technology.

Adopting successful methods or practices allows companies to advance rapidly. Large companies use the technological transfer to save their own knowledge basis, by using it for different reasons, obtain a competitive advantage or offer a certain status to their affiliates. A company's skill in creating new knowledge elements is directly influenced by the company's portfolio of strategic alliances. For many companies, the strategic alliances have become an important form of organization in order to obtain a competitive advantage in their field of activity or in order to explore new opportunities in other areas of interest. The strategic alliances offer companies an *adequate* access to vital resources, an *optimum* control over opportunities, more *flexibility* and more powerful *stimuli.*

The motivations that reside in the companies' decisions to enter this kind of partnerships are various and regard the penetration of new markets, the launch of a counterattack against competitors, the sharing of risks associated with high investments, the common use of global resources, and last but not least, both the sharing of costs and risks of the R&D activity, as well as, the assimilation of the lessons learned from the partners (Best 2003).

4. The evolution of the research, development and innovation field in Romania

The successful on economy based on knowledge, on long term, needs innovation and creativity, qualities which are especially promoted by the *high education* system, than the medium one, which more develops basic skills.

An analysis of actual situation of Romania can say a lot about the chance which our country has in new global economic landscape. The studies shows that in Romania, poverty still has a big percentage, owning to some factors as inequality of incomes' distribution or different level of education. This situation is trying to be mended through measures and economic developing strategies in education, health, social assistance, legislation, and on labor market. The situation which results from hi–education dedicated to ITC is a favorable one, the image which Romanian specialists have aboard being a favorable one, according to their preparedness. The problem is that a great part of these specialists leaves the country, emigrating in developed countries, where they have the perspective of a better salary than the one received in the country. It can be observed the fact that young generation is more flexibly and more interested by using the ITC technology than the adult generations, who still have a limited perception concerning to domain's advantages and risks.

Another major problem is the high cost of hi–technology, which determinates restriction to the access to these technologies only for persons with relatively good material situation. With all high costs, the ITC has a bigger and bigger level of penetrating Romanian market. The PC, the internet, mobile and immobile telephony, but also cable TV, they all start to become very known in Romania. Although, the absorption power of these technologies is still low, comparatively with other countries from Northern America or Occidental Europe, concerning of high costs.

Through practiced policies, in Romania, now is tried to sustain this domain through a series of measures destined to encourage informational society development. It is also given priority to ensuring quality to education and professional qualification, including special actions for fitting out schools with ITC equipments, and growing the level of connection to internet.

Setting up this economy mainly starts with *changing human outlook*, of their way of thinking. There isn't an obvious solution for implementing this way of thinking in a country, company or other kind of organization, but the Government has a huge responsibility in adopting reforms in education, in encouraging entrepreneurial spirit and creativity, and risks linked to this challenge, but also in creating institutional and legal frame good for developing informational society.

The next step in developing economy based on knowledge in Romania is *setting up the ITC infrastructure*. Romania, which wants to promote an economy based on knowledge, also has to give priority to infrastructure's development. The bottoming owed to telecommunications infrastructure is a national problem and that's why developing of these services is very important.

In this new economy it can be observed a change of companies' organization: passing from a vertical hierarchic structure to one more plane, horizontal, which puts the accent on team work, involving a bigger recognition of thinking autonomy and knowledge.

Technological parks represent an important component of informational infrastructure. Studies to regional development had proved that areas with informational technology contribute to general economic wellbeing through distributing economic benefits. Once made, those technological parks will attract external investments for software projects, which will help Romania to become more competitively on international market.

Software industry in Romania is one of the domains which can have a shinny future and a decisive role in economic develop of our country.

Another measure which must be taken for developing the ITC sector is *ensuring the legal framework* and asked settlements of using ITC and developing informational society. Of an major importance informational infrastructure success is ensuring the right of intellectual propriety, a measure which can takes to reducing the software piracy.

Promoting Romanian *ITC produces* and services aboard and *investments and* external partnerships *encourage* is a priority, looking to new economy's implementation.

While Romania advances in developing this new economy, it is obvious the fact that it is absolutely necessarily *a qualified labor,* able to use in optimal way the new technologies, and *flexible,* able to adapt slowly to new situations. For this, trainings in informatics domain had become very often in companies. Because in this economic medium, being in permanent change, the accent is put on applicable ideas and innovation, and only the firms which will have the capacity of adapting to new concepts and technologies will survive in informational society. So, it is required a briefing of managers and employees, an application of some successful economic practices, of some policies for encouraging the economic activity and transforming in private firms the companies owned by state which can't resist on market.

These are just a few of measures which must be taken in Romania, for following this way, of economy based on knowledge. The reality in our country indicates that new economy's characteristics designed in the last few years, represent an important step to informational society. New Economy changes Romanian economy in an important way, because Romania is involved in global and European effort of developing Informational Society, national priorities in this domain being harmonized with strategically targets defined in e–Europe, and with settlements of UNCTAD and WTO.

The evolution of the research, development and innovation field in Romania is influenced by a series of important changes, especially because of the context generated by the integration into the European Union.

By the Declaration of the Presidency of the European Council, Lisbon, 2000, the European Union aims at developing in the space of a decade, the most competitive knowledge–based economy. This declaration contains also a measure plan providing the guidelines for the main directions of action.

We want to mention here three of them: *information society, education and research*.

No doubt Romania, as a new member of the EU, cannot ignore these evolutions. On the contrary, her only chance to reduce the economic gaps is by orienting herself fast towards the newest evolutions at world level, in general, and European level, in particular.

According to the responsibilities assumed through the Governmental Document regarding the negotiation on the EU policy (Chapter 17 – *Science and Research*, regarding the consolidation of the Romanian system of research and development), Romania will proceed to increase gradually the funds allocated for research in order to be in line with the latest orientations of the EU policy on research and development.

This alignment with the EU strategy must underline the specific constraints with respect to this sector, such as:

▪ the low commitment to the development of advanced technologies and to efforts of durable technological development, in almost every economic sectors;

▪ the low interest and the enterprises' poor involvement in the research, development and innovation activities, including the cooperation with both the R&D institutions and the absorption of results from research;

▪ the old technological infrastructure for research and development and still a poor connection between research and industry;

▪ the infrastructure and services for the transfer of technology and innovation still insufficiently developed and having a low viability;

▪ the enterprises' reduced capacity of absorption of results from research and development;

▪ the insufficient development and disparities in the activities and infrastructures for research, development and innovation at regional level;

▪ the still low capacity for collaboration and integration at national, European and world level in science and technique.

Nevertheless, form the customers' perspective, the accent should be more on exporters, the consolidation of capacity and increase in the number of participations of the public and private sectors in research, development and innovation programs. The fact is that enterprises carry out not enough research to improve their products. It is necessary to create associated facilities, in order to build "excellence centers" and to lead to sectoral clusters.

With respect to the vision on the role of science in our country, in the context of the information society, there are three key problems and they must be dealt with, correlatively:

▪ **capitalizing on the economic research**. The technological transfer is still a difficult problem for the Romanian research. It is not only a matter of legislation or organizational structures. We have to ask ourselves: what kind of technologies and products are we to transfer and to whom? In the world, the technology transfer is supported by the state, in the field of high technologies, or for the benefit of innovative enterprises. In Romania, we are far from this scenario.

▪ **integrating effectively the Romanian research into the EU research**. The integration is difficult for many reasons. We are mentioning only a few: **a.** scarcity of human resources and difficulty in luring young people into a scientific career; **b.** the delay of the institutional restructuration; **c.** poor financing of research which has led among other things to the lack of an appropriate material basis for research; **d.** difficulties associated with travelling abroad; **e.** absence of an attractive economic environment, capable of asking for research and (co)–financing it; **f.** country's unfavorable general image;

▪ keeping on and developing human resources. As we have already shown, there are enough reasons that explain why a scientific career is not alluring anymore. The exodus of skills has risen out of proportion and we don't know yet clearly how it can be slowed down.

The vision on this triad is the following: **a.** the difficulties that we have mentioned are at the same time also the chances of the Romanian research; **b.** they must be dealt with simultaneously and concertedly; **c.** the solution for a problem can offer resources for the solving of another.

The Romanian infrastructure for innovation and technological transfer must be build fast at institutional level. The key objectives of this process are the following:

▪ partnerships between the business environment and research organizations, and the stimulus to activities within technological parks;

▪ companies' stimulus to research and development, as well as, meeting their requests for research and development, especially *high tech* ones;

▪ increasing the number of innovative exporting companies;

▪ stimulating research and development within the already existent regional centers of innovation and technology and supporting the opening of other centers.

A major objective is also overcoming technological gaps such as: a fast development of advanced technologies in all economic sectors and an implementation of directions of durable technological development at sectoral level, by adopting the following measures: a direct support for enterprises for the purchase, transfer and adjustment to advanced technologies; a direct support for enterprises for technical services necessary for the early phases of investments: finding appropriate technical solutions, planning necessary technological adjustments/changes; supporting the implementation of high–performance IT technologies on a large scale in all economic sectors: developing integrated environments for efficient economic operations and transactions, at sectoral, regional and national level.

Another objective is the increase in the enterprises' capacity to cope with both the technological evolution and competition at European an international level, hence: support for campaigns for promoting innovative culture; direct support for enterprises for the introduction and implementation of good managerial practices for the activities of technological and innovation development; support for the implementation of the company's own policies and strategic planning with respect to the processes of long–term technological development and innovation, depending on the tendencies and evolution of the market and competitors; support for the implementation of the enterprises' own programs and projects with respect to the technological development and innovation; support for the creation and development of innovative companies, especially in *high–tech* fields, by assuring an adequate legislative framework that includes fiscal and financial provisions, by developing appropriate infrastructures and by stimulating public and private investments within innovative companies.

A last objective is represented by high added–value exports: developing research, development and innovation activities within enterprises, especially in *high–tech* fields, by: encouraging enterprises to have a higher frequency of participation in the publicly financed programs of research, development and innovation; direct support for enterprises with respect to the development of *in–house* research capacities, such as: hiring trained personnel, creating research and development departments, developing specialized laboratories; support for the creation and development of clusters/technological networks, including enterprises, research and development institutions and similar technological universities, especially at regional level.

The essential effort must be oriented towards the training of human resources and the aim to lure them into not leaving the country, by offering specialists, attractive wages and working conditions, meant to convince other specialists working abroad to return back home.

Research must be oriented especially towards the directions of international partnership in general, and of cooperation with the EU in particular, that is, directions of high–tech research. A local system of innovation and technological support must be created in order to allow the access to the centers of technological services within the EU, as well as, to the domestic specialists.

Our country must understand both the demands imposed by technologies and the demands of less–developed countries and by having the technical–organizational capacity necessary for the transfers of technologies, can win a favored position with respect to the transfer of technology to developing countries.

The strategies for the transfer of technology in our country to developing countries must aim at the following goals: promoting the transfer of technologies for a wider range of products, including advanced technologies and their adjustment to the developing countries' demands; assuring the volume of necessary technical assistance on the basis of the contract provisions, in accordance with the partner's necessities and promoting the cooperation with respect to the training of personnel, including the participation in the R&D activity; providing professional advice on the organization of transfers of vertical and horizontal technologies.

At the same time the adopted strategies must take into account the national policies adopted by each partner in the field of technologies and implicitly in the field of international transfers of technology, as well as, be in line with the goals pursued and the stage of their accomplishment. These objectives can aim at creating the basic conditions for the integration of important technologies into the process of economic development as well as creating a potential of scientific research and technological development, capable of assuring the formulation of an efficient export policy, including in the field of technologies, and achieving an equilibrated technological balance.

5. Conclusion

Because of both the unprecedented explosion of the technical–scientific revolution and increase in the economic interdependencies between states, the international transfer of technology is growing more and more important, giving birth to a real international flow of technology within the world economic circuit, which determines the creation of an international market for technology.

The durable economic development has always been determined by innovation and transfer of technology. In order to be successful, the technological transfer must aim at the market's satisfaction need in terms of products, technologies and new or modernized services. The technological innovation implies especially capitalizing on the technical creation, which is an integrative part of the general process of innovation. It refers to the technical, financial, production and market activities, involved in: the introduction into the trade circuit of a product, technology or service; the initial use of a production process or equipment; opening of a new market; identification of a new source of raw materials; reorganization of an economic field both at microeconomic and macroeconomic level.

Network economies increase productivity, which leads to the improvement of the potential result of the economy. Increased productivity can also lead to a short–term shortage of working places, if the capital and product markets don't function efficiently and don't create new activities that can transform the potential result into a real growth. Under these circumstances we need dynamic capital markets to support new companies and a labor market that can offer qualified and flexible personnel. The electronic information and the knowledge transmitted via computer networks have become the central elements, around which the society is organized, and this will be the final result in the new arrangement, with new rules, new organization methods and new ways of thinking for governments and all sectors of the economy.

In brief, we can state that the productive system is no longer eclipsed by the economic model of standards, and subsequently it enters the world of the specific, dominated by the logic of coproduction (customer/consumer integration into the process of conception and production). The degree of both interactivity and integration of the knowledge process that is based on the cognitive interactivity within the production process is also important. The innovation is the most effective method of development of high skills and high added value high–tech products.

The Romanian economy demands as a vital condition the stabilization of the macroeconomic framework, so that all relevant aspects necessary for the restructuring and modernization of the Romanian society can be approached in an integrative manner. Under these circumstances, the only vital way to assure the economic development and to create premises for the increase in the competitiveness of the national industry is by adopting the innovation–based model of development, in which the central element must be the domestic system of science and technology.

The possibility to benefit from the science's and technique's conquests represents a condition for the multilateral progress of each country, the capitalization on resources to our mutual benefit, as well as, for efficient and mutually advantageous international economic changes. The most important way to achieve this objective is to allow a large modern transfer of technology, assure the technical assistance in all development fields, as well as, promote and stimulate scientific research.

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MANAGEMENT OF STOCK PRICE AND ITS EFFECT ON ECONOMIC GROWTH: CASE STUDY OF WEST AFRICAN FINANCIAL MARKETS

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Abstract

This paper investigates the statistical properties of stock returns in the West African regional stock market and the link between the West African regional stock market and economic growth. To examine the nature of the distribution of West African regional stock returns, the daily closing prices of the two stock index of West African regional stock market, and eighteen of it sub–indices were utilized. Nine years data from 1998 to 2007 interval were employed. The analysis of our study shows that the distribution of the West African regional stock market returns is non–normal and non–i.i.d (independent, identically and normally distributed). The linear and non–linear dependencies in the returns appeared to be the main reasons for the data being non–i.i.d. The study also demonstrates the presence of the day–of–the–week effect in West African regional stock market.

Keywords: West Africa regional stock markets, day of the week effects, economic growth

JEL Classification: C52, E44, G15, N27, R11

1. Introduction

The rapid growth of capital markets in emerging market economies has come as a major event in recent financial history. According to the International Finance Corporation (IFC), portfolio flows to emerging countries has kept rising since the early 1980s and the trend has continued even after a number of financial crises (IFC 2000). The stock markets in these countries have also grown considerably in size. The aggregate market capitalization of the countries classified by the IFC as emerging markets rose from US$488 billion in 1988 to US$3073 billion in 1999. Trading on these markets also rose in similar magnitude, growing from US$411 billion to US$2873 billion in that period (IFC 2000).There is indeed a growing body of research which points towards capital market development and financial deepening in general and stock markets development in particular making positive contribution to economic growth. An array of financial instruments including stock market quoted shares and the bond market is almost certainly going to enhance the overall level of savings in an economy. Capital markets are the markets for long–term loanable funds as distinct from the money markets, which deals in short–term funds. However, there is no clear–cut distinction between the two markets. In principle, capital market loans are used by industry and commerce mainly for fixed investment. The capital market is an increasingly international one and in any country the market is not one institution but all those institutions that match the supply of and demand for long–term capital and claims on capital. In this respect, stock exchanges could be defined as the central point of the capital market. The evolution of capital markets in Africa in recent years has been rather dramatic, as countries have sought not only to mobilize domestic resources but also to attract foreign direct investment. Accordingly, activity in a number of capital markets that had been dormant for years picked–up significantly and a number of new markets have emerged. In a number of established stock exchanges, activity has been boosted by increased listings of companies; mostly made possible by privatization of state–owned enterprises. At present, there are about twenty six stock exchanges in the continent *See* annex]. However, many African stock markets are characterized by a relatively limited number of scrip, which are held to a substantial extent in perpetuity by few insurance and pension funds. The participation by individual savers/investors is significantly limited in a number of markets. The result is that African stock markets (with the exception of Johannesburg) are illiquid. Widening stock market access beyond national boundaries to other stock markets in the region should enhance stock market liquidity and provide savers/investors with significantly more diversified risk

opportunities. To this end, the establishment of the West African Regional Stock Exchange in Abidjan in 1998, whose scrip will encompass issues in the eight countries of the West African Monetary Union is already a very encouraging step forward.

The existence of well–functioning capital markets and especially stock markets is essential to the mobilization of resources both internally and externally. For these securities markets to operate with some degree of efficiency, the conditions are: a stable macro–economic environment; an appropriate capital market infrastructure; and an adequate regulatory, legal and supervisory framework in order to protect investors, promote public confidence, and guarantee market discipline. To concretize our work, we will make a case study of the West African Regional Stock Exchange (La Bourse Regionale des Valeures Mobilieres (BRVM)) to present its statically characteristics and show how it contributes to the economy growth in West African Monetary Union (WAMU). The next Section (2) describes the Further Literature Review and the theoretical justification of the study. Section 3 presents the data and methodology, including a discussion of the measures of the stock market development and economic growth. The econometric methodology including a presentation of Traditionally (Granger 1969) and subsequent improvements, namely, (Toda, and Yamamoto 1995) version of Granger causality model to test the causal relationship between the stock market and economic growth. Section 4 presents the result and interpretations: the finding of statistical properties of the stock returns in BRVM Stock Market markets, the stock market development and economic growth causality test and, what determines stock market development in West Africa. This study closes with a summary; concluding remarks and policy in Section 5.

2. Literature review and theoretical justification of the study

This section presents the literature on the statistical properties of the stock returns, and Finance, Investment and the real Economy. In this section, the literature on the stock return distribution is addressed. It provides the empirical evidence of the stock return distribution as well as its subsequent theoretical explanations.

As far as we know, the assumptions underlying the financial theories and empirical methods are that the security returns are independent, identically and normally distributed with parameters that are stationary over time. These assumptions are crucial due to the non–complicating properties of the normal distribution such as the stability under addition and the finite variance. Moreover, the assumptions of normality and stationary parameter are required for most of the econometric techniques typically exploited in empirical studies. However, the empirical evidence indicated that: **1.** Stock return distribution is not normally distributed but it is found to be leptokurtic (Fama 1965, Westerfield 1977, Hagerman 1978, Peiró 1999, Valkanov 2006, Ghysels 2007 among others); **2.** Linear as well as non–linear dependency exists in stock prices (French, and Roll 1986, Errunza, Hogan, Kini, and Padmanabh 1994, Booth *et al* 1994, Corhay, and Rad, Daily returns from European stock markets 1994, Yadav, Paudyal, and Pope 1999 among others); **3.** Anomalies/Seasonalities in return distribution such as the day of the week effect, January effect, the holiday effect, the size effect and others do exist (Keim, and Stambaugh 1984, Rogalski 1984, Jaffe, Jeffery, and Westerfield 1985, 1989, Smirlock, and Starks 1986, Wong *et al* 1992, Cheung, Ho, and Draper 1994, Alexakis, and Xanthakis 1995, Martikainen, and Puttonen 1990 among others). The main literature of characteristics of stock return was studied by (Hsieh 1988). He examined the statistical properties of daily rate of change of five foreign currencies from 1974 to 1983. He found that the exchange rate distributions like the equity return distributions have similar characteristics. Specifically, both return distributions are leptokurtic (too small). Hsieh suggested that there are two competing explanations for the observed heavy tails of the distribution: **a.** the data are identically distributed drawn from a heavy tail of distribution whose parameters remain fixed over time; **b.** the data are not identically distributed but drawn from a distribution whose parameters vary over time. In addition, he documented the day–of–the–week effect for the exchange rate data. However, he concluded that the rejection of the *i.i.d.* hypotheses for the exchange rate data was not attributable to the presence of the day–of–the–week effect.

In spite of the typical assumption of normality, pioneering research by (Kendall 1953), Osborne (1963), and (Fama 1965) reported the deviation from this presumption. These studies have concluded that stock price change behave like a random walk (The random walk theory is based on two assumptions: **1.** price changes are independent random variables, and **2.** the changes conform to some

probability distribution – no memory) even though there is some evidence of leptokurtosis in the distribution of the stock price changes. In these studies, the empirical distributions of stock price changes over time yield a higher frequency of observations near the mean and the tails than would be expected for a normal distribution. The simple kurtosis is almost always found to be greater than 3 (the value expected for a normal distribution). This type of distribution is characterized as peaked and fat–tailed. Since the normality of the stock return distribution is the crucial assumption underlying financial theories and their empirical evaluations, the "fat–tailed" findings cast doubts on the validity of findings which assume the normal distribution of stock returns. At least two explanations of the observed kurtosis in stock returns are found in the literature. One suggests that stock returns are best described by a member of the class of distributions with infinite variance, "the stable paretian distribution" while the other suggests that stock returns are sampled form a mixture of distributions that have different variances "the mixture of distribution hypothesis" (Fama 1963), and (Mandelbrot 1962) proposed that security returns follow a stable paretian distribution with an infinite variance. (Fama 1965) illustrated that stable paretian distribution has two crucial properties: **1.** their stability under addition and; **2.** their limited distributions for sums of independent, identically distributed random variable. Fama discussed that:"By definition, a stable paretian distribution is any distribution that is stable or invariant under addition. That is, the distribution of sums of independent, identically distributed, stable paretian variables is itself stable paretian and, except for origin and scale, has the same form as the distribution of the individual summands. Most simply, stability means that the values of the parameters α and β remain constant under addition" (Fama 1965, 43). Blume (1970), Roll (1970), and Teichmoeller (1971) have provided empirical support to this line of reasoning. A stable paretian distribution is defined by the log characteristic function as follows:

$$Log f(t) = Log \int_{-\infty}^{\infty} \exp(uit)\, dP(\tilde{u} < u) = i\delta t - \gamma|t|^{\alpha}\left[1 + i\beta\,(t/|t|)\tan\left(\frac{\alpha\pi}{2}\right)\right] \quad (1)$$

The characteristic function tells us that stable Paretian distributions have four parameters, α, β, δ, and γ. The location parameter is δ, and if α is greater than one, δ is equal to the expectation or mean of the distribution. The scale parameter is γ, while the parameter β is an index of skewness which can take any value in the interval $-1 \leq \beta \leq 1$. When β= 0 the distribution is symmetric. When β > 0 the distribution is skewed right (i.e., has a long tail to the right), and the degree of right skewness increases in the interval $0 < \beta \leq 1$ as β approaches 1. Similarly, when β< 0 the distribution is skewed left, with the degree of left skewness increasing in the interval $-1 \leq \beta < 0$ as β approaches –1. Of the four parameters of a stable Paretian distribution the characteristic exponent α is the most important for the purpose of comparing "the goodness of fit" of the Gaussian and stable Paretian hypotheses. The characteristic exponent α determines the height of, or total probability contained in, the extreme tails of the distribution, and can take any value in the interval $0 < \alpha \leq 2$. When $\alpha = 2$, the relevant stable Paretian distribution is the normal distribution[38] . When a is in the interval $0 < \alpha < 2$, the extreme tails of the stable Paretian distributions are higher than those of the normal distribution, with the total probability in the extreme tails increasing as a moves away from 2 and toward 0. The most important consequence of this is that the variance exists (i.e., is finite) only in the extreme case $\alpha = 2$. The mean, however, exists as long as $\alpha > 1$. Mandelbrot's stable Paretian hypothesis states that for distributions of price changes in speculative series α is in the interval $1 < \alpha < 2$, so that the distributions have means but heir variances are infinite. The Gaussian hypothesis, on the other hand, states that α is exactly equal to 2. In terms of empirical test, (Officer 1972), (Barnea, and Downes 1973), (Blattberg, and Gonedes 1974), and (Hagerman 1978) reported evidence in favor of the Stable paretian hypothesis. However, (Hagerman 1978) reported that the estimated characteristic exponents of individual securities and portfolios increase with the holding period. This finding is a clear violation of the properties of a stable paretian distribution.

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[38] The logarithm of the characteristic function of a normal distribution is log f(t) = i μ t$-\frac{\sigma^2}{2}$ t^2 This is the logarithm of the characteristic function of a stable Paretian distribution with parameters α= 2, **δ**=μ, and γ= $\frac{\sigma^2}{2}$ **.**

The mixture of distribution hypothesis or the subordinated stochastic theory is an alternative explanation for the observed fat–tail in the empirical distribution of stock returns. This hypothesis asserts that stock returns are sampled from a mixture of distributions which have different conditional variances. The Heteroskedasticity associated with such mixtures of normal distributions will result in larger values of the sample kurtosis. As a result, this hypothesis implies that the distributions of underlying parameters are nonstationary over time. (Clark 1973), (Epps, and Epps 1976), (Tauchen, and Pitts 1983), (Harris 1986), (Lamoureux, and Lastrapes 1990), and (Richardson, and Smith 1994) have presented evidence supporting the mixture of distribution hypothesis from their studies of the stock return volatility–volume relationship. These findings have suggested that stock price data be generated by a conditional stochastic process with a changing variance parameter which can be proxied by volume. Also, several researchers including (Praetz 1972), and (Blattberg, and Gondeds 1974), among others, have verified that if conditional variance follows an inverted gamma distribution, the resulting (posterior) distribution is the student *t* which is a distribution with fat–tailed properties. In this study, the scope of hypotheses is delineated as follows:

H_{0A} : The stock returns are normally distributed

H_{1A} : The stock returns are not normally distributed

The study employs two statistical tests to determine whether each return series is normally distributed: the chi–square goodness of fit test for normality of residuals by Klein (1974) and the Jarque–Bera statistic. According to (Jarque–Bera 1987), the Jarque–Bera statistic is calculated as follows:

$$JB = n[s^2/6 + (k–3)^2/24] \qquad (2)$$

Where n = the number of observations; s = skewness; and k = kurtosis.[39] We begin with the assumption that log price Pt follows an RW1 without drift:

$$H_0 : P_t = P_{t–1} + \varepsilon_t, \qquad \varepsilon_t \sim IID\ (0, \sigma^2) \qquad (3)$$

Denote by I_t the following random variable:

$$I_t = \begin{cases} 1 & if \quad R_t = p_t - p_{t–1} > 0 \\ 0 & if \quad R_t = p_t - p_{t–1} \le 0 \end{cases} \qquad (4)$$

I_t is a indicator variable indicating whether the *Rt* is positive or negative. Define N_s and N_r as the numbers of sequences and reversals respectively in historical stock return, where the former are pairs of consecutive returns with the same sign, and the latter are pairs of consecutive returns with opposite signs. Given a simple of n+1 returns R_1, R_2, R_{n+1}, the N_s and N_r can be expresses a simple functions of I_t *'s:*

$$N_s = \sum_{t=1}^{n} y_t, y_t = I_t I_{t+1} + (1 - I_t)(1 - I_{t+1}) \qquad (5)$$

Where $\qquad N_r = n - N_s$

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[39] The expected value of kurtosis for normal distribution random variable is 3. Consequently, a value of zero for the excess kurtosis corresponds to normality (Nanjand, and Yang 1991).

If we add the further restriction that the distribution of increments is symmetric, then whether Rt is positive or negative should be equally likely, which implies that for any pair of consecutive returns, a sequence and reversal are equally probable; hence the ratio $\hat{CJ} = N_s/N_r$ (Cowles, and Jones 1937) should be approximately equal to one. Since returns at different time are independent under H_0, $\hat{CJ}$ can be interpreted as a consistent estimator of the ratio of the $1-\pi_s$, which is

$$\hat{CJ} = \frac{N_s}{N_r} = \frac{N_s/n}{N_r/n} = \frac{\hat{\pi}_s}{1-\hat{\pi}_s} \xrightarrow{pr} \frac{\pi_s}{1-\pi_s} = CJ \tag{6}$$

Under H_0, $\pi_s = 1/2$, CJ=1. We need the asymptotic distribution of statistics $\hat{CJ} = N_s/(n-N_r)$ which ban be derived by delta method from the distribution of N_s. *With* N_s being a binominal random variable, i.e. the sum of n Bernoulli random variable y_t where:

$$y_t = \begin{cases} 1 \text{ with probability } \pi_s = \pi^2 + (1+\pi)^2 \\ 0 \text{ with probability } 1+\pi \end{cases} \tag{7}$$

We may approximate the distribution of N_s for the large n by a normal distribution with mean $E(N_s) = n\pi_s$ and variance $Var(N_s)$. Because each pair for adjacent y_t 's will be dependent[40] ,the *Var* (N_s) *is:*

$$Var[N_s] = Var(\sum_{t=1}^{n} y_t) = nVar(y_t) + 2\sum_{t>s} Cov(y_t, y_s)$$
$$= n\pi_s(1-\pi_s) + 2nCov[y_t, y_{t+1}] \tag{8}$$
$$= n\pi_s(1-\pi_s) + 2(n-1)(\pi^3 + (1-\pi)^3 - \pi_s^2)$$

Since y_t is independent of y_{t+k} for k>2 and

$$Ey_t y_{t+k} = \begin{cases} P(y_t = 1, y_{t+1} = 1) \\ = P(I_t = 1, I_{t+1} = 1, I_{t+2} = 1) + P(I_t = 0, I_{t+1} = 0, I_{t+2} = 0) & for \ k = 1 \\ = \pi^3 + (1-\pi^3) \\ P((y_t = 1, y_{t+k} = 1) = P(y_t = 1)P(y_{t+k} = 1) = \pi_s^2 & for \ k \geq 2 \end{cases} \tag{9}$$

And then

$$Cov(y_t, y_{t-k}) = \begin{cases} \pi^3 + (1-\pi^3) - \pi_s^2 & for \ k = 1 \\ 0 & for \ k \geq 2 \end{cases} \tag{10}$$

Let $\bar{N}_s = N_s/s$.

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[40]In fact y_t is a two–state Markov chain with probabilities $Pr(y_t = 1/y_{t-1} = 1) = (p^3 + (1-p)^3)/p_s$ and $Pr(y_t = 0/y_{t-1} = 0) = 1/2$

$$E\bar{N} = \pi_s(1-\pi_s) \ and$$

$$Var(\bar{N}_s) = \frac{1}{n^2}Var(N_s) = \frac{1}{n}[\pi_s(1-\pi_s)+2(1-1/n)\left(\frac{1}{2}(3\pi_s-1)-\pi_s^2\right)]$$

$$= \frac{1}{n}[4\pi_s - 3\pi_s^2 - 1 + 0\left(\frac{1}{n}\right)]$$

(11)

The Central Limit Theorem (CLT) can be applied to Y_1, Y_2,...., Y_n,.... Although Y_t's are independent. $\sqrt{n}(\bar{N}_s - \pi_s)$ Follows normal distribution asymptotically:

$$\sqrt{n}(\bar{N}_s - \pi_s) \sim (.)N(0, 4\pi_s - 3\pi_s^2 - 1)$$

Doing the first order Taylor expansion of

$$\hat{CJ} = N_s/(n-N_s) = \bar{N}_s(n-\bar{N}_s) \ for \ \bar{N}_s \ at \ \bar{N}_s = \pi_s$$

$$\hat{CJ} \approx \frac{\pi_s}{1-\pi_s} + \frac{1}{(1-\pi_s)^2}(\bar{N}_s - \pi_s) \sim (\cdot)N\left(\frac{\pi_s}{1-\pi_s}, \frac{4\pi_s - 3\pi_s^2 - 1}{n(1-\pi_s)^4}\right).$$

(12)

We end up with conclusion that: Under H_0: $\pi_s = \frac{1}{2}$, the test statistics $\hat{CJ} \sim (\cdot)N(1, \frac{4}{n})$

According to (Hsieh 1989), "There is no reason to believe that economic systems must be intrinsically linear". His finding that returns are uncorrelated is insufficient to prove that the data are statistically independent since it is possible for returns to be linearly uncorrelated and nonlinearly dependent simultaneously. The ARCH and GARCH models are examples of the nonlinear models describing the long term memory in the data series. Specifically, for common stock, these models capture the persistence in the volatility of stock returns. In empirical context, there is substantial evidence that stock returns show nonlinear dependency. For example, (Akgiray 1989) found a strong evidence of autocorrelation in squared residual and return series of the S$P 500 index. Additional evidence has been presented by (Hinich, and Patterson 1985), Corhay, and Rad (1994), (Booth, Martikainen, and Tse 1997), and (Brorsen, and Yang 1994). (Hinich, and Patterson 1985) presented the evidence for 15 stocks listed on NYSE and AMEX. They reported that stock returns are generated by non–linear process. They also noted that the degree of dependence in stock returns is much higher than that suggested by the second order time series models. (Brorsen, and Yang 1994) examined the distribution of the three alternative models of daily stock index returns: a diffusion–jump process, an extended GARCH process, and a combination of the GARCH and jump process. The data are obtained from the Center for Research in Security Price (CTSP) and the S$P 500index. They found that there is evidence of nonlinear dependency in these indices. In addition, nonlinear dependence is not removed for the value–weighted index and the S$P 500 index when the indices are fitted into GARCH (1, 1) model. Corhay, and Rad (1994) found strong evidence of nolinear dependency in daily returns of Franc, German, Italian and UK stock markets while (Booth, Martikainen, and Tse 1997) documented that the Finnish stock returns exhibit non–linear dependence and the form of the dependence is not chaotic.

Sewell, Lee, and Pan (1993) documented nonlinear dependencies in the stock markets of South Korea, Japan, Hong Kong, Taiwan, and Singapore whereas (Errunza *et al* 1994) identified nonlinear dependencies in the markets of Japan, Germany, and the emerging markets of Brazil, India, Chili, Mexico, and Argentina. Their findings are similar to (Yadav, Paudyal, and Pope 1999)'s examination that nonlinear dependence in stock returns for an exclusive sample of UK stocks for a 21–year period is highly significant in all cases for both individual stocks and stock portfolios formed on the basis of trading frequency. Following in Hsieh's footsteps (Hsieh 1988), the i.i.d. hypotheses next offered are:

H_{0B} : The stock returns exhibit no serial dependence

H_{1B} : The stock returns exhibit a serial dependence

H_{0C} : The stock returns exhibit no nonlinear dependence

H_{1C} : The stock returns exhibit a nonlinear dependence

To investigate if the BRVM stock price changes exhibit nonlinear dependence, we will use three tests such us the autocorrelation coefficients and Box–Pierce Q–statistics of the square residual of an ARMA model are examined. In a step by step process utilized by (Hsieh 1988) to uncover the possible causes of the rejection of the *i.i.d.* hypothesis for the five exchange rates, be documented the day–of–the–week effect. However, he concluded that the rejection of the *i.i.d.* hypotheses for exchange rates was not attributable to the presence of the day–of–the–week effect. To test the day–of–the–week effect in stock returns this study, we follow 3 steps. i) investigates whether the day–of–the–week effect is present in the West African Regional stock market, ii) tests whether the distribution of stock returns changes across days of the week, and iii) Examines if the rejection of the *i.i.d.* hypothesis is attributable to the day–of–the–week effect.

As a preliminary test, the study conducts a test of whether the day–of–the–week effect exists in the stock returns of the West African Regional stock market, by running the following regression with binary dummy variables for each index to test whether there is any statistically significant difference among stock market returns, on different days of the week. The model which he estimated can be represented as follows:

$$R_t = \sum_{i=1}^{5} B_i D_{it} + \mu_t \tag{13}$$

Where D_{1t} = 1 if day t is a Monday and 0 otherwise; D_{2t} = 1 if day t is a Tuesday and 0 otherwise; and so on. The coefficients $B1$ to $B5$ are the mean returns for Monday through Friday, respectively. The stochastic error term is given by u_t. Using the regression in Equation (13), the following hypotheses are proposed and tested to determine the existence of the day–of–the–week effect in the West African Regional stock market.

H_{0D} : Mean returns of each trading day are equal. (Days before and after holidays are included in the data set)

$(B1 = B2 = B3 = B4 = B5)$

H_{1D} : At least one trading day has a significantly different mean return.

In order to test whether the distribution of stock returns actually changes across the days–of–the–week, the data are categorized into five groups (Monday through Friday) in accordance with days of the week. We test the following null hypothesis of equal mean returns across days of the week:

$(B1 = B2 = B3 = B4 = B5)$

If the daily returns are drawn from an identical distribution, they will be expected to be equal. However, the rejection of the null hypothesis would indicate a specific observable pattern in the stock market returns, thus violation of weak–form market efficiency.

3. Econometric framework and data

There was a significant difference in the statistical test of the multiple unit root test. Although their asymptotic distribution seems to be the same, the distribution of limited simple is still exhibit significant difference. Dissimilarity of the data Generating Process (DGP) in the data sample will produce different unit root result. Hence, from the practical point view, we should review the methodology of the multiple unit root test and implement the tests according to the different circumstances. Applying one or two unit root test that having similar tests power to economic or financial research may outcomes bias conclusion. The unit root test basically assumes the GDP having the characteristic as bellows:

$$y_t = d_t + u_t \tag{14}$$

$$u_t = \alpha u_{t-1} + v_t \tag{15}$$

Where d_t (t=1,…, T) is the time trend, u_t is the stochastic disturbance, the stochastic residual variable can be expressed as the first order autoregressive model as equation above, $\{v_t\}$ represent the stable stochastic process. If the null hypothesis of $\alpha = 1$ is not rejected, the time series of $\{u_t\}$ is an unstable unit root process. If the alternative hypothesis of $\alpha < 1$ is accepted, the time series of $\{u_t\}$ is stable process with trend. The ADF unit root test is proposed by (Dickey, and Fuller, 1979) and (Phillips–Perron 1988). They assume that the stochastic process $\{v_t\}$ is an AR (p) process and it is OLS regression as follow:

$$\Delta y_t = \delta_0 \delta_1 t + (\alpha - 1) y_{t-1} + \sum_{j=1}^{p} a_j \Delta y_{t-j} + e_t, \qquad t = 1….T \tag{6}$$

The null hypothesis is $\alpha = 1$. The ADF use the statistical test T ($\hat{\alpha} - 1$) and the t–test, $t_{\hat{\alpha}-1}$ of the coefficient ($\hat{\alpha} - 1$) to examine the null hypothesis. If the null hypothesis is rejected, the time series is a stable process. It necessary for us to determine the appropriate lag length (k) before the cointegration tests is conducted. We use the criteria developed by using the Akaike Information criterion (AIC) and Schwarz Bayesian Criterion (SBC) in this form:

$$AIC(p) = Ln\left(\frac{SSR(p)}{p}\right) + (p+1)\frac{2}{T} \tag{17}$$

$$BIC(p) = Ln\left(\frac{SSR(p)}{T}\right) + (p+1)\frac{LnT}{T} \tag{18}$$

Where $SSR(p)$ is the sum of square residuals of the estimated $AR(p)$ the BIC estimator of $\hat{p}$, p is the value that minimizes $BIC(p)$ among the possible choices $p = 0,1 …, p_{max}$ is the largest value of p value considered. Because the regression decreases when add lag. In contrast, the second term increases when you add a lag. The BIC trades off these two forces so that the number of lag that minimizes the BIC is a constant estimator of the true lag length (Waston, 1994).The difference between the AIC and the BIC is that the term "LnT" in the BIC is replace by "2" in the AIC, so the second in the AIC is smaller then T represent the simple.

Traditionally (Granger 1969) and subsequent improvements, namely, (Toda, and Yamamoto 1995) version of Granger causality (Granger 1969) is employed to test for the causal relationship between two variables. This test states that, if past values of a variable y significantly contribute to forecast the future value of another variable x then y is said to Granger cause x . Conversely, if past values of x statistically improve the prediction of y, then we can conclude that x Granger causes y. The test is based on the following regressions:

$$y_t = \beta_0 + \sum_{k=1}^{M} \beta_k y_{t-k} + \sum_{l=1}^{N} \alpha_l x_{t-l} + u_t \tag{19}$$

$$x_t = \gamma_0 + \sum_{k=1}^{M} \delta_k x_{t-k} + \sum_{l=1}^{N} \gamma_l x_{t-l} + v_t \tag{20}$$

Where y_t and x_t are the two variables, u_t and v_t are mutually uncorrelated error terms, t denotes the time period and 'k' and 'l' are the number of lags. The null hypothesis is $\alpha_l = 0$ for all l's and $\delta_k = 0$ for all k's versus the alternative hypothesis that $\alpha_l \neq 0$ l and $\delta_k \neq 0$ for at least some l's and k's. If the coefficient α_l's are statistically significant but δ_k's are not, then x causes y. In the reverse case, y causes x. But if both α_l and δ_k are significant, then causality runs both ways. The F–statistics are the Wald statistics

$$F = \frac{(RSS_r - RSS_u)/l}{RSS_u/(T - 2l - 1)} \qquad (21)$$

Where RSS_r is the restricted sum of squared–residual while RSS_u is the unrestricted sum of squared–residual, T is the number of observations; l is the lagged order and degree of freedom of the statistics is (T–$2l$–1). The joint hypothesis is $\beta_1 = \beta_2 = ... = \beta_l = 0$ for each equation. The null hypothesis is that x does not Granger–cause y in the first regression and that y does not Granger–cause x in the second regression. Recent studies on time–series econometrics have highlighted several crux issues pertaining to Granger causality test. *First*, the direction of causality depends critically on the number of the lagged terms included. If the chosen lag length is smaller than the true lag length, the omission of relevant lags may cause bias. Conversely, the inclusion of extraneous lags in the equation may cause the estimates to be inefficient. In our model, we have used the Akaike and Schwarz information criterion (AIC / BIC) to fix the choice of lag length. *Secondly,* traditional Granger causality (Granger 1969) test is based on the assumption that the variables are stationary, or even if non–stationary must have the same order of integration. As observed by Toda, and Phillips (1993), any causal inference in Granger jargon is questionable when there are stochastic trends and the F – test is not valid unless the variables in levels are cointegrated.

We consider two measure of stock market development namely size and liquidity: SIZE denotes market capitalization as a % of GDP at constant price whereas LIQUIDITY denotes total value of share traded as a % of GDP at constant price. We build our model based on the following augmented production.

$$Y_t = \beta_1 FDI_t + \beta_2 HUMAN_t + \beta_3 MD_t + \mu_t \qquad (22)$$

Where *Y*t denotes real GDP per capita; FDI denotes foreign direct investment, HUMAN denotes human capital and MD denotes stock market development. The econometric model can write as reduced form logarithm equation for SIZE and LIQUIDITY;

$$LnY_t = \beta_0 + \beta_1 LnFDI + \beta_2 LnHUMAN + \beta_3 LnSIZE + \mu_1 \qquad (23)$$

$$LnY_t = \beta_0 + \beta_1 LnFDI + \beta_2 LnHUMAN + \beta_3 LnLIQUIDITY + \mu_1 \qquad (24)$$

Over the years, the country has experienced sustain and consistent growth. Many factors have contributed to this namely successful trade liberalization, political stability, institutional factors among others. However, it can be argued two main factors that have help the country in the attainment of sustained growth is FDI and human capital.

To test the nature of the distribution of West African Regional stock returns data, the daily closing prices of Brvm Composite Index, Brvm 10 Index as well as its eighteen (18) sub–indices are utilized. These indices are Nestle, Solibra, Uniwax, Ciec ,Sdcc , Snts , Bicc , Safca, Sgbci , Sdvc, Sdv–Saga, Sivom, Ph Ci, Sicor, Sogb, Shec, Ttlc, Bnbc. Table 1 displayed the West African Regional Stock Price Indices and eighteen of its sub–indices. This data stream results in a total of 2000 daily observations on prices.

Table1. The West African Regional stock market two indices and is eighteen sub–indices

Indices	–BRVM–10 –BRVM COMPOSITE
Industrie	–NESTLE –SOLIBRA beer –UNIWAX –CIEC Compagnie Ivoriene d'electricite
Public Services	–SDCC Ste de Distribution d'eau de la Côte D'Ivoire SNTS Société Nationale de Télécommunication – Sonatel BICC BICICI, Banque Internationale pour le Commerce et l'Industrie de Côte d'Ivoire
Banks	SAFCA Société Africaine de Crédit Automobile SGBCI Société Générale de Banque en Cote d'Ivoire SDVC Delmas Vieljeux Cote d'Ivoire
Transport	SDV–SAGA company specialized in transport and logistics services SIVOM Société Ivoirienne d'Operations Maritimes PH CI Plantation et Huileries de Côte d'Ivoire
Agriculture	SICOR Société Ivoirienne de Coco Rape SOGB Société des Caoutchoucs de Grand Bereby SHEC Shell Cote d'Ivoire
Distribution	TTLC Total Fina Elf Oil Côte d'Ivoire BNBC BERNABE–Côte d'Ivoire (huilerie)

Source: Banque Régionale des Valeurs Mobilières Cote d'Ivoire

The return from the index, R_t, is computed as follows the log return.

$$R_t = log(p_t / p_{t-1}) * 100 \tag{25}$$

Where p_t is the current closing price and p_{t-1} is the previous closing price. Log Return Throughout this paper, we will use these notations

Price change   price return   log return
$$ct = p_t - p_{t-1} \quad rt = (p_t - p_{t-1}) / p_{t-1} \quad R_t = 100 \; rt \tag{26}$$

Where log is the natural logarithm , p_t is the close price of the security at time t , p_{t-1} is the close price of the security at time $t-1$ and τ is the time lag ($\tau = 1$). In financial literature, people often use log return rather than simple return. If stock price at time t, the log return R_t over time interval [t, $t+1$] is defined as the first order difference logarithm of p_t over [t, $t+1$],

$$R_t = logp_t - logp_{t-1} = log(p_t / p_{t-1}) \tag{27}$$

We will usually use the log return, mainly for these reasons: First and most important is that, empirical evidence shows that the distribution of stock price tends to have a thicker tail than that of normal distribution. Using normal distribution to calculate the probability of extreme events is most likely misleading. Log normal distribution has a thicker tail than normal distribution and can be employed to describe the tail features of stock prices. The second reason is normal distribution permits a random variable to take negative values and then is not obviously suitable for nonnegative stock price. Log price that can be negative overcomes this difficulty. The third reason for using log return is it's summability over time interval [$t-1$, t] and [t, $t+1$] respectively. The log return over [t, $t+2$], R_t (2) is the sum of R_t (1) and R_{t+1} (t):

$$R_t (2) = log\ p_{t+2} - log\ p_t = log\ p_{t+2} - log\ p_t + log\ p_t - log\ p_t = R_t(1) + R_{t+1}(1). \qquad (28)$$

In the same way, we have

$$R_t(k) = R_t(1) + R_{t+1}(1) + ...R_{t+k}(1), \qquad (29)$$

Final*y* financially, it corresponds to the continuously compounded return of the asset *S*.

The current study focuses on West African Monetary union economy spanning over a period of more than eleven years (1995–2006). Any study on stock market development should preferably be based on daily (or monthly) frequency, given the dynamic nature of the market. But given the fact that monthly GDP figures in West African Monetary union economy are not available only year and quarter GDP. In the present study, we have used quarterly data on output and indicators of stock market development for the period 1995:Q1 – 2006:Q4. **1.** Economic development is measured by the growth rate of real GDP; **2.** Stock market development is measured by two proxies: real market capitalization ratio (*size proxy*) defined by the ratio of market capitalization to real GDP, and real value traded ratio (*activity proxy*) defined by the ratio of trading volume to real GDP. MCR means Market Capitalization Ratio. This measure equals the value of listed shares divided by GDP. The assumption behind this measure is that overall market size is positively correlated with the ability to mobilize capital and diversify risk on an economy–wide basis. STR signifies Total Value of Shares Traded Ratio. This measure equals total value of shares traded on the stock market exchange divided by GDP. The total value traded ratio measures the organized trading of firm equity as a share of national output and therefore should positively reflect liquidity on an economy–wide basis. The total value traded ratio complements the market capitalization ratio: although a market may be large, there may be little trading. For other variables we have**:** Foreign Direct Investment (FDI); Foreign direct investment is used as a control variable since it is presumed that FDI is a determinant of economic growth. Data was obtained from different source. The data on market capitalization and total trade value is collected from the Brvm stock market; while that of real GDP and FDI was obtained from Brvm–Togo; the data on stock development measures namely SIZE and LIQUIDITY was obtained from Stock Market of West African various bulletin, HUMAN (proxied by secondary enrollment ratio was obtained from Central Statistical Office, UEMOA.

4. Empirical results and interpretations

This section presents the empirical result of the study. First Statistical Properties of the Stock Returns in West African stock market are reported. Descriptive statistics of the daily returns on the West African Regional Market along with its two Stocks Index as well as its eighteen sub–indices are reported in Table 2. The Jarque–Bera statistics exhibited in Table 2 indicate that all of the return series are significantly non–normally distributed. One possible explanation for the rejection of the hypothesis is that the distributions of the stock returns are leptokurtic. Specifically, they are fat–tailed and peaked. These characteristics can be clearly observed from the values of the coefficients of the excess kurtosis and the coefficients of the skewness. The level of excess kurtosis ranking from 18.62 to 309.18 indicates fatter tails than the normal distribution.

The results of tests of independence and identical distributions for the sample series under consideration are summarized in Table 3. For the entire period (1997–2007), the Cowles, and Jones statistics indicate that the null hypotheses are rejected for the BRVM tow indices and as well as its 18 sub–indices choose. In order to examine whether the rejection of the hypothesis is predominantly attributable to a particular time period within the ten (10) year study, this paper devides the sample into three periods (1998–2003, 2004–2007, Jan 2007– Dec 2007. The Cowles, and Jones results strongly suggest the rejection of the null hypothesis of independence and identical distribution for the Brvm indices and its fifteen sub–indices returns for all periods evaluated. As already noted, the rejection of the *i.i.d.* hypothesis could be caused by several reasons. Some of the reasons could be a changing distribution of returns across days of the week, dependency within the data, or time–varying means and variances. In order to determine the possible causes underlying the rejection of the *i.i.d.* hypothesis, the subsequent tests are conducted.

Table 2. Summary Statistics of Daily stock Returns Indices of West African Regional Stock Exchange
From 16 September 1998 to 31 December 2007

	Mean	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque–Bera	Observations
BICC	−0.002721	8.702956	−16.96567	0.883087	−4.143558	92.91484	678766.9	1998
BRVM_10	0.017381	2.233289	−4.791725	0.420602	−0.991576	18.62458	20661.36	1999
BRVM_COMPOSITE	0.014878	3.945388	−4.640333	0.362723	−0.661692	37.11805	97100.83	1999
CIEC	−0.006129	9.376961	−10.13005	1.133793	−1.233620	23.70759	36222.85	1999
NESTLE	−0.010432	4.800773	−8.006193	0.624769	−1.920570	42.39773	130447.4	1998
PH_CI	−0.012327	13.00784	−20.67174	0.975260	−1.166816	156.3558	1959307.	1999
SAFCA	−0.014665	3.621217	−7.449562	0.408341	−6.144954	124.8404	1247178.	1996
SDCC	−0.008181	9.390450	−12.49387	0.928435	−1.376496	49.36357	179673.4	1999
SDV_SAGA	0.016568	9.014532	−10.13498	0.709001	−0.060885	65.80318	327866.1	1995
SDVC	0.005952	6.280641	−15.91158	0.866415	−4.663198	95.55244	659786.3	1830
SGBCI	0.010534	10.91922	−14.73571	1.068094	−1.475844	45.30972	149752.2	1998
SHEC	−0.010193	9.375679	−6.069784	0.788373	0.830814	30.60563	63704.10	1999
SICOR	−0.027158	6.821406	−20.08458	0.761997	−10.13188	272.3075	6075055.	1999
SIVOM	−0.018563	9.342169	−23.64658	0.916812	−9.510714	274.9679	6190933.	1999
SNTS	0.042276	3.140846	−5.551733	0.624869	−0.528760	18.69275	20604.76	1999
SOGB	0.011753	9.315516	−13.51924	1.096374	−1.705146	33.66173	79274.66	1999
SOLIBRA	0.023612	12.73671	−25.04939	0.926703	−8.570164	309.1878	7821390.	1996
TTLC	0.021290	9.422357	−5.270635	0.704084	1.736847	37.84004	102106.8	1999
UNIWAX	−0.043376	3.385827	−7.918125	0.467600	−5.584672	77.97955	478651.1	1999

Source: Own computation by Eview 3.1

Note: 1. Return R_t = log (P_t / P_{t-1})*100; 2. Normality test is a Jaque–Bera Asymptotic LM Normality test.

Table 3. Statistic of Cowles and Jones (CJ)

Index	1998–2007	1998– 2003	2004–2007	01/2007–12/2007
Brvm_10	0.95117	0.99602	0.90805	0.93701
BRVM_Composite	0.96847	1.02424	0.91538	0.98387
UNIWAX	0.05158	0.08795	0.01736	0.04681
CIEC	0.26376	0.33600	0.19856	0.30851
SDCC	0.11933	0.13477	0.10421	0.15493
SNTS	0.43431	0.47570	0.39496	0.50000
SIVOM	0.03096	0.01933	0.04293	0.06034
PH_CI	0.05658	0.06369	0.04953	0.12329
SICOR	0.05603	0.09508	0.01945	0.05579
SOGB	0.18435	0.15571	0.21463	0.36667
SHEC	0.18929	0.21308	0.16628	0.20588
TTLC	0.17946	0.19570	0.16355	0.18841
NESTLE	0.12191	0.14009	0.10421	0.16038
BICC	0.11068	0.09879	0.12289	0.14419
SGBCI	0.14376	0.13235	0.15545	0.17703
SDVC	0.11564	0.10730	0.12415	0.01653
BNBC	0.08474	0.11346	0.05732	0.12329
SOLIBRA	0.09136	0.08587	0.09692	0.12329
SAFCA	0.01994	0.01835	0.02154	0.02500
SDV_SAGA	0.07780	0.04171	0.11659	0.23000

Note: 1. Return R_t = log (P_t / P_{t-1})*100; CJ= $\hat{C}J \sim (\cdot) N(1, \frac{4}{n})$

The autocorrelation coefficients for the Brvm Composite Index, Brvm 10 Index as well as eighteen (18) of is sub–indices returns series up to 23 lags are reported in Table 4. The autocorrelation coefficients indicate that most return series exhibit significant positive serial dependence for lags of 1 day. The magnitude of the first order autocorrelations is large; ranging from –0.057 to 0.154. The Box–Pierce Q (23) statistics of the Brvm Composite Index, Brvm 10 Index as well as eighteen (18) of is sub–indices are also presented in Table 4. However, except for SDCC and SNTS the statistically significant Q (23) values in the table suggest the presence of a long term linear dependency in the Brvm Composite Index, Brvm 10 Index as well as its eighteen (18) sub–indices. The Box–Pierce statistics for that squared return series up to 23 lags, Q (23), are presented in Table 5. The null hypothesis of conditional homoskedasticity is easily rejected at the 5 percent significance level in the Brvm Composite Index, Brvm 10 Index as well as eighteen (18) of is sub–indices. This strong evidence of linear as well as nonlinear dependencies in the Brvm Composite Index, Brvm 10 Index as well as its eighteen (18) indices is similar to that reported for Australia, Belgium, Canada, France, Italy, Switzerland and Germany by (Theodossiou, and Lee 1995), for Thailand by (Kamath *et al* 1998), and (Jirayuth, and Ravindra 2002). The findings indicate that the rejections of serial independence using the standard testing procedure had resulted from the presence of the heteroskedasticity in the data. In spite of the evidence of the serial correlation in the data, its magnitude is too small to be responsible for the rejections of the *i.i.d.* hypothesis. Therefore, to validate the result, this study investigates whether changing distributions of the data (across days of the week) can explain the Average daily returns over the trading period of 1998–2007 for the West African Regional stock market two indices and eighteen of is sub–indices along with their t–values are presented in Table 4 and Table 5 (all days of the week are included).

Table 4. Average Daily returns over trading periods of 1998–2007,
for the BRVM index and, 18 of its indices (All days are included)

INDEX	B1	B2	B3	B4	B5	R^2–Adj	F–value	P–value	DW
BRVM_10	0.0161	0.0072	0.0032	0.0228	0.0357	–0.0012	0.4192	0.7949	1.8154
	(0.8072)	(0.3035)	(0.1657)	(0.9468)	(1.8504)*				
BRVM_COMPOSITE	0.0180	0.0033	0.0038	0.0344	0.0194	–0.0011	0.4297	0.7873	1.6862
	(1.0419)	(0.1588)	(0.2264)	(1.6568)*	(1.1680)				
NESTLE	0.0279	–0.0010	–0.0785	0.0178	–0.0029	0.0020	2.0125	0.0902	1.8867
	(0.9409)	(–0.0281)	(–2.7233)**	(0.4992)	(–0.1029)				
SOLIBRA	0.0875	–0.0537	–0.0387	0.0816	0.0387	0.0019	1.9418	0.1014	1.9025
	(1.9864)	(–1.0258)	(–0.9048)	(1.5413)	(0.9115)				
UNIWAX	–0.0312	–0.0407	–0.0655	–0.0418	–0.0350	–0.0012	0.3815	0.8220	1.7516
	(–1.4012)	(–1.5402)	(–3.0295)**	(–1.5626)	(–1.6319)				
CIEC	–0.0544	–0.0806	0.0349	0.0771	–0.0061	0.0002	1.1093	0.3504	1.7726
	(–1.0103)	(–1.2573)	(0.6675)	(1.1889)	(–0.1168)				
SDCC	–0.0245	–0.0452	–0.0687	0.0719	0.0396	0.0011	1.5501	0.1851	1.8601
	(–0.5556)	(–0.8614)	(–1.6044)	(1.3548)	(0.9316)				
SNTS	0.0609	0.0418	0.0093	0.0377	0.0598	–0.0010	0.5210	0.7203	2.1127
	(2.0508)**	(1.1824)	(0.3235)	(1.0541)	(2.0862)**				
BICC	–0.0482	0.0677	0.0222	0.0017	–0.0339	0.0001	1.0380	0.3861	1.8416
	(–1.1485)	(1.3555)	(0.5437)	(0.0330)	(–0.8375)				
SAFCA	–0.0180	0.0056	–0.0077	–0.0091	–0.0352	–0.0009	0.5525	0.6973	1.8623
	(–0.9244)	(0.2435)	(–0.4062)	(–0.3890)	(–1.8800)				

Note: 1. The Equity of means tests are based in the $R_t = \sum_{i=1}^{5} B_i D_{it} + \mu_t$, where t=1, 2, 3….N. R_t is the return from the index i on the day 1. $B_{1t} = 1$ for the day j and zero otherwise. u_t is the disturbance term

2. The values in parentheses denote the t–value of the coefficients. *, **, and *** denote statistical significance of given coefficients at 10%, 5% and 1% respectively.

With the exceptions of Brvm–10, Brvm–Composite, Nestle, Solibra, Uniwax, Snts, Sdv_Saga, Sivom, and Sicor the presented evidence shows that the H_{0D} can be rejected. In fact, the insignificance of all F1 values in Table 4 and Table 5 of the West African Regional stock market two indices and is eighteen sub–indices support the conclusion that the distribution of returns for each day of the week might be *i.i.d.* The coefficient of variation (CV), standard deviation divided by mean return, is used as a measure of risk per unit return. The highest CV values are observed on Thursday among days of the week. Moreover, the lowest CV values appear towards the end of the week (Friday) returns. The lowest standard deviations returns on Mondays is does not conform to the studies: Fama (1965), Gibbons, and Hess (1981), Agrawal, and Kishore (1994), and Balaban, (1995,1996). However, it is interesting to observe the lowest standard deviations returns on Tuesdays, just after Mondays with the lowest standard deviations. As illustrated in Table 6 the highest daily mean returns in SNTS index.

Table 5 – Average Daily returns over trading periods of 1998–2007,
for the BRVM index and, 18 of its indices (All days are included)

INDEX	B1	B2	B3	B4	B5	R²–Adj	F–value	P–value	DW
SGBCI	0.0430	0.0303	0.0267	0.0069	–0.0465	–0.0010	0.4964	0.7384	1.8638
	(0.8460)	(0.5014)	(0.5410)	(0.1134)	(–0.9488)				
SDVC	–0.0449	0.0208	0.0537	0.0329	–0.0198	–0.0003	0.8707	0.4807	1.9735
	(–1.0489)	(0.4028)	(1.2922)	(0.6280)	(–0.4782)				
SDV_SAGA	0.0289	0.0084	0.0590	0.0099	–0.0273	–0.0001	0.9274	0.4470	1.8413
	(0.8559)	(0.2088)	(1.8012)*	(0.2451)	(–0.8389)				
SIVOM	–0.0294	–0.0004	0.0195	–0.1175	0.0059	0.0005	1.2316	0.2953	2.0153
	(–0.6753)	(–0.0074)	(0.4609)	(–2.2418)**	(0.1400)				
PH_CI	–0.0228	0.0250	–0.0479	0.0110	–0.0068	–0.0013	0.3318	0.8567	1.8745
	(–0.4907)	(0.4523)	(–1.0636)	(0.1980)	(–0.1531)				
SICOR	–0.0358	–0.0013	–0.0579	0.0053	–0.0262	–0.0011	0.4341	0.7841	2.0256
	(–0.9871)	(–0.0311)	(–1.6444)	(0.1215)	(–0.7491)				
SOGB	–0.0207	0.0698	–0.0184	0.0321	0.0205	–0.0011	0.4415	0.7787	1.8501
	(–0.3976)	(1.1258)	(–0.3641)	(0.5117)	(0.4074)				
SHEC	–0.0265	0.0322	–0.0361	0.0098	–0.0101	–0.0011	0.4502	0.7723	1.8712
	(–0.7059)	(0.7215)	(–0.9910)	(0.2181)	(–0.2789)				
TTLC	0.0497	0.0511	–0.0093	0.0029	0.0168	–0.0008	0.5997	0.6629	1.9203
	(1.4857)	(1.2837)	(–0.2851)	(0.0714)	(0.5198)				
BNBC	–0.0248	–0.0191	–0.0134	–0.0014	0.0110	–0.0016	0.2056	0.9354	1.7673
	(–0.7896)	(–0.5116)	(–0.4374)	(–0.0371)	(0.3619)				

Note: 1. The Equity of means tests are based in the $R_t = \sum_{i=1}^{5} B_i D_{it} + \mu_t$, where t=1, 2, 3….N. R_t is the return from the index i on the day 1. $B_{1t} = 1$ for the day j and zero otherwise. u_t is the disturbance term; 2. The values in parentheses denote the t–value of the coefficients. *, **, and *** denote statistical significance of given coefficients at 10%, 5% and 1% respectively.

Table 6. Summary Statistics for the Returns

Index	Mean	Std. Dev.	Skewness	Kurtosis	CV
BRVM_10	0.0173	0.4206	–0.9908	18.6120	24.2713
BRVM_COMPOSITE	0.0149	0.3628	–0.6611	37.1225	24.3931
NESTLE	–0.0105	0.6248	–1.9211	42.4232	–59.7855
SOLIBRA	0.0236	0.9266	–8.5727	309.3277	39.2770
UNIWAX	–0.0434	0.4676	–5.5859	78.0109	–10.7823
CIEC	–0.0061	1.1339	–1.2325	23.7037	–184.9785
SDCC	–0.0082	0.9284	–1.3773	49.3565	–113.3552
SNTS	0.0422	0.6250	–0.5277	18.6718	14.7958
BICC	–0.0027	0.8832	–4.1453	92.9313	–328.3387
SAFCA	–0.0147	0.4084	–6.1514	124.8979	–27.8365
SGBCI	0.0105	1.0682	–1.4760	45.3174	101.3815

Index	Mean	Std. Dev.	Skewness	Kurtosis	CV
SDVC	0.0059	0.8663	–4.6649	95.5638	145.7188
SDV_SAGA	0.0166	0.7090	–0.0582	65.7475	42.7358
SIVOM	–0.0186	0.9169	–9.5134	274.9876	–49.3502
PH_CI	–0.0123	0.9753	–1.1660	156.3316	–79.1611
SICOR	–0.0271	0.7620	–10.1273	272.1330	–28.0751
SOGB	0.0118	1.0964	–1.7044	33.6641	92.9056
SHEC	–0.0102	0.7884	0.8321	30.6215	–77.3717
TTLC	0.0213	0.7042	1.7373	37.8233	33.0845
BNBC	–0.0092	0.6613	–1.0642	37.1637	–71.5721

However, the lowest risk per unit return in BICC index where all the days have not significantly positive mean returns. The highest risk per unit return in SDVC index among the West African Regional stock market two indices and eighteen of its sub–indices which exhibit daily seasonality. For all the two indices and eighteen sub–indices of West African Regional stock market return, the highest risk per unit return is observed in the SDVC index. This study presents evidence for the existence of the day of the week effects for a recent period of time West African Regional stock market return. The daily effects are analyzed in stock market returns of the West African Regional stock market two indices and eighteen of its sub–indices. A daily pattern in stock markets is observed for the two indices of West African Regional stock market return and five of its eighteen sub–indices. We believe that our empirical results detecting significant and different daily patterns of mean returns and their volatility in West African Regional stock market return terms have useful implications for international portfolio diversification.

In summary the study finds the following characteristics in the West African Regional Stock data as follow: **1.** The distribution of the BRVM indices and eighteen of its sub–indices returns is distinctly fat–tailed non–normal, and leptokurtic; **2.** The returns of the West African Regional Stock Price Indices and eighteen of its sub–indices are not independent and identically distributed; **3.** The conclusion that the distribution of returns is not *i.i.d.* across different days of the week in the West African Regional Stock Price Indices and eighteen of its sub–indices during 1998–2007 is not strongly validated; **4.** There is evidence of both linear and nonlinear dependency in the West African Regional stock market data; **5.** The dependency of the stock return data is found to be one of the causes that might have led to the rejection of the i.i.d. hypothesis. The overall conclusion of comprehensive investigation of this study indicates that West African Regional stock market return data is non–normal and *non–i.i.d*. The linear and non–linear dependency in the data appears to be the primary cause of the data being non–*i.i.d*. Consequently, the GARCH methodology, which does not require the assumption of normality, can overcome the problem of dependency and is the preferred choice.

Second, using the Toda and Yamamoto (1995) Test, the result on the Stock Market Activity and Economic Growth Causality Testing in West African Monetary Union are reported. As discussed in the earlier section, we first check whether the series under consideration are stationary or not. In the latter case, we also determine their order of integration. The results of Augmented Dickey Fuller (Dickey, and Fuller 1979) unit root test are depicted in Table 7. The results suggest all variables, real market capitalization ratio (MCR), real value traded ratio (VTR) and real GDP growth rate (GDPGR) has a unit root, but the first difference of each is stationary. Thus the four variables in our model are not cointegrated and hence F–test in Granger causality may not be reliable in inferring leads and lags among such variables, with different orders of integration (Toda, and Phillips 1993).

Table 7. Results for the Unit Root Test in First Difference

Variables	Augmented Dickey–Fuller			Phillips–Perron		
	ADF statistic	Critical Value		P–P Statistic	Critical Value	
GDP	–4.9737*	1%	–3,5814	–7.001*	1%	–3,5778
		5%	–2,9271		5%	–2,9256
		10%	–2,6013		10%	–2,6005
MCR	–5.0178*	1%	–3,5814	–7.0472*	1%	–3,5778
		5%	–2,9271		5%	–2,9256
		10%	–2,6013		10%	–2,6005
TTV	–4.6462*	1%	–3,5814	–6.6924*	1%	–3,5778
		5%	–2,9271		5%	–2,9256
		10%	–2,6013		10%	–2,6005
FDI	–3.737*	1%	–3,5814	–5.6924*	1%	–3,5778
		5%	–2,9271		5%	–2,9256
		10%	–2,6013		10%	–2,6005
SE	–3.501**	1%	–3,5814	–5.0175*	1%	–3,5778
		5%	–2,9271		5%	–2,9256
		10%	–2,6013		10%	–2,6005

Note: Asterisk (*), (**), (***) denote statistically significant at 1%, 5% and 10% levels respectively

Given that the maximum order of integration (d_{max}) equals 1, we next determine the number of lagged terms (k) to be included using AIC / SIC rule and find it to be 2. Finally, we construct a VAR in levels, similar to that depicted in (5) with a total of ($k + d_{max}$) equaling 3 lags.

$$\begin{bmatrix} GDP \\ MCR \\ TTV \end{bmatrix} = B_0 + B_1 \begin{bmatrix} GDP_{t-1} \\ MCR_{t-1} \\ TTV_{t-1} \end{bmatrix} + B_2 \begin{bmatrix} GDP_{t-2} \\ MCR_{t-2} \\ TTV_{t-2} \end{bmatrix} + B_3 \begin{bmatrix} GDP_{t-3} \\ MCR_{t-3} \\ TTV_{t-3} \end{bmatrix} + E_t \tag{30}$$

The results in Table 8 suggest unidirectional causality between economic growth proxied by GDP and stock market proxied by market capitalization and Total trade value. The research makes a modest attempt to explore the causal relationship between stock market development and economic growth in the West African monetary union for the period from 1995:Q1– 2006:Q4. The study primarily revolved around two major questions: first whether at all any relationship exists between stock market development and economic growth and secondly, what could be the nature and direction of the causal relationship, if any i.e. does development of stock market promote economic growth or vice versa? To test this hypothesis, we employ the methodology of *Granger non–causality* proposed by (Toda, and Yamamoto 1995). In this study, the Brvm Index is used as a proxy for the West African stock market. The two important indicators for stock market development variables included in the study are real market capitalization ratio and, real value traded ratio. Real GDP growth rate is used as a proxy for economic development. In the Toda–Yamamoto sense, the causality test suggests that stock market development proxied by market capitalization and Total trade value causes economic growth without a feedback. These two outcomes suggest stock market development led "economic growth" in the West African monetary union. This empirical result validates (Levine *et al.* 1999), and (Jung 1986) but fails to validate (Waqabaca 2004) and (Kar, and Pentecost 2000). The empirical results suggest that financial sector development and economic growth is positively cointegrated indicating a stable long–run equilibrium relationship between "market–based" financial deepening and economic growth. This means that high but sustainable economic growth would lead to financial sector development. Also, a unidirectional causality between financial deepening and economic growth exists running from financial deepening to economic growth. This suggests that financial sector development would lead to high but sustainable economic growth in West African monetary

union. Therefore, the performance of financial intermediaries influences real sector development as well as real economic activity.

Table 8. Result of Long Run Causality due to Toda–Yamamoto (1995) Procedure

Null Hypothesis:	MWALD Statistics	p–value
Real GDP Growth(GDPGR) versus Market Capitalization Ratio(MCR)		
MCR does not Granger Cause GDP	4.82296**	0,01329
GDP does not Granger Cause MCR	1,94993	0,15557
Real GDP Growth(GDPGR) versus Value Traded Ratio(TTV)		
GDP does not Granger Cause TTV	2.12485	0.47842
TTV does not Granger Cause GDP	6.75402*	0,00023
Market Capitalization Ratio(MCR) versus Value Traded Ratio(VTR)		
TTV does not Granger Cause MCR	1,8796	0,12658
MCR does not Granger Cause TTV	5.7271*	0,00074

Table 9 and Table 10 reports result for the Long Run Equation of model (24). The results indicate that all the independent variables have the expected positive sign and are highly significant. Both measures of stock market development demonstrate the importance of stock market development to growth. A 10% increase in SIZE leads to a 1.75% increase in RGDPPC whereas a 10% increase in LIQUIDITY leads to a 6.33% increase in RGDPPC. These results suggest that development of the stock market is an important ingredient for economic growth. However, LIQUIDITY has a greater impact on growth rather than SIZE. We check for the presence of multicollinearity using the variance inflation factor (VIF). As a rule of thumb, a variable whose VIF values are greater than 10 may merit further investigation when it comes to multicollinearity. Equation (23) produces a VIF of 4.88 and Equation (24) 3.37.

Table 9. The Long Run Equation, Equation (23)

Variables	Coefficient	t–ratios	p–value
FDI	0,221	6,822	0
SIZE	0,175	4,423	0
HUMAN	2,033	5,237	0
Constant	−6,111	−3 435	0

Table 10. The Long Run Equation, Equation (24)

Variables	Coefficient	t–ratios	p–value
FDI	0,121	6,822	0
LIQUIDITY	0,633	4,423	0,011
HUMAN	2,537	5,237	0
Constant	−8,435	−3 435	0

Table 11 and Table 12 depict results from the short run equations. The results are replicated compared to the long run ones. The Adjusted R^2 is 0.7635 and 0.7954 which indicate the ability of the model to fit the data reasonably well. The lagged error terms have the required negative sign and are significant at 1%. This reinforces the finding of along run relationship among the variables.

Table 11. The Short Run Equation, Equation (23)

Variables	Coefficient	t–ratios	p–value
FDI	0.102	2.467	0.029
SIZE	0.132	3.211	0.007
HUMAN	1.846	3.773	0.002
μ_{t-1}	−0.755	−3.321	0.010

Table 12. The Short Run Equation, Equation (24)

Variables	Coefficients	t–ratios	p–value
FDI	0.102	2.467	0.029
SIZE	0.132	3.211	0.007
HUMAN	1.846	3.773	0.002
μ_{t-1}	−0.755	−3.321	0.010

The results in Table 9 and Table 10 indicate that the immediate effect of SIZE as well as LIQUIDITY is positive and significant. In fact, the immediate impact of all other variables namely HUMAN and FDI is positive and significant. The size of the coefficient of the error correction terms, namely –0755 and –0.635 for Equation (23) and (24) suggests a high speed adjustment from the short run deviation to the long run equilibrium in RGDPPC. It indicates that 75% (for Equation 23) and 63% (Equation 24) of the deviation is corrected every year. The model analyzes relationship between stock market development and economic growth in West African monetary Union over the period of time 1995 to 2006. Using two measures of stock market development namely Size and Liquidity, we found that stock market development is an important ingredient for growth in West African monetary Union since the stock market gives a general idea of an economy's health. We adopt the simple two step procedure of Engle and Granger when it comes to the econometric methodology. Given the small size of our sample and the number of parameters to be estimated, the Engle–Granger approach is more attractive than the Johansen approach which would require the estimation of a system of 3 equations, implicitly there is a loss of degree of freedoms. The positive relationship between stock market development and economic growth is replicated in both the long run and short run equations. Our two controlling variables have the expected positive result and are highly significant. Both FDI and HUMAN are crucial determinants of growth in West African monetary Union. The emerging literature on FDI stipulates that FDI's positive impact on growth depends on local conditions and absorptive capacities. Essential among these capacities is financial development. This model provides support for this hypothesis in the context of West African monetary Union. Like FDI, the importance of human capital to economic growth in not a doubt.

5. Conclusion

This study has investigated the statistical properties of stock returns in the West African regional stock market and the link between the West African regional stock market and economic growth. In all the two areas, the study has made important contributions to the finance literature. We first started by investigated the statistical properties of the West African Regional stock market. To examine the nature of the distribution of West African regional stock returns, the daily closing prices of the two stock index (brvm–10 and brvm–composite) of West African regional stock market, and eighteen of it sub–indices were utilized. Nine years data from 1998 to 2007 interval were employed. The primary conclusion of this study indicated that the distribution of the West African regional stock market returns is non–normal and non–*i.i.d.* The linear and non–linear dependencies in the returns appeared to be the main reasons for the data being non–*i.i.d.* Accordingly, the GARCH methodology, which does not require the assumption of normality, is the appropriate methodology for the West African regional stock market. The existence of the Day–of–the–week–effect in the stock returns implies that the stock market is not efficient since investors can earn excess returns by buying stocks on Monday and selling them on Friday afternoon.

Therefore, a study of the Day–of–the–week–effect in West African regional monetary union helps in uncovering the trends and evidence from the market. This examination helps to better

understand this phenomenon in a market with different institutional, political, and regulatory environments. We also demonstrate the presence of the day–of–the–week effect in West African regional stock market. This paper has provided a comprehensive empirical investigation on the days–of–the–week effect in West African regional stock market both for the overall index (brvm–10, brvm–composite) and eighteen sub–indices from September 1998 to December 2007.

This study presents evidence for the existence of the day of the week effects for a recent period of time in West African Regional stock market return. The daily effects are analyzed in stock market returns of the West African Regional stock market two indices and eighteen of its sub–indices. A daily pattern in stock markets is observed for the two indices of West African Regional stock market return and five of its eighteen sub–indices. We believe that our empirical results detecting significant and different daily patterns of mean returns and their volatility in West African Regional stock market return terms have useful implications for international portfolio diversification.

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THE MONETARY ORIGINS
OF THE ECONOMIC AND FINANCIAL CRISIS

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Abstract

   The global economic situation suddenly worsened in the fall of 2008 and output expansion was negative almost everywhere for 2009. Fluctuation analysis has shown that most of the financial crises and recessions of the past were triggered and worsened by inadequate monetary policies. For our times, the monetary policy played a significant role in the development of the events through its responsibility in the outbreak of the financial crisis.

   All together, the monetary policy, especially the American one, can be blamed for the remote role (2002–2004) it played in the creation of the speculative bubble which led to a financial crisis. It also has a part of the responsibility through its restrictive direction during the 2004–2006 period; this time, a direction shared by other central banks. Finally, it is more immediately involved through its lack of clear–sightedness and responsiveness in the first months of the recession.

Keywords: monetary policy, interest spread, Taylor Rule, financial crisis, recession.

JEL Classification: E 62

1. Introduction

   The global economic situation suddenly worsened in the fall of 2008 and output expansion was negative almost everywhere for 2009: 3.8% on average for the GDP decrease of developed countries. Although there has been a moderate recovery since the summer of 2009, for many countries, this economic and financial crisis has been the worst and longest since the 1930s.

   Economists have been all the more perplexed in that nothing foretold of such events, as the intensity of fluctuations had been decreasing since 1985. Moreover, this was considered to be due to better management of economic policies, notably monetary policies.

   Along the same lines, fluctuation analysis has shown that most of the financial crises and recessions of the past were triggered and worsened by inadequate monetary policies. Thus, after having examined the sudden speculative rises and crises since the 18th century, Charles Kindleberger (2005) noted that monetary expansion played a key role in each of the bubbles studied: "Money and credit growth have allowed the bubbles to accelerate and in many cases have been the original cause of such events."

   Also, the analysis of American economic fluctuations since the Second World War has highlighted the role that monetary policies play in triggering recessions, the worst of which was during the anti–inflationist policies put in place in the early 1980s by Paul Volker.

1.1. The precedent of the 1930s

   Even if an irrelevant parallel is rejected, as the intensity of the current recession is around one–fourth that of the depression in the 30s in countries that were the most effected, from a monetary point of view, it could be useful to go back over the main lessons learned during the Great Depression.

   Among its remote causes, Friedrich Hayek and the Austrian authors point out that the monetary policy and credit conditions had distorted market signs leading to poor or excessive investments. Their inevitable correction was the cause of the Great Depression. It should be noted that then, and now, the inflation index of consumer prices could not indicate the progressive increase of economic and financial risks linked to the meltdown to the players or monetary managers.

   Christina Romer (2009), the current Chair of the Council of Economic Advisers in the Obama administration, underlined the major role played by the monetary policy in the Great Depression of 1929 in the United States. A misguided practice, initiated by a bewildered Federal Reserve, led to a decrease of the monetary mass and deflation between 1929 and 1933. In France, a persistent attachment to the gold standard blocked growth of monetary mass and credits, thus provoking a sustainable slowdown in the accumulation of capital. Conversely, Great Britain extricated itself by

renouncing convertibility as early as 1931, therefore having to undergo only a slight and very brief decline in its production.

On the other side of the Great Depression, a similar efficiency can also be noted. After 1933, and for three years, the Federal Reserve of the United States committed to intensive growth of the monetary mass (+17% per year) which helped push aside the deflationary tendencies of the previous years (prices had lowered 25% between 1929 and 1933) and triggered immense demand and production expansion. The first effects were noticeable for operations in capital goods, in the automobile industry for example, which benefited from the drop of anticipated real rates. On the other hand, the monetary policy, which had become tighter after 1936 when faced with fears of unjustified inflation, provoked the relapse of 1937 and 1938.

As for the British, their policy of "cheap" money stimulated the housing industry as early as 1931. Lastly, there was no recovery in France until after 1936 when government deficits were monetized and prices started going back up.

The monetary policy was thus implicated, first of all through its responsibility in the emergence and the seriousness of the Great Depression, secondly through its acknowledged capacity to soften the effects, and finally, through the breaking out of it completely. The lessons which the monetary policy makers learned, including those which should be made when the nominal interest rates are close to zero, helped them to improve their results during the current crisis on a long–term basis. Stephen Cecchetti (1997) already indicated that the central banks had learned two main lessons from the Great Depression: first, deflation absolutely must be avoided and secondly, they have to play their role of lenders with no qualms as a last resort. He emphasised to what point these lessons bore their fruit, on the one hand by eradicating the idea of having a zero inflation objective, too close to an area where prices drop and on the other hand, by pointing out through a few significant episodes, notably the Stock Market crash of 1987 and the "Savings and Loans" crisis, an unwavering determination to procure liquid assets to the failing financial actors. In the contemporary context, these well–learned lessons are indeed the basis of efficient reactions noted since the autumn of 2008, however they can also explain why the central banks, who have a strong capacity to manage a crisis once underway, show a certain amount of negligence prior to the crisis, notably in 2002 and 2005. Moreover, it is through what we call the "Greenspan Doctrine" that this type of excessive confidence played a part in the outbreak of the crisis.

In conclusion, the renewal of a crisis situation in 2007–2008 undoubtedly showed flagging of central bank vigilance, which was rather similar to what had taken place in the years prior to the Great Depression, yet he does not question all of the progress that has been made since the 1930s, from which the current global economy has benefited.

To come back to our times, after the outbreak of the financial crisis and after the recession that followed, it is now time to renew the previous sequence of thought through two successive parts.

The monetary policy played a significant role in the development of the events through its responsibility in the outbreak of the financial crisis. A monetary policy which was too accommodating most probably helped create a speculative bubble in the housing sector; this is the topic of the first part.

In the second part, the consequences of the restrictive business policies since 2005 will be assessed. They have undoubtedly contributed to the outbreak and the sinking of the recession into a context of a global crisis

2. One of the causes of the financial crisis

The monetary policy especially that of the United States can be criticized for having lowered interest rates excessively over a long period of time, thus favoring the creation of a housing bubble and weakening its own financial system, as well as those of the other countries in the world.

A similar criticism can be made on the concomitant creation of a "climate" favorable to the emergence of the speculative bubble and to the development of risky behavior from the financial players. One of the recognized results of the monetary policy is its impact on players' anticipation and behavior. The *Greenspan Doctrine* (Greenspan 2002) first, but also Bernanke (2002) states that the creation of a speculative bubble should not be opposed, but that the focus should be on mitigating the fallout when they burst, which probably encouraged excessive risk taking and the feeling of impunity, according to the well–known mechanism of "moral hazard".

2.1. The rise of risks: an excessively accommodative policy between 2002 and 2005

William Niskanen (2008) indicates that the financial crises (stock market crash of 1987, Asian and Russian crises in 1997 and 1999 respectively, and finally the events of 2001) have led the Federal Reserve to decide to lower rates so as to supply global demand; he observes that these successive reactions systematically exceed their goal, thus leading to the effect of excessive expansion; this overreaction then obliges the central bank to put restrictive policies in place, thus leading to the next recession. This scenario can also be applied to the years after 2001!

To measure the extent of the accommodation of the monetary policy in place, a comparison will be used between the effective intervention rates and those from the calculation of the standard Taylor rule. This comparison is justified by the idea that the latter represent the type of efficient and wise policy that would lead to the "Great Moderation" from 1985 to 2000. Figure 1, due to William Poole (2007), shows the gap between the rates; the Federal Reserve intervention rate was very low after 2001, which can be justified by the threat of the crisis; it is then maintained at this level for too long and with no legitimate reason. In fact, the criticism against the easy policy of the Federal Reserve is mostly for the years 2002, 2003, and 2004. More generally, one may call into question its refusal to take the evolution of active prices into account to set forth a policy, which was a constant refusal confirmed by Ben Bernanke until recent years.

John Taylor (2009) continues this analysis by trying to determine what the situation of the American housing market would have been if the interest rate of the Central Bank had followed his rule. He asserts that the high speculative increase that took place in this market would probably not have happened with a tighter monetary policy after 2002. Moreover, the consequence of the decrease in interest rates prompted financial institutions to look for more lucrative investments by taking more risks, provoking a flight forward towards doubtful and unclear credits. Their accumulation triggered the financial crisis. Indeed, Roger Altman (2009) indicates that the amount of mortgage credits increased six fold in 2005 and 2006. These doubtful credits were also granted somewhat everywhere.
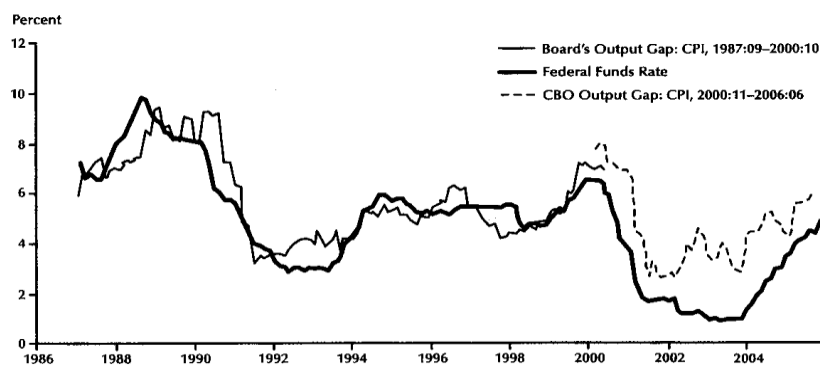
Figure 1. The Greenspan Years: Federal rate and Taylor rate

Caption   Bold line : Federal rate ; Dotted line : Taylor rate calculated by the simple rule

The American monetary policy also has a leading role in world rates as some countries have a currency for which the dollar amount is set; they, therefore, set their monetary policy according to the U.S. monetary policy. For other reasons, the European Central Bank and other central banks in the world also implicitly follow the American policy.
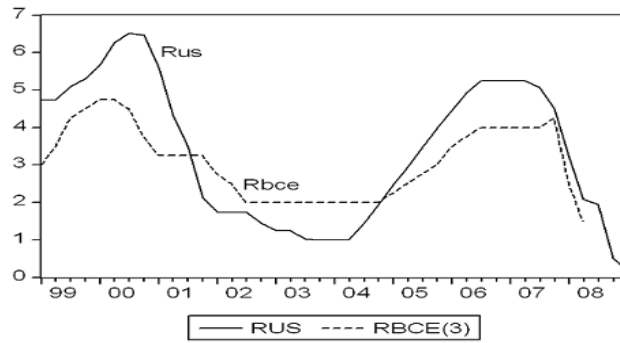
Figure 2. European and American intervention rates (1999–2008)

Caption R_{us}: American rate (The Federal Reserve) ; R_{bce}: European rate (European Central Bank)

Figure 2 illustrates this dependency by showing the respective situations of the European and U.S. intervention rates from 1999–2008. The conformity of the lines seems significant and the cross–correlation calculation shows that the ECB rates "follow" the American rates with an interval of one to three quarters.

Was the European monetary policy too accommodative during the time period in question? The question does not hold the same importance as it does for the United States as the financial crisis did not start in Europe and no one considers that the European Central Bank is significantly responsible for the financial cataclysm of 2007–2008. However, a comparison with the Taylor rates could be made. In Figure 3, the intervention rate of the European Central Bank is lower than the one given by the Taylor rule, for the prevailing conditions over the entire Euro Zone. The difference is greatly negative over a long period of time, from 2001 to 2006.
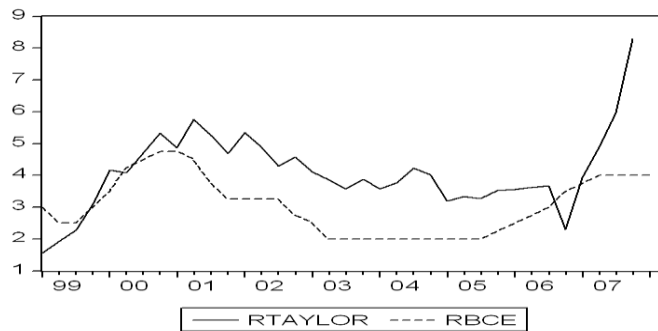
Figure 3. ECB rates 1999–2008 and Taylor rates

Sources: ECB numbers and the author's calculations

Such a situation certainly derives from that of the United States at the same time period; to verify this point, an attempt is made here to explain these European quarterly differences between the rates (R_{BCE}) and the Taylor values by using the Federal Reserve rate (R_{US}) as an explicative variable

$$\text{"Taylor Differences"}_{BCE} = -2.18 \; + \; 0.30 \; R_{us} \qquad\qquad R^2 = 0.434$$
$$\phantom{\text{"Taylor Differences"}_{BCE} = } (-8.47) \qquad (4.50) \qquad\qquad n = 40$$

Consequently, the American monetary policy did have an effect in the sense given by the theory and could; therefore, explain the weak rates between 2001 and 2005. Exchange considerations could also be used to justify these differences. To be more moderate, it is not certain that the Taylor rule is as good a monetary policy guide outside the United States, which leaves a doubt to the excessively

accommodative character of EBC policy for the Euro Zone. Furthermore, the housing speculation was never as significant in the Euro Zone as in the United States.

However, one of the reasons that the European monetary policy can be considered as responsible for the housing and financial crisis is the laxity it has shown, from necessity, for some countries. Indeed, the Euro Zone is a rather a sundry whole and the different situations are quite contrasted, from inflation risks to production or employment perspectives. The national deviations with regard to the Taylor rule are irregular as the inflation and "production gap" are different for each country.

Ireland, Spain, Greece, and the Netherlands have undergone an aggravated housing bubble because the monetary policy that best suited them, calculated by the national Taylor rule, should have been more rigorous than the single policy put in place by the European Central Bank. These are some of the countries which have been affected the most by the economic and financial crisis.

Rudiger Ahrend (2008) tried to generalize this reasoning for all of the OECD member countries. He shows that the accumulated quarterly differences of the effective rates with regards to the national rates simulated by Taylor are correlated to mortgage rates, to building investments and to housing prices, thus increasing the intensity of housing speculation and financial unsteadiness.

Figure 4 gives the different cases of each of the OECD member countries to which this reasoning can be applied for the 2002–2006 period. It shows the impact of the easy monetary policies (high accumulated quarterly differences) on the value of housing investment.

The countries on the right of the figure are those for which the monetary policy has proven the most accommodative over long periods of times and due to this, they are also the ones that have undergone the worst housing crisis with the worst threats on their banking system and later on public finances.
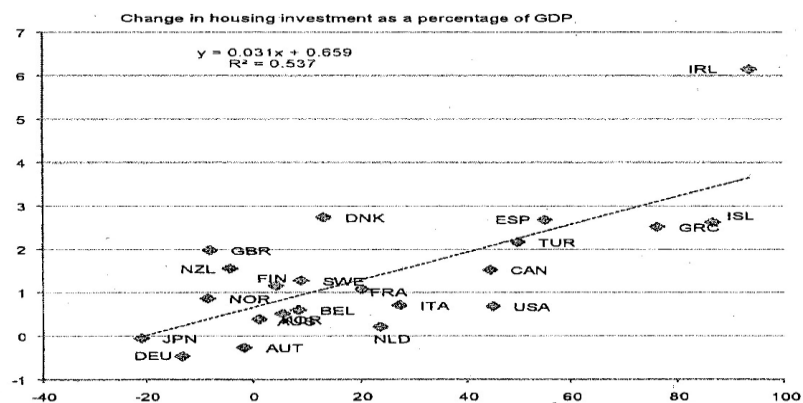
Figure 4. Housing investments and "Taylor differences" 2001–2006

Source: Ahrend

Caption: Abscissa: Accumulated quarterly "Taylor differences" between 2001 and end of 2006; Ordinate: housing investment progression for the same period

Furthermore, the influence of the monetary policy combines with that of financial innovations and deregulation to accentuate the associated phenomena and risks. Thus, in the British case, the financial innovations seem to have been more decisive than the monetary policy in the progressive creation of the housing bubble. This does not *a priori* put the action of the Bank of England in the clear as it could also be feared that its policy of targeting inflation incites negligence of elements such as the increase of financial or housing dangers. Nonetheless, Daria Finocchiaro and Virginia Queijo Von Heideken (2007) have shown that the Bank of England took housing prices into account quickly enough in its reaction. Moreover, its rates are high enough during the crucial period (between 4 and 5%, between 2002 and 2006).

3. Discussion

The argument presented here, therefore, gives the responsibility of the financial crisis largely to the monetary policy, all the while conceding that there were other factors. Its adversaries, among the first of which are quite naturally the heads of the central banks in question, assert that the monetary policy is but weakly implicated. Thus, Ben Bernanke (2010) endeavors to minimize its impact through a series of four theoretical and empirical propositions.

He insists first of all on the fact that the "Taylor rule" used as a reference for a healthy monetary policy should be of a prospective nature, taking into account the normal transmission delays. Inflation and the "production gap" should be apprehended as forecasts (for a year for example) so as to calculate the appropriate intervention rate of the reference. In this case, the Taylor differences found between 2002 and 2006, all the while negative, are the weakest, indicating a more accommodative policy than what it seems according to the standard calculations of Taylor which are reproduced in Figure I.

He also claims that the increase in the housing speculation dates happened before the first "negative Taylor differences" seen after 2002, which could clear the monetary policy of suspicion.

Ben Bernanke also underlines the diversity of national experience and refers to recent works by other IMF teams (Fatas *et al.* 2009) who oppose the conclusions that Rudiger Ahrend has drawn. According to these works, there was only a weak econometric link between the Taylor differences and the amount of the housing values over a sample of 20 industrial countries.

Finally, the President of the Federal Reserve brings the debate back to the real origin of low interest rates which incited speculation. Several observers insist on the abundance of saving on a global level, the saving glut which Ben Bernanke himself made reference to as early as 2005. The Asian, Russian, and South American financial crises of the 90s caused many emerging countries to renounce international loans and to becoming moneylenders on a global scale, which also brings to mind China and other oil–producing countries who wanted to invest their large reserves. It is possible, even probable, that the United States and other countries having an exterior deficit therefore obtained easy financial terms at low rates during the related years of 2002–2005.

However, some of Ben Bernanke's arguments do not seem absolutely convincing.

The Standard Taylor rule, which used contemporary inflation data and the production gap, is undoubtedly not the perfect formula to carry out a prospective monetary policy, but it was effectively applied to the policies carried out by the Federal Reserve since 1985 which brought about the "Great Moderation". Thus, it is not abusive to see it as a sort of empirical ideal and to accept it as a reference.

There are also other proofs of monetary laxity during the crucial years of 2002–2005, such as the negative value of the real Federal fund rates or the high increase in internal nominal demand that could be seen in the United States. Lawrence White (2009) indicates that, from a rate of 3.1% which could be seen in 2001–2002, the nominal sales to national buyers progress at a rhythm of 6.7%, and then 7.1% during the following years, and did not slow down until after the beginning of 2006. It is this same indictor that incited William Niskanen (2008) to use the thesis of monetary responsibility. In Figure V, nominal sales give very pronounced fluctuation. After 2002, a great deal of progression of nominal sales can be seen, reflecting an easy monetary policy. An action of the same type was undertaken in reaction to the bursting of the stock market bubble of 1987 and yet another after the troubles caused by the Asian crisis, the Russian bankruptcy of 1998 and the collapse of the technology bubble of 1999. Each time, the behavior of the Federal Reserve obeyed the logic of the Greenspan doctrine and each time the excessive and drawn out reaction was the cause of the following financial bubble. Thus, the monetary analysis carried out on a theoretical basis and the different indicators of the Taylor rule confirming the indications of the latter thus make Ben Bernanke's defense less compelling.
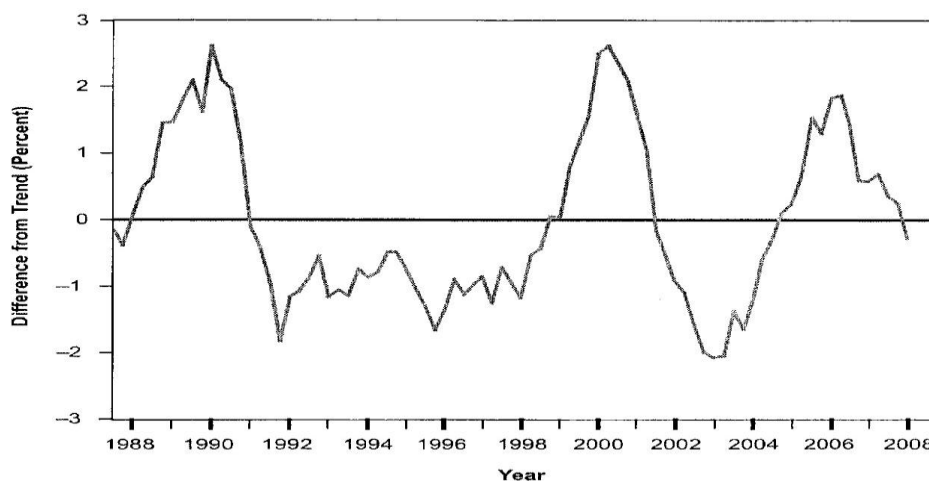
Figure 5. Final nominal sales to U.S. national buyers

Source: Niskanen 2008

Furthermore, a bubble is obviously not dangerous when it is created. It should be admitted that the monetary policy was not responsible from the start, but having fed speculation at a later stage was not innocent and even less excusable as the bubble was already visible. Credit gap indicators, recently perfected by Claudio Borio and Philip Lowe (2002), showed an excess of credit beyond the warning limit of +5% from 2001 for the U.S.A. The housing prices certainly began rising before the year 2000, but it was only in 2003 that they went over the warning threshold inciting a bubble creation – bubble bursting chain (Bharat Trehan 2009). At the time that happened, reinforcing an excessively easy monetary policy with the disastrous effects of the Greenspan doctrine on the implicit guarantee of safety in the case of a crisis could but encourage financial actors and borrowers to take exaggerated risks, establishing the illusion that the rise in housing prices could last forever.

Finally, as for the saving glut and by using IMF works, John Taylor (2009) points out that beyond the increased imbalance between groups of countries during this period, global savings did not see a significant enough progression to be the sole explanation for the low American and global interest rates. Instead, it went down at the end of 2002, before picking back up after 2002, however its level never increasing significantly. The responsibility of the monetary policy can, therefore, not be removed, for the United States or for all of the global economies. This conclusion can be confirmed by a study carried out by the economists of the Deutsche Bank (Becker 2009) who have pointed out the great increase of the global monetary mass, particularly during the years 2001–2003.

4. The monetary policy: one of the causes of the recession

When the time came, the monetary policy was also implicated in the collapse of the housing bubble and banking crisis. As is the case for many past recessions, it can, therefore, be blamed for triggering the global recession. In his aforementioned article, Niskanen (2008) wrote: "A third lesson is that the necessary measures to deflate the demand bubbles caused by overreacting to financial crises should be expected to lead to a recession." When this was written, he was still wondering what would happen to the American economy after the monetary stance was tightened in 2005…

4.1.Tightening of the monetary stance

If you look back over Figure V by Niskenen, you can see the first appearance of the Federal Reserve's tightening monetary stance, which was put into place after 2004. The last part of the final demand curve starts to decline at the beginning of 2006 and falls below the long–term trend line at the beginning of 2008.

From 2004, Greenspan and in 2006, Bernanke, his successor, stated their concern about the housing bubble and started to bring intervention rates back up to slow it down. Convincing results do not seem to have been obtained, at least not in 2005 and 2006 (as was pointed out by Roger Altman). The distribution of rate increases towards the longest possible terms seemed painstaking: Alan

Greenspan colorfully called the phenomenon "conundrum", thus showing an "abnormal" trend toward the lowering of long–term rates. Ben Bernanke polished up his own explanation with a global "saving glut" which fueled American mortgage loans thus, countering national monetary restrictions. Nonetheless, despite appearances, tightening the monetary stance started off well. However, it had a negative influence on the American economy and as a result on the global economy, which should be explained beyond "conundrum": how can a recessionary impact of a monetary policy which has proven to be incapable of raising long–term loan rates be justified. This is what the rate gap theory and explicative analyses recently proposed by New York economists claim to do.

4.2. Forecasting recessions with rate gaps

Tobias Adrian, Arturo Estrella, and Hyun Song Shin (2010), economists at the New York Federal Reserve Bank, evoke that the rate gap forecasts real future activity very well and dominates all other advanced economic indicators in this role.

For their part, David Wheelock, and Mark Wohar (2009), who wrote a synthesis article on this relationship, point out the more specific utility of the rate gap for foreseeing recessions, as early as a year before. A recession is all the likelier when the gap between long–term rates (over 10 years for example) and short–term rates (3 months) tends to decrease or invert. Figure 6 gives an illustration of this relationship for the United States. Other countries have also been studied with similar results in a whole series of related studies by Wheelock, and Wohart. For example, the rate gap is particularly useful in forecasting recessions for Germany (for France, the number of recessions since the Second World War do not let one clearly draw out a link).
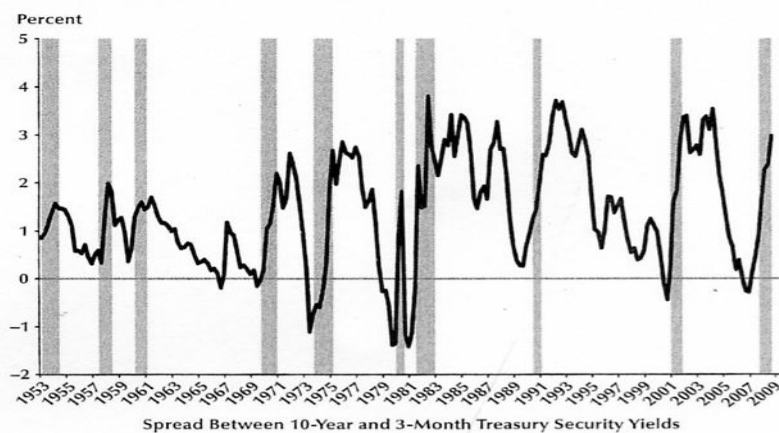
Figure 6. "Rate gap" and American recessions

Source: Wheelock and Wohar

Since 1955, 12 recessions have taken place in the United States, each of these recessions were preceded by an inversion of the yield curve slope. Symmetrically, only one inversion was not followed by a recession, but did nonetheless end in a rise in unemployment. To be more precise, Adrian et al. (2010) note that one rate gap under the threshold of 93 basis points and all the more so in the negative zone, has always heralded a recession or a rise in unemployment, in the indicated period.

What role does the monetary policy play in the inversion and more generally in the movement of rate curves? Monetary tightening, which can be spotted by the variations of intervention rates, has a very significant impact on the rate gap as can be seen in Figure 7, proposed by Adrian et al. (2010). A personal analogous work confirms this for France, an indicator country for the Eurozone (Figure 8). In both examples, the elevation policy of Central Bank conditions brought about a decrease in the rate gap of around one for one in the United States, and a little less (slope: –0.82) for France. The simple regression for France, which reached an R_2 of 0.67, indicates the role played by the monetary policy in the evolution of the rate gap between 10–year loans and 3–month loans is around two–thirds.
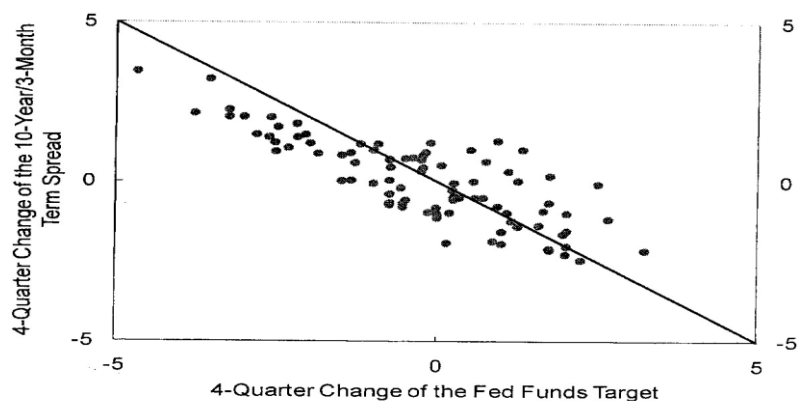
Figure 7. Federal rate changes and the U.S. rate gap
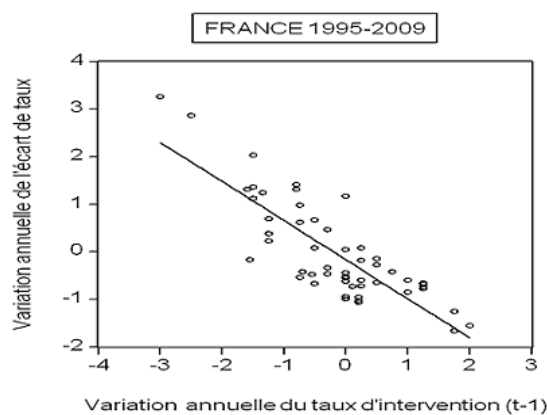
Source: Adrian *et al.*

Figure 8. Central Bank intervention rate movements and the rate gap (1995–2009)

Source: ECB and Federal Reserve Bank of St. Louis numbers: calculations by the author

Caption : The "Central Bank" is the Banque de France before 1999 and the EBC after.

4.3. A theory linking the rate gap and the probability of recession

Tobias Adrian, Arturo Estrella, and Hyun Song Shin (2010) offer an explanation of why the lowering of the rate gap and its eventual inversion bring about a recession and the progression of unemployment.

The traditional logic underlying the monetary tightening effects represent an increase in the short–term rates is the progressive propagation of this increase toward longer–term exchanges. The industrial and housing investments respond to this rise of long–term loan conditions and decrease. The global demand then reduces, thus increasing the probabilities of going into recession. This classical scenario includes reducing the rate gap at the beginning of the contamination process of diverse market segments of loans, however this decrease is temporary and stops after long–term rates finally adapt. In 2005, Alan Greenspan expected things to happen in this way.

Adrian et al. think that a monetary policy can behave in another way. The increase in short–term interest rates seems a threat to them for the return on loan operations. The financial intermediaries and the banks indeed borrow over the short term and loan over the long term. The decrease of the rate gap is, therefore, seen as a narrowing of marginal profit made on the operations and incites different intermediaries to restrict their credit offers and to increase their risk premiums; these phenomena are, therefore, an impact on global demand and real activity.

Their empirical study first endeavors to show the positive link that exists between the rate gap and the net margin of financial intermediaries (in practice commercial banks). They conclude by

stating the statistically significant character of this link. Reaching another level, they come to consider that the interest gap predicts recessions well because it predicts a decrease of future return, a decrease of future asset values and a weaker value of the net margin on loan operations.

Conversely, a rate curve with a steep slope is a promise of a greater upturn as it helps to restore the profitability of new loans and thus supports the rise of credits for the real economy. This remark is interesting in two ways: it helps understand how the easy policy of 2002–2004 could stimulate the rise of credits and the risk taking behavior of the financial intermediaries; it also gives some light on the chances of a rapid upturn of the global economy after 2009. In fact, the policy set forth by the central banks in reaction to the crisis caused a great increase in the rate gap as early as the end of 2008. In Figure 6, the last segment of the curve representing the rate gap in the United States shows the recorded progression. In France, the gap becomes positive again at the beginning of 2009 (See Figure 9).

4.4. Rate gap and monetary tightening

Studying Figure 6 confirms the monetary tightening put in place by Alan Greenspan, and Ben Bernanke during 2004 and 2006. The rate gap decreases and becomes negative at the end of 2006, thus making a slide into recession more probable. For the Euro Zone, and more particularly for France, the joint movement of short–term and long–term interest rates (Figure 9) can be followed. Knowing that the former represent the monetary policy of the European Central Bank rather well, the rate gap starts to decrease after 2004 and inverts after mid 2007; it stays in the negative zone for about a year and a half.
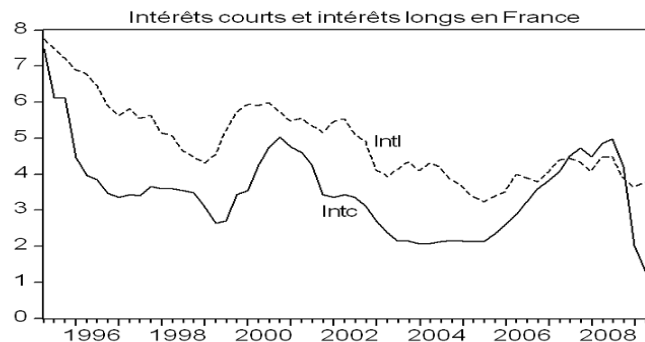
Figure 9. Rates and rate gaps : France 1995–2009

Source: FRB Saint–Louis

Both retrospectives unfold identically with a delay (about two quarters late) in the case of Europe (France): a decrease in the gap rate corresponding to a monetary tightening brought on by an inversion after about two and a half years. The economic recession began approximately one year after this inversion.

The rate gap forecasting approach, being thus based on the theoretical analysis of the transmission given by economists and the Federal Reserve Bank of New York, has thus highlighted how the monetary tightening of 2004 could prepare the way for the economic recession of 2008. The monetary policy is thus in part responsible, not only in the creation of the housing and financial bubble, but also in the bursting of this bubble and the economic recession under the influence of restrictive monetary policies that were then put into place. The American Central Bank was involved in both stages of this scenario, and as for the European Central Bank, it was involved in the second stage, with a slight delay.

Moreover, the central banks were rather slow in perceiving the danger of the crisis and threats of an economy slowdown. Late in 2008, they did not seem resolved to vigorously change their policy to adapt to the new perspectives…

4.5. Approaching the conclusion

According to Robert Hetzel (2009), the collapse happened in the second and third quarters of 2008. Despite significant deterioration of the American economy, the Federal Reserve was satisfied

with maintaining its intervention rate at 2%, which was reached on April 30th, moreover allowing anticipation of ulterior recovery from this rate to develop. Even before the development of destruction of wealth caused by the decrease of stock market values in September, the implicit tightening of the monetary policy probably triggered the real beginning of the recession. The sudden gas price increase was combined with this more restrictive policy and the financial crisis to thus deepen the stronger postwar recession.

The monetary policy carried out by other large bodies (United Kingdom, Japan, Euro Zone) is characterized by similar hesitations at the same period. The Bank of England maintained its intervention rate at 5% during the whole summer of 2008, and only lowered it on October 8th. In its defense, it can be said that it no longer had much of a lowering margin for the intervention rate that had already been reduced to 0.5%.

Finally, when it comes to the Euro Zone, the decisions are even more surprising, the European Central Bank was obviously wrong in its forecasts during the first two quarters of 2008. Its monetary policy was explicitly tightened until the summer (in July: increase of the intervention rate from 4 to 4.25%). Fears of even greater inflation, combined with the rising prices of raw materials and the wage growth in some countries of the zone explain this mistake.

Thus, Axel Weber (2008), President of the Bundesbank and probable candidate to replace Jean–Claude Trichet, declared at the University of Constance as late as June 25, 2008:

"Even though financial stability is of vital interest to the Eurosystem, our primary objective is the maintenance of price stability in the euro area."

As well as, "This confirms that the current upward pressures on the euro–area inflation, which result largely from sharp increases in energy and food prices at the global level, are rather persistent."

Finally, "Furthermore, economic growth is slowing down on a global scale, even though, as far as the euro area is concerned, we do expect it to remain robust, but certainly less dynamic in the quarters ahead."

It can be seen that this excessive priority given to the inflation of consumer prices, the neglect of taking these recessionary aspects of the increase in price of gas and basic products into account, and a certain nonchalance toward immediate financial threats have led to this blunder by the European Central Bank.

The ECB made up for it at a later date (October 8th), but still regretted its diagnostic errors and its lack of responsiveness to the alarming international economic context. It can be all the more regretted considering the standard delay of action, such errors have probably had repercussions for a rather long period of time afterwards.

For Robert Hetzel, a bad monetary policy, characterized by the neglect of lowering rates, let alone their European increase, could be considered as the primary cause of the extraordinary decline of the economic situation in Europe and Japan from the spring and summer of 2008. The propagation of the slowdown from the moderate recession of the American economy does not seem to have played as significant a role. However, naturally, this does not mean there was not propagation as far as the financial crisis itself is concerned.

5. Conclusion

All together, the monetary policy, especially the American one, can be blamed for the remote role (2002–2004) it played in the creation of the speculative bubble which led to a financial crisis. It also has a part of the responsibility through its restrictive direction during the 2004–2006 period; this time, a direction shared by other central banks. Finally, it is more immediately involved through its lack of clear–sightedness and responsiveness in the first months of the recession. However, the way the central banks then dealt with the serious issues that resulted from the crisis itself probably does not call for similar criticism…

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PUBLIC DEBT AND ECONOMIC GROWTH
IN THE EUROPEAN UNION

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Abstract

The main aim of the article is to present the relationships between public debt and economic growth in the European Union in the period 2000–2010. The article consists of two parts. The first part deals with theoretical analysis of the relationships between public debt and economic growth, including reasons and factors determining these relationships. In the next part of article, there are examined the relationships between public debt and gross domestic product in the EU by using the Vector Autoregression Model (VAR). There are estimated elasticity coefficients of public debt to GDP and elasticity coefficients of GDP to public debt on the base of impulse response function. Then, there is made variance decomposition of the public debt and GDP in order to assess the impact of these factors on the variability of GDP and public debt respectively.

Keywords: public debt, budget deficit, economic growth, crowd–in effect

JEL Classification: H6

1. Introduction

The issue concerning the impact of public debt on the economic growth was and still is one of the subjects of the debate among theorists and practitioners of economics. Basically, in the economics literature on this subject, theoretical and empirical considerations can be divided into three main groups. The first group of analyses constitutes works of Keynesians, the second, research of the Neo–classical School representatives and the third, studies of proponents of the *Ricardian Equivalence* hypothesis. These three contrasting approaches to budget deficit and public debt contribute to many discussions in the country and abroad on the role of budget deficit and public debt in the process of economic growth.

2. Model of budget deficit, public debt and economic growth

Budget deficit is typically defined as the difference between government expenditure (including interest on debt) and government income. However, in accordance with the more complex definition, budget deficit is the difference between the size of public debt at the end of the year and the size of public debt at the end of the previous year. These two definitions are equivalent if the public debt is defined as the value of issued bonds.

Budget deficit in country implies that public debt increases. But because GDP also increases, the ratio of government debt to GDP may change or remain stable. Therefore, whether the ratio of government debt to GDP varies or remains unchanged that depends on the growth rate of the national debt is greater or less than the GDP growth rate. Systematically increasing the ratio of domestic debt to GDP is a threat for the country, the public debt will enter the unsustainable growth path, leading to the insolvency of the country. Even if the ratio of public debt to GDP does not increase rapidly, high debt–to–GDP ratio is serious and unfavorable consequences for the country associated the growing cost of public debt service. Therefore it is important to understand the causes of the increase the ratio of public debt to GDP and to find the optimal size of this ratio in the country. For this purpose it is necessary to distinguish the standard budget deficit from the primary budget deficit. Basic (primary) budget deficit is equal to the standard budget deficit corrected by the cost of public debt service (Feldstein 2004). Therefore, standard budget deficit and the primary budget deficit can be presented in the form of the following expressions, as:

$$SB = G + (i \cdot PD) - T \tag{1}$$

$$PB = G - T \tag{2}$$

where:
SB – standard budget deficit;
PB – basic budget deficit;
PD– public debt;
G – government expenditure;
i – interest of public debt;
T – government incomes (tax and non–tax).

Hence, on the basis of the above mentioned expressions we can present the ratio of public debt to GDP in the following form:

$$\frac{PD}{GDP} = \left(\frac{G-T}{GDP}\right) + \left(i - \frac{\Delta GDP}{GDP}\right) \cdot \left(\frac{PD}{GDP}\right) \qquad (3)$$

where:
GDP – gross domestic product.

In accordance with Equation 3, the ratio of public debt to GDP is the sum of the ratio of primary budget deficit to GDP and the difference between the interest rate and the growth rate of GDP multiplied by the ratio of government debt to GDP. Therefore, in accordance with the above mentioned equation the ratio of government debt to GDP rises when in the situation of the primary budget deficit, interest of public debt is greater than the growth rate of GDP. In order to reduce the ratio of public debt to GDP it must be the surplus in the primary government balance (greater government income than public expenditure) or GDP must grow faster than the cost of public debt service.

3. Literature review on the public debt and economic growth

According to Keynesian opinions, budget deficit and the public debt have a positive impact on economic activity in the country, in particular through the mechanism of public expenditure multiplayer. Moreover, they provide arguments indicating the prevalence of crowd–in effect in public expenditure as a result of deficits and debt induced by expansionary fiscal policy. They also argue that budget deficit and government debt increase national production, what makes that private investors perceive the future economic situation more optimistic and increase their investments.

On the other hand, representatives of the Neo–classical School state that the budget deficit and public debt can make harmful effects for economic growth. They analyze consumption expenditure of households during their entire life cycle and consider that the government with budget deficit moves the tax burden on future generations, what leads to increase of current consumption. On the assumption of full employment, representatives of the Neo–classical School argue that increasing consumption means decreasing savings. Therefore interest rates must increase in order to restore equilibrium on the capital market what leads to decrease the size of private investment (Keho 2010).

However, advocates of the *Ricardian Equivalence* conception argue that government deficit and public debt are neutral for economic growth. According to this hypothesis the current budget deficit, resulting for example from tax decreasing must be repaid in the future, for example by tax increasing, thus leaving private investments and interest rates unchanged (Saleh 2003).

Some economists, such as Modigliani (1961), Diamond (1965), and Saint–Paul (1992) indicate that increasing public debt always contributes to economic growth. In turn, Patillo, Poirson, and Ricci (2004) concluded that the low level of public debt affects positively economic growth but high public debt affects negatively the growth rate of GDP. Furthermore, the results of empirical studies carried out by Kumar, and Woo (2010) on a group of countries including both developed economies, as well as developing countries indicate the presence of negative relationship between initial public debt and economic growth in the period 1970–2007. The results of their analyses confirmed that the increase in the ratio of public debt to GDP by 10 p.p. accompanied the decline in real GDP per capita by 0.2 p.p. within one year.

Schclarek (2005) analyzing 59 developing countries and 24 developed economies stated that in the case of developing countries it is always negative and substantial relationship between the total indebtedness of the country and economic growth. On the other hand, in relation to high developed

countries Schclarek (2004) did not find a significant relationship between the public debt and economic growth.

Ferreira (2009) analyzed the relationship between economic growth and public debt using vector autoregression model and Granger causality test confirmed the existence of the relationship between economic growth per capita and the ratio of public debt to GDP in OECD member countries over the period 1988–2001. Furthermore, he confirmed that this relationship is always bidirectional.

Keho (2010) examined the relation between budget deficit and economic growth in seven West African countries in the period 1980–2005 using VAR model and Granger causality test. He obtained inconclusive results. In the case of the three countries he did not find a causal relationship between budget deficit and economic growth. But in the case of three other countries he found two–way, negative relationship between fiscal balance and economic growth.

Simultaneously, it should be emphasized that many empirical studies conducted over the past several years suggests a non–linear relationship between the public debt and economic growth (Moore, Chrystol 2008). Namely, the results of these studies indicate that public debt positively affect economic growth, but only to a certain level of the debt in relation to GDP. To similar conclusions came Elbadawi, Ndulu, and Ndung'u (1997) analyzing the relationship between public debt and GDP in 26 sub–Saharan African countries in the period 1980–1994. They have demonstrated that public debt positively affected economic growth in these countries, but only up to 97% of GDP. Similarly, Pattillo, Poirson, Ricci (2002) examined 93 developing countries in the period 1972–1998 and they found positive impact of public debt on GDP growth rate, but only up to 35–40% of GDP.

Similar studies conducted Smyth, and Hsing (1995), who analyzed the impact of public debt on economic growth in the USA in the 80s and 90s of the 20th century. However, these authors assessed an optimal level of public debt (the level of public debt, which maximizes economic growth) for the U.S. economy. Their results indicated that an optimal level of public debt to GDP for American economy amounted to 38.4% in the analyzed period.

Reinhart, and Rogoff (2010) examining 44 developed and developing countries over the last hundred years concluded that the high level of public debt in relation to GDP (over 90%) is accompanied by a lower level of economic growth in developed countries as well as in developing countries. Furthermore, in the case of developing countries, the relatively high level of external debt in relation to GDP (over 60%) negatively affected economic growth.

4. Public debt and economic growth in the EU in the period 2000–2010

Relatively high size of public debt in many EU member countries contributed to numerous discussions on the impact of public debt on economic growth (Biondo 2010). In order to analyze the causal relationship between changes of public debt and GDP in the EU member countries in the period 2000–2010 there was used vector autoregression model (VAR) proposed by Ferreira (2009) and presented by the following expressions:

$$GDP_{i,t} = \sum_{k=1}^{p} \alpha_k GDP_{i,t-k} + \sum_{k=1}^{p} \beta_k PD_{i,t-k} + \mu_{i,t} \qquad (4)$$

$$PD_{i,t} = \sum_{k=1}^{p} \chi_k PD_{i,t-k} + \sum_{k=1}^{p} \delta_k GDP_{i,t-k} + \upsilon_{i,t} \qquad (5)$$

where:
PD – public debt expressed in national currency;
GDP – gross domestic product expressed in national currency;
¢, υ–residuals;
t–given period;
k–lag length.

All the above mentioned time series had quarterly frequency and cover the period from the first quarter of 2000 to the first quarter of 2010. These data came from the base of the European Union Statistical Office (*Eurostat*). Before the model structural parameters were estimated, it was necessary to isolate a seasonal factor from the time series. The existence of a seasonal factor in the time series

could lead to difficulties in interpreting changes in a given phenomenon in the analyzed period. To eliminate the time series from seasonal fluctuations, the X12–ARIMA method was applied.

Moreover, it was necessary to specify the stationarity of the analyzed time series. For this purpose the Augmented Dickey–Fuller Test (ADF) was used. Among analyzed variables there were time series of the integration degree 0 and 1. The lack of stationarity of time series forced the modification of function model, in order to bring the variables to stationarity. This modification was to replace the size of variables by their first differences. It should be also pointed out that in the absence of cointegration between variables there was no possible to expand and transform structural VAR model into the Error Correction Model (ECM).

In the analysis one lag period (one quarter) between explanatory variables was adopted. The choice of lag lengths was in line with the results of the information criteria of the Akaike, Schwartz–Bayesian and the Hannan–Quinn models. According to these criteria, a model with one lag length was characterized by the biggest information capacity.

Analyzing ratios of public debt to GDP in the EU it can be noted that these indicators increased significantly over the past ten years. The average share of public debt in GDP in the 27 EU member states was 65% at the beginning of 2000 and at the beginning of 2010 this ratio was about 75%. The highest ratios of public debt to GDP were found in Greece, Italy and Belgium but the lowest in Estonia, Luxembourg and Bulgaria.
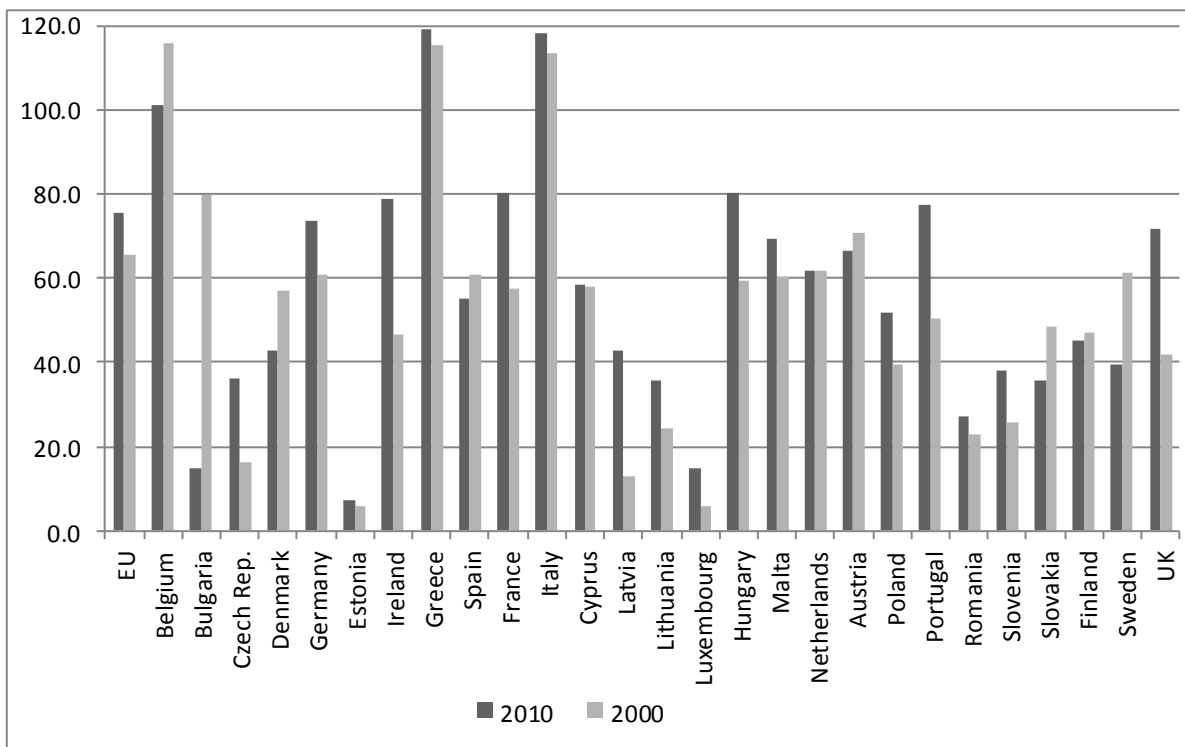
Figure 1. The ratios of public debt to GDP in the EU member countries in years 2000 and 2010 [in %]

Source: Own calculations on the basis of *Eurostat* (2010).

Moreover, the size of GDP per capita in the EU increased substantially over the past few years. The average level of GDP per capita in the 27 EU member countries was 19 thousand euro at the beginning of 2000 and 24 thousand euro at the beginning of 2010. The highest sizes of GDP per capita in 2010 were in Luxembourg, Denmark and Ireland, but the lowest in Romania, Bulgaria, Lithuania and Latvia.
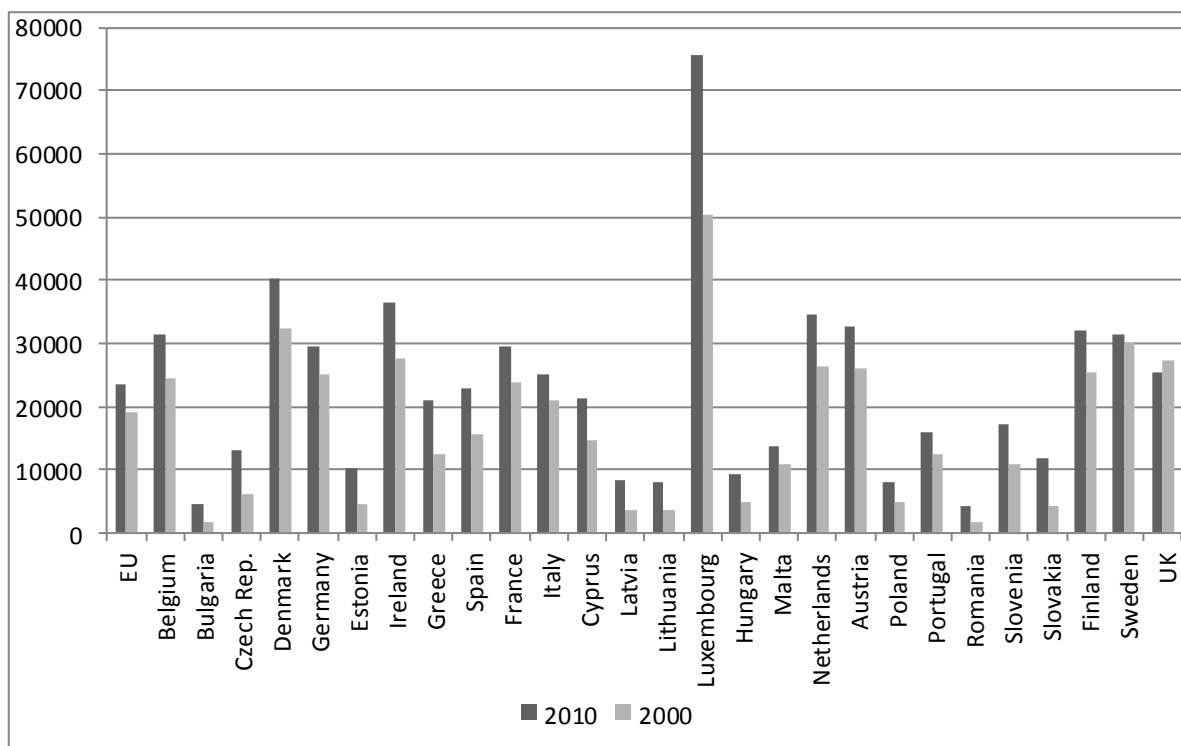
Figure 2. Size of GDP per capita in the EU member countries in years 2000 and 2010 [in euro]

Source: Own calculations on the basis of *Eurostat* (2010).

From a theoretical point of view, less economically developed countries should have generally higher level of public debt in relation to GDP than highly developed countries due to financial constraints and economic needs in poorer countries. However, analyzing data concerning the share of public debt in GDP in the EU member countries we may notice higher ratios of public debt to GDP in relatively high developed EU member countries. This may indicate a positive impact of public debt on the level of economic development of these countries or the positive impact of the economic growth on the size of public debt. However, the experience of many countries, both developed, as well as developing shows that too high share of public debt in GDP may increase the risk of investment in the country, the outflow of foreign capital and consequently the depreciation of the national currency. Of course, this situation negatively affects the rate growth of GDP in the country.

In order to find a causal relationship between the average level of public debt and GDP in the EU in the period 2000–2010 it was necessary to estimate structural parameters of VAR model. Results of parameters estimation of the model were shown in the following table.

Table 1. The results of structural parameters estimation of VAR model

VAR system, lag order 1
OLS estimates, observations 2000:2–2010:1 (T = 40)
Log–likelihood = 258,18577
Determinant of covariance matrix = 8,4843479e–009
AIC = –12,7093
BIC = –12,5404
HQC = –12,6482
Portmanteau test: LB(10) = 67,6214, df = 36 [0,0011]

Equation 1: GDP

	Coefficient	Std. Error	t–ratio	p–value
GDP_1	1,32922	0,167257	7,9472	<0,00001 ***
PD_1	–0,334161	0,169398	–1,9726	0,05585 *
GDP_1	0.861849	0.0250165	34.4513	<0.00001 ***
PD_1	0.145892	0.0265551	5.4939	<0.00001 ***

Mean dependent var	15,71887	S.D. dependent var	0,121356
Sum squared resid	0,006189	S.E. of regression	0,012762
R–squared	0,999999	Adjusted R–squared	0,999999
F(2, 38)	30343398	P–value(F)	1,4e–118
rho	0,199296	Durbin–Watson	1,504455

F–tests of zero restrictions:
All lags of GDP   F(1, 38) = 63,158 [0,0000]
All lags of PD   F(1, 38) = 3,8913 [0,0558]

Equation 2: PD

	Coefficient	Std. Error	t–ratio	p–value
GDP_1	0,430476	0,168944	2,5480	0,01500 **
PD_1	0,563264	0,171107	3,2919	0,00216 ***

Mean dependent var	15,51963	S.D. dependent var	0,123634
Sum squared resid	0,006314	S.E. of regression	0,012891
R–squared	0,999999	Adjusted R–squared	0,999999
F(2, 38)	28991312	P–value(F)	3,3e–118
rho	0,049724	Durbin–Watson	1,828029

F–tests of zero restrictions:
All lags of GDP   F(1, 38) = 6,4925 [0,0150]
All lags of PD   F(1, 38) = 10,837 [0,0022]

Source: Own calculations.

On the basis of the estimation results of the Equation 4 (GDP), we can see that one of the factors that determined GDP growth in the EU in the period 2000–2010 was public debt. Namely, the increase in public debt by 1% led to decline the value of GDP on average by 0.3%. On the other hand, on the basis of the estimation results of the Equation 5 (PD) it was affirmed that one of the most important factors which determined the size of public debt in the EU in the period 2000–2010 were just GDP changes. In this case, GDP growth by 1% led to increase public debt on average by about 0.4%. However, comparing the elasticity coefficients in these two equations it was proved that GDP changes affected the size of public debt in much more degree, than public debt influenced on GDP growth in the EU in the examined period.

The next step of analysis was the measurement of the impact strength of public debt changes on GDP and GDP changes on the size of public debt in the EU. It was made using the so–called impulse response function, i.e., function of a GDP and public debt response to an impulse resulting from one unit changes of public debt and GDP respectively.
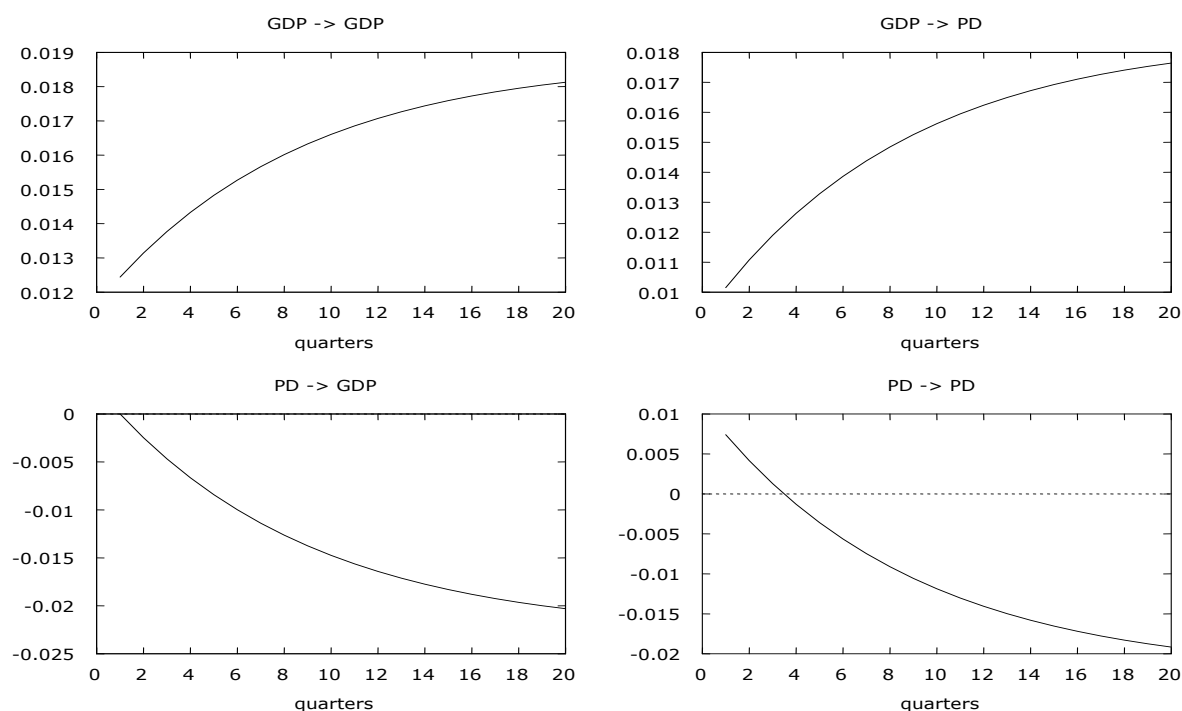
Figure 3. Impulse response function of gross domestic product (GDP) and public debt (PD) to a one shock in public debt and gross domestic product

Source: Own calculations.

On the basis of above figure, it was noted one shock change in GDP led to the gradual growth of GDP over the next twenty quarters from the time of shock, and subsequently to stabilization. What is more, the increase of GDP led to increase in the size of public debt over next 20 quarters, and then to gradual stabilization. The situation seemed differently in the case of GDP reaction to changes in the size of public debt. The increase of public debt led to the gradual decrease of GDP over the next twenty quarters, and subsequently to gradual stabilization. However, one shock change in size of public debt led to an immediate increase in public debt and then to gradual decline during the next twenty quarters. The last step of the analysis was the residual component variance decomposition of public debt and GDP, in order to estimate the impact of these factors on the variability of GDP and public debt respectively in the EU.

Table 2. The *error variance decomposition* for public debt and gross domestic product in the EU in the period 2000–2010

The number of quarter after shock	The *error variance decomposition* for variable PD		The *error variance decomposition* for variable GDP	
	PD	GDP	PD	GDP
1	34,7	65,3	0,0	100,0
2	24,3	75,7	1,8	98,2
3	16,8	83,2	5,1	94,9
4	12,5	87,5	9,1	90,9
5	11,2	88,8	13,2	86,8
6	11,9	88,1	17,1	82,9
7	13,8	86,2	20,8	79,2
8	16,4	83,6	24,1	75,9
9	19,3	80,7	27,0	73,0
10	22,1	77,9	29,7	70,3
11	24,9	75,1	32,1	67,9
12	27,5	72,5	34,2	65,8
13	29,9	70,1	36,1	63,9

The number of quarter after shock	The *error variance decomposition* for variable PD		The *error variance decomposition* for variable GDP	
	PD	GDP	PD	GDP
14	32,1	67,9	37,7	62,3
15	34,0	66,0	39,2	60,8
16	35,8	64,2	40,6	59,4
17	37,4	62,6	41,8	58,2
18	38,9	61,1	42,9	57,1
19	40,2	59,8	43,9	56,1
20	41,4	58,6	44,8	55,2

Source: Own calculations.

In accordance with data in above table it can be noted that GDP changes accounted for 87% of the public debt variance in the EU after fourth quarter and nearly 59% after twentieth quarter. For comparison, changes in the size of the public debt in the EU explained about 9% changes of GDP at the end of the fourth quarter and close to 45% after twentieth quarter.

The impact of public debt on economic growth and the impact of economic growth on public debt significantly varied in size among the individual EU member countries. Namely, the highest absolute values of impact coefficients of public debt to GDP were affirmed in Spain and Ireland, and the lowest value in Latvia. On the other hand, the highest absolute values of impact coefficients of GDP to public debt were found in Finland and the smallest in Spain, Ireland, Slovenia, Sweden, Denmark, Netherlands and Cyprus.
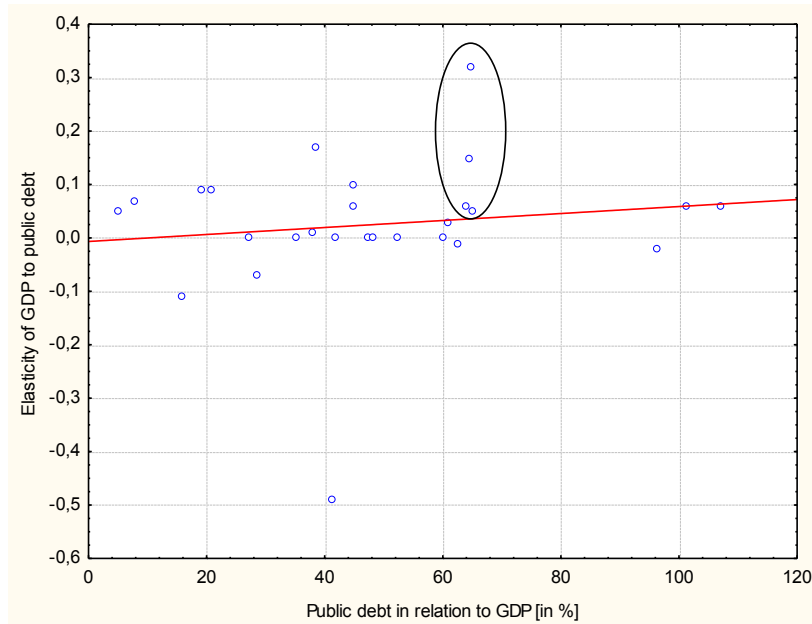
Table 3. Elasticity coefficients of public debt to GDP and elasticity coefficients of GDP to public debt in the EU member countries in the period 2000–2010

| Country	GDP → PD	PD → GDP
Belgium	0,01	–0,02
Bulgaria	–0,04	0,01
Czech Rep.	0,02	–0,07
Denmark	–0,06	0,00
Germany	0,02	0,05
Estonia	0,08	0,05
Ireland	–0,29	0,00
Greece	0,07	0,06
Spain	–0,32	0,00
France	0,03	0,06
Italy	0,05	0,06
Cyprus	–0,04	0,00
Latvia	0,00	–0,11
Lithuania	0,05	0,09
Luxembourg	0,02	0,07
Hungary	0,09	–0,01
Malta	0,01	0,32
Netherlands	–0,01	0,00
Austria	0,01	0,15
Poland	–0,01	0,06
Portugal	0,03	0,03
Romania	–0,02	0,09
Slovenia	–0,24	0,00
Slovakia	0,03	0,17
Finland	0,03	–0,49
Sweden	–0,12	0,00
UK	0,02	0,10

Source: Own calculations.

Analyzing values of elasticity coefficients of GDP to public debt and public debt to GDP in each of the EU member countries it was identified certain regularities. Generally speaking, it was found the highest, positive impact of public debt on GDP in these EU member states, in which the share of public debt in GDP was close to 65%. Therefore, such a share of public debt in GDP was an optimum from the impact of public debt on economic growth point of view.

Figure 4. Elasticity of GDP to public debt and the ratio of public debt to GDP in the EU member countries in the period 2000–2010

Source: Own calculations.

Taking into account the values of elasticity coefficients of public debt to GDP and public debt to GDP in the EU member countries it was not identified a significant relationship between these variables. However, it should be noticed that the negative values of elasticity coefficients of public to GDP were confirmed in these countries where the share of public debt in GDP was between 20% and 60%.
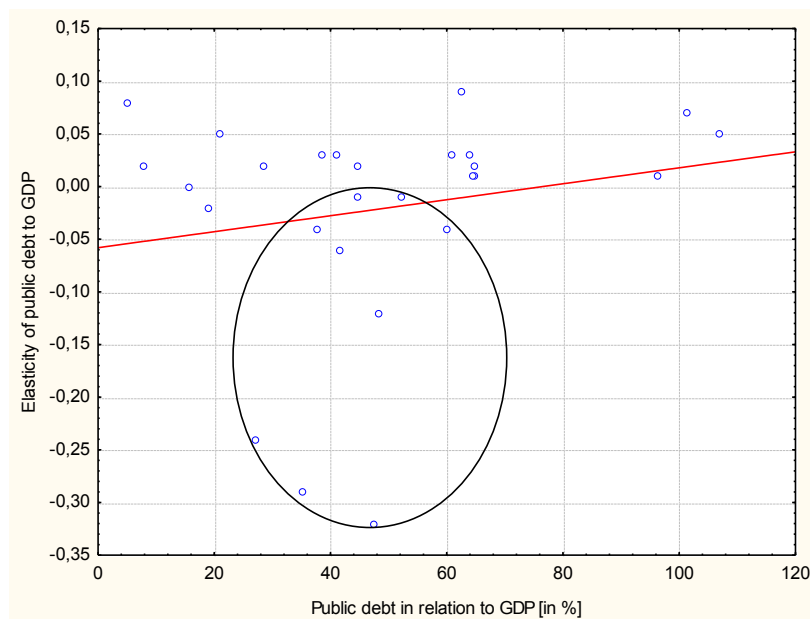
Figure 5. Elasticity of public debt to GDP and the ratio of public debt to GDP in the EU member countries in the period 2000–2010

Source: Own calculations.

To sum up, an optimal share of public debt to GDP, expressing the highest, positive impact on economic growth in the EU member countries was close to 65%. While the negative impact of economic growth on the size of public debt was found in these EU member countries, whose public debt was from 20% to 40% of GDP.

Taking into account public debt forecasts to 2020 in selected developed countries and emerging markets made by Deutsche Bank, it should be noted that among examined EU member countries, we should expect a positive impact of public debt on economic growth in Poland, Czech Republic, Hungary and Romania, in which public debt will be closest to the optimum level in 2020.

Table 4. Matrix of public debt projections by 2020 in selected EU member countries

Developed countries			
The share of public debt in GDP/Tendency	**Low (debt ratio<73.7)**	**Medium (73.7<debt ratio<131.4)**	**High (debt ratio>131.4)**
Falling	Denmark, Sweden	Belgium	Italy
Stable		Germany, Ireland, Spain	
Increasing		France, Slovakia, UK	Greece, Portugal
Emerging markets			
The share of public debt in GDP/Tendency	**Low (debt ratio<20)**	**Medium (20<debt ratio<52.2)**	**High (debt ratio>52.2)**
Falling			
Stable			Poland
Increasing			Czech Rep., Hungary, Romania

Source: Deutsche Bank Research (2010).

However, according to data reported in the above table, the most of developed EU member countries will perceive a negative impact of public debt on economic growth in 2020, because the level of public debt in these countries will significantly exceed its optimal size,

5. Conclusions

On the basis of the results of investigation concerning the relationship between public debt and economic growth in the EU during the first quarter of 2000 to the first quarter of 2010 we can point at several key conclusions.

Firstly, it was found that one of the factors that determined GDP growth in the EU in the period 2000–2010 were changes in public debt. Namely, average elasticity coefficient of public debt to economic growth amounted to –0.3. On the other hand, one of the factors which determined the size of public debt in the EU in the period 2000–2010 was changes in GDP. In this case, average elasticity coefficient of GDP to public debt in the EU amounted to 0.4. Moreover, it was estimated that changes in GDP accounted for public debt variability in much more degree than the scale in which public debt changes accounted for GDP variability in the EU.

Secondly, it was found that elasticity coefficients of public debt to economic growth and economic growth to public debt significantly differed in the individual EU member countries. The highest absolute values of impact coefficients of public debt to GDP were reported in Spain and Ireland, but the lowest value in Latvia. However, the highest absolute values of impact coefficients of GDP to public debt were found in Finland and the smallest in Spain, Ireland, Slovenia, Sweden, Denmark, Netherlands and Cyprus.

Thirdly, it was affirmed that the highest, positive impact of public debt on GDP took place in the EU member countries, where the share of public debt in GDP was close to 65%. What is more, there was not found a significant relationship between the values of elasticity coefficients of GDP to public debt and the share of public debt in the GDP in individual EU member countries, but it was noted the existence of negative values of elasticity coefficients of public debt to GDP in these countries where the share of public debt in GDP was from 20% to 60%.

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