

The sensitive symmetries

“The participative symmetry – to both the effort and to the effect – of the factors and agents is not an ideological pretence, but the primary condition of the natural purpose of economicity.”

Today's crisis has highlighted the Economics users' predisposition to neglect the signalling formulas which are specific to the fundamentals. In fact, as it stands the crisis is the result of these signals not being taken into consideration. The most serious offense was the ignoring of correlations and proportionalities. It is known that the correlative grid between the elements located deeper in the generic substrate of economicity is built on the tensed binomial of the human condition and of human nature. Their fields of competence are found in a structural conjunction, conditioning each other in accordance with the specific patterns of the complex systems wherein learning is a self-corrective function. Particularly, the crisis is the distinct consequence of failing the lessons of past evolutions.

Functionality in the space of economic rationality is possible when the dimensions, the intensity and the duration of the specific vectors of engagement for the factors and agents, which can be found in the extent and the consistency of the economic processes and phenomena, take well determined correlative values. We could call them prevalent constants of size and rhythm, mathematical ratios occurring at intervals with invariable limits, a genetic distribution of effects or a priority order of the impulses according to rational motivation.

Without a doubt, the equation is the formalized expression of the representation of correlations. All correlations, including the ones without a result, even though they belong to the space of intersubjectivity which is interested in utility – in randamental terms, have as a direct expression the actional harmony and the equilibrium of the benefit. From input to output, in quantitative guise, and from intention to consequence, in qualitative guise, there are drawn out the relations of size, prevalence and pre-eminence, speed, volume, terms and level. Economic

thinking asserts, calculates, tests and corrects proportions, equilibriums, disparities, deficits or dynamic conditionalities regarding sustainability, durability, participation, cohesion, convergence, development and modernisation.

In sui-generis guise, Economics doesn't think any different than Physics when it dissects the structure and evolution of the universe. Economics is interested in the relationships between its fundamental elements. These elements are of a subjective and objective nature in the complex context of the dimensioning of the utility. This is why the science makes use of correlative parameters of a positive nature between the various processes of growth, or uses rules of conduct, such as the limits between the consequences of the various phases of the economic circuit, with the most used example being "let's consume less than we produce".

The diversity of the parameters is reducible to two alignments: the first, with two levels: one for targeting the correlation between the main economic factors – work and capital, and the other for dealing with the correlative aspects between effort and effect; the second alignment is represented by the control panel of Macroeconomics. The focusing in the first level is realized by the correlation between the increase in productivity and revenues, in a manner which extends to the specific areas of contribution of each factor – and not just regarding salary. The level of efficiency contains the key to the social finality of the economic processes and the foundation of economic power. The macroeconomic panel establishes performance, certifies the value of economic governance and insures the potential for progress.

For an economy to function it needs to keep fair relationships between size and rhythm for each component between the two alignments, the micro-level generic rule being the expansion of the business cycle (revenues greater than expenses) and the macro-level rule being the participative economic growth (effects of wealth and of development). Functioning by respecting the correlations gives satisfaction to the reasons for the existence of the economy, which are situated in the structure of the human condition, and they pertain to work, labour and action.

For an economy to perform though, it needs a much finer tuning, to the level of the profound substrate of the weave determined by the human nature. Here the adjustments are in accordance with the ineffable elements of the nature of motivations, the imponderable behaviours stemming from hopes and expectations, the identity-dimensioned projective ambitions, the emotional solutions, the subjective calculations or the irrational beliefs, the egotistic drives or the excessive risk-taking. The range of elements multiplies according to context. It must be pointed out that Economics is shy in the cognition of this part of its fundamental area.

The most important aspect in need of solving is something entirely delicate, which almost defies the rational propensity of the economic approach; in any way,

it is hardly perceived and completely ignored by theorists, regardless of their doctrinary inclination. It is the need to include the sentiment of proportions into the understanding of the problems and into the validation of solutions. Its real sense springs from the claiming of rights, the interior impulse which attests the existence of the conscious participation to the economic process of those who shape and give content to the input and the output, to the effort and to the effect. The fine tuning means the validation of the recompense, the symmetrical perception of the obligations not between the abstracts of work and capital, but between the possessing subjects.

By and large, the participative symmetry – to both the effort and to the effect – of the factors and agents is not an ideological pretence, but the primary condition of the natural purpose of economicity. The correct consequence of economicity remains an illusion when the symmetric engagement of roles and statuses is not respected, or it could be at most a result obtained by forcing the imbalance between rights and obligations. Success comes from the balanced distribution of the rights, where the postmodern obsession for the equality of chances is to break through the wall which obscures from sight the sensitive symmetry.

The long line of positive discrimination practices in favour of entrepreneurship, starting with the limited responsibility and culminating with the staying of bankruptcy on the grounds that the business is too large, demonstrates the absence of symmetrical vision in establishing the paths toward comfort and cohesion. Without internalizing the intensionality of the symmetries in the configuration of economic reality, the theorists stumble through the black hole of formal knowledge and occasionally escape from it by masquerading as the horsemen of the apocalypse.

Ignorance does not excuse, it accuses!

Marin Dinu

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Sustainability of the public debt and the financial crisis

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Abstract. *The European Union sovereign-debt crisis brings up again the problem of current account sustainability, the fiscal policy sustainability and the public debt sustainability, as well as the interconditionality between them. On the background of the severe structural problems, the lack of competitiveness has constituted the main factor resulting in the severe deterioration of the European public finances. The external deficits have put additional pressure upon the fiscal deficits. Practically, they entered a vicious circle, to a great extent due to the extremely different economic evolutions of the weak economies opposite to the strongly structurally advanced and solid economies. This study makes a risk analysis of the public debt sustainability in Romania for the period 2010-2015, under the circumstances in which it will enter the Euro zone in the near future.*

Keywords: public debt sustainability; primary surplus-generating capacity; Euro crisis; financial crisis.

JEL Codes: E62, H63.

REL Code: 8K.

1. Introduction

Each financial/economic crisis has its own individual features, but most of them have a number of common characteristics. This also applies to the current world crisis. Charles Kindleberger's paper "*Manias, Panics and Crashes*" transformed Hyman Minsky's typology into a more modern expression. The Euro zone experienced, besides the entire world economy, each of the steps described below. Until 2008, the moment when the crisis appeared in USA, The Euro zone improved well enough. The Euro zone specific problem was that many of the constituent economies could not have finished the convergence process which had been started before 1999. Moreover, some of them even recorded deviations from the levels considered as sustainable: first of all, the competitiveness of the participant states was extremely heterogeneous, this resulting in unsustainable current account deficits and external debts; secondly, the public sectors deficits and, consequently, the levels of the public debt were not sustainable in some of the countries; thirdly, also the private sector deficits proved to be unsustainable and, consequently, the levels of the private debts. According to the typology of Minsky/Kindleberger⁽¹⁾, the crises have the following evolution:

1. The events start with a "dislocation", an exogenous shock outside the macroeconomic system (a war, adoption, to a large extent, of a new invention, a political event, etc.).
2. The extension of the bank loan results in the increase of the money supply and it supplies the economic growth. This may result in the creation of new banks, in the development of new loan instruments and in the unlimited extension of the personal loans until the moment when the phenomenon practically becomes impossible to be controlled.
3. The demand increases, the prices also get increased, new profit opportunities, new companies and investors appear. The revenues increases stimulate the additional investments, new increases of revenues...
4. The soap bubbles develop. The excessive trade extends from one country to another, through arbitration for goods and internationally traded assets, the capital flows or, simply, the psychological effects of transmission. The interest rates, the velocity of money and the prices, all of them continue to get increased. Some initiates profit and sell everything.
5. Financial disaster. Everybody start to be aware of development of a rush for cash – in order to get rid of assets and to obtain cash –, this resulting in some speculative lenders' incapacity to return their loans. As the disaster persists, the speculators realize that the market cannot grow more. It is the moment for them to draw back, and the rush to transform the real or financial assets into cash for a long term turns into panic.

6. Crisis. The trigger may be the failure of a bank or of a big company/corporation, the revealing of a cheat or of a defalcation, or a price decrease of the initial speculation object. The prices get decreased. The bankruptcies get increased. Closeout is sometimes required, but this cannot degenerate into panic. The banks cease to grant loans for collateral assets, of which prices get decreased.

When the crisis occurred, the states recording unsustainable positions from the points of view described above proved to be extremely vulnerable, with all the risks deriving from here. When the crisis appeared in the whole world, it shook even the most solid European economies, and, until the end of 2009, the Euro zone entered the first stage of a severe public debt crisis. On the background of the severe structural problems, the lack of competitiveness has constituted the main factor resulting in the severe deterioration of the European public finances. The external deficits have put additional pressure upon the fiscal deficits. Practically, they entered a vicious circle, to a great extent due to the extremely different economic evolutions of the weak economies opposite to the strongly structurally advanced and solid economies. The European Union sovereign-debt crisis brings up again the problem of the interconditionality between the current account sustainability, the fiscal policy sustainability and the public debt sustainability. The recent crisis has demonstrated, one more time, the fact that the pro-cyclical fiscal policies, the lack of structural reforms and the lack of support for pro-increase and competitiveness structural reforms have generated external imbalances, unsustainable public debts accompanied by high risks of non-payment of the debt service.

2. Public debt sustainability. Effects of a monetary union

The problem of the budget deficit *sustainability* is as follows: the budget deficit determines the increase of the public debt, which will have to be paid in the future. If the interest rate to the public debt exceeds the economic growth rhythm, the public debt will increase faster than the gross domestic product. Eventually, this dynamics results in unsustainable deficits which require corrective actions. Formally, the dynamics of the debt can be analyzed starting from the definition of the government budget constraint.

$$\begin{aligned}
 G - T + r \times B &= \Delta B + \Delta M \\
 (g - t) + r \frac{B}{Y} &= \frac{\Delta B}{Y} + \frac{\Delta M}{Y} \\
 \left(\frac{B}{Y} \right)' &= \frac{B' \times Y}{Y^2} - \frac{B \times Y'}{Y^2} \rightarrow \dot{b} = \frac{\Delta B}{Y} - \frac{B \times \Delta Y}{Y^2} \rightarrow
 \end{aligned} \tag{1}$$

$$\frac{\Delta B}{Y} = \dot{b} + \frac{B}{Y} \times \frac{\Delta Y}{Y} \quad (2)$$

If we introduce equation (1) into equation (2), we will obtain

$$(g - t) + r \times \frac{B}{Y} = \dot{b} + \frac{B}{Y} \times \frac{\Delta Y}{Y} + \frac{\Delta M}{Y}$$

Noting, $\frac{\Delta Y}{Y} = x$ the result will be

$$\dot{b} = (g - t) + (r - x) \frac{B}{Y} - \frac{\Delta M}{Y} \quad (3)$$

If $r < x$, then either a budget surplus ($g - t$) or a money supply will be necessary. The ratio debt/GDP will become stable when

$$(r - x) \frac{B}{Y} = \frac{\Delta M}{Y} + (t - g) \quad (4)$$

Equation 4 shows that when the interest rate to the government debt gets increased faster than the GDP, the ratio between debt and GDP gets increased without limits. In other words, the deficit may explode. The increase of the debt accumulation can be stopped if the primary deficit (expressed as a percentage of the GDP) turns into surplus ($g - t < 0$). Thus, if the interest rate exceeds the rate of economic growth, either the stabilization of a primary surplus ($t > g$), or the increase of the money quantity will be necessary, which has to be enough so as to stabilize the ratio between debt and GDP (by Grauwe, 2003). On the other hand, relation 4 shows that the stabilization of the public debt at its sustainable level depends on the following: a national economy's capacity to generate primary surpluses, the interests to which the markets grant loans to the state, according to the attached risk premium, as well as its own rate of economic growth.

If a country is part of a monetary union, then the effects are the more important. A country encountering problems related to the sustainability of the budget/public debt sustainability generates negative externalities within that monetary union. In case a country allows the increase of the current budget deficit so that the interest rate to the government debt exceeds the rate of economic growth, then it will be constrained to appeal more and more frequently to the capital markets from the monetary union, thus generating pressures meaning the increase of the interest rates. But the increase of the interest rates results in the increase of the debt burden for the other countries from the monetary union. If the governments of these countries decide to stabilize the ratio between debt and GDP, they will be forced to adopt restrictive fiscal policies. Consequently, an unsustainable increase of some countries' budget deficits will force other countries from the monetary union to follow deflationary policies and exactly these countries support the necessity of a control mechanism which makes the restrictions for the extent of the budget deficits possible. Another possible negative externality of the unsustainable budget deficits affect the central bank from the monetary union (ECB). The countries affected by the increase of the interest rates may put

pressures upon the central bank, meaning the relaxation of the monetary policy. Thus, the unsustainable fiscal policies promoted by the national governments may come into conflict with the monetary policy which covers the entire monetary union (Grauwe, 2003).

Determining the limit of the sustainable public debt and of the insolvency

The sustainability relation described above may also be viewed from another perspective. Thus, the relation between the term $(r-x) \times d$, which does not represent but *the net financing need*, and (pb) – primary surplus, or rather *a country's capacity to generate primary surpluses* (as it is described in IMF, 2011) determines *the sustainable level of a country's public debt*. (Figure 1). It is well known that a higher and higher level of the public debt determines a less and less sustainable fiscal policy and debt. This is because – *ceteris paribus* – a higher debt supposes a higher primary surplus in order to support it. Moreover, higher rates of the debt in the GDP are usually associated with higher interest rates and, very likely, low rates of economic growth, this creating, again, a primary surplus which is too high to be able to balance the situation again. Hypotheses such as the existence of high interest rates or of a low economic growth, for example, result in a less favorable dynamics of the public debt, thus requiring an increase of the primary balance in order to stabilize the share of the public debt in the GDP, which could further determine modifications in the analysis related to the debt sustainability.

The empirical evidences show that the countries starting from high shares of the public debts in the GDP are more sensitive to the shocks determined by the increase of the interest rate and/or by the decrease of the economic growth rate. The higher the initial level of the debt, the greater is the impact of a given increase of the interest rate or of a decrease of the economic growth upon the primary surplus required to maintain the debt stable. Beside certain levels, a higher level of the public debt results in a low rate of economic growth on a long-term (Kumar, Woo, 2010).

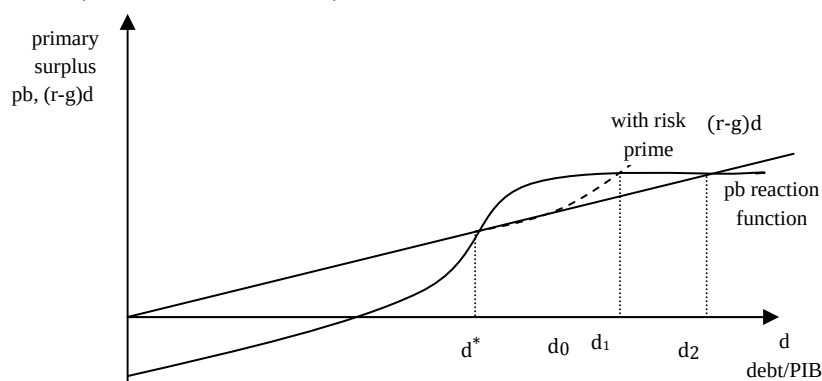


Figure 1. Limit of the sustainable debt

Point d^* is the point in which $(r-x) \times d$ is equal to pb and it represents the sustainable level of the public debt. We can notice that in the first part of the chart the curve describing the primary surplus-generating capacity (pb reaction function) is more elastic than in the second part. This means that, starting from the initial levels of a low debt, then the necessity to generate a primary surplus is quite low. In the second part, the primary surplus-generating capacity saturates, this meaning that, beside the level d^* , any increase of the debt results in a necessity to generate much higher primary surpluses. As we have previously shown, if the own rate of economic growth is lower than the interest to which the state grants loans, then it is necessary to generate primary surplus in order to stabilize the debt. An economy's primary surplus-generating capacity is determined based on an estimation made for the reaction function of the fiscal policy.

3. Public debt sustainability in Romania. Effects under the terms of entry into the Euro zone

Under the terms of Romania's proposing to be part of the Euro zone, we make further a risk analysis for Romania's public debt sustainability for the period 2010-2015, after a procedure calibrated according to the public debt sustainability made by World bank experts, the resulting toolkit providing indicators able to identify the risks and vulnerabilities of the debt. This toolkit uses three categories of variables as inputs: macroeconomic, budgetary and related to the debt, making calculations starting from the trajectory of the public debt in the GDP to the profile of the public debt, making an analysis of the risks related to re-financing and cash, by using Monte Carlo simulations. Moreover, we may estimate the risks associated with the shocks upon the public debt as a result of various hypotheses related to the evolution of the rate of exchange, of inflation and of the real GDP increase rate, thus generating various stochastic scenarios.

The inputs necessary to the analysis are divided into three categories: a) Macroeconomic variables (the real economic growth rate, the initial GDP, the domestic inflation rate, the foreign inflation rate, the share of the tradable goods sector in the GDP, the rate of exchange and the real interest rate to the initial debt and to the new debt – domestic and foreign); b) Budgetary variables (the share of the primary budget balance in the GDP and the initial payments with interests to the public debt) and c) Variables related to the public debt (the initial weight of the debt in the GDP expressed in national currency, the maturity profile for the initial debt stock expressed in the national currency, the initial share of the debt in the GDP expressed in foreign currencies, the maturity profile for the initial debt stock expressed in foreign currencies, the share of the

debt in the newly created debt expressed in foreign currencies and the maturity profile of the newly created debt).

In the first scenario, we analyzed the public debt sustainability based on the official macroeconomic hypotheses of the National Forecast Commission and the Ministry of Public Finance. The share of the tradable goods sector has been estimated based on the added value brought by the output in the total added value. The real rate of interest has been calculated based on the data provided by the National Bank of Romania. The estimates for the primary budget balance have been based on the hypotheses provided in the Government Debt Management Strategy for 2011-2013. Considering the macroeconomic data from the official scenario, we have obtained a trajectory for the dynamics of the public debt, which is presented in Table 1.

Table 1

The dynamics of the public debt – The official scenario

Years	Debt to GDP (%)	Total debt dynamics mld Ron
2010	34.29	180,0
2011	36.74	205,9
2012	38.43	227,9
2013	38.56	242,6
2014	37.87	251,9
2015	37.45	249,6

Source: author's calculations.

We can notice that the share of the public debt in the GDP will increase from 36.7% in 2011 up to 38.6% in 2013, and then tending to decrease up to 37.9% in 2014, 37.45% in 2015, respectively as a result of the high rates of economic growth taken into account and of the decrease of the real interest rate. Moreover, the primary deficit as a share in the GDP is improving from 2.7% of the GDP in 2012 up to 0.5% of the GDP in 2014.

In the second scenario, we have introduced four hypotheses with a high realism degree, accounting for the nature of the new macroeconomic European framework and the new domestic macroeconomic situation. Thus, we have considered as follows: the decrease by one percent of the economic growth rate in each of the years 2012/2015; the increase by one percent of the real interest rate in each of the years 2012/2015; the increase by one percent of the primary budget deficit in each of the years 2012/2015 and the maintenance of the estimates for the domestic inflation, the foreign inflation and the share of the tradable goods in the GDP.

Table 2

The dynamics of the public debt – The pessimistic scenario

Years	Debt to GDP (%)	Total debt dynamics mld Ron
2010	34.29	180,0
2011	36.74	205,9
2012	39.95	236,2
2013	39.64	249,4
2014	41.26	274,5
2015	41.98	280,7

Source: author's calculations.

The sensitivity analysis for the public debt in the hypothesis of the pessimistic scenario shows a share of the public debt in the GDP of 39.95%, this representing an increase by 1.5 percents of the GDP compared to the estimate made in 2012 for the same year. The major difference for the public debt dynamics in the two estimates is given by the fact that, in the pessimistic scenario, the share of the public debt marginally decreases in 2013, up to 39.64% of the GDP, and then it increases in 2014 up to 41.26% of the GDP (in the optimistic scenario, the share of the public debt in the GDP was getting marginally increased in 2013 compared to 2012, from 38.43% of the GDP up to 38.56% of the GDP, after which it was getting decreased in 2014 up to 37.87% of the GDP).

Moreover, the result of the calculations made was that the constant primary surplus necessary to stabilize the public debt to the level from 2011, considered sustainable for the Romanian economy (namely 37% of the GDP), is 0.3% of the GDP (the hypothesis of the official scenario) and 0.8% of the GDP (the hypothesis of the pessimistic scenario). As solutions for improvement of the debt sustainability and/or risk management, we may propose: the annual review of the government public debt management strategy or, whenever the market conditions and/or the financing needs require it; maintenance under control of the refinancing risk through *bond exchange* instruments (conversion of the medium-term securities into long-term securities) and *buyback* (rebuying securities in advance) – these instruments being specific to the secondary securities market; extension of the securities due time by issuing a significant proportion from the financing need with medium and long-term due times, obtaining loan contracts from international financial institutions with medium and long-term due times, the development of a financial buffer in foreign currency which could cover the financing need of the deficit and the refinancing of the public debt for approximately four months; the active management of the cash by placing fixed-term deposits at the Romanian financial institutions, collateralized with securities; the performance of repo and reverse repo operations (buying securities with the seller's obligation to rebuy them at a higher price within the term agreed in the convention); conventions agreed with

the pension funds from pylon 2 so that they could rebuy the securities on a medium and long term; the analysis of the opportunity to rebuy, in advance, for certain loans previously agreed upon at very high interests, mutually agreed with the financing institutions; the issuance of inflation indexed securities on the domestic market (especially for the population and for the banks, in order to diversify the risk); the decrease of the foreign exchange risk by increasing the share of the government public debt denominated in lei in the total debt; the active management of the foreign exchange risk by using foreign exchange swap instruments; the active management of the interest rate by using the interest rate swap instruments; the increase of the share of the public debt with fixed interest; the development of the occurring opportunities related to the financing on the foreign markets; the constant going out on the foreign markets in order to increase the investors' confidence.

Conclusions

When the crisis appeared in the whole world, it shook even the most solid European economies, and, until the end of 2009, the Euro zone entered the first stage of a severe public debt crisis. On the background of the severe structural problems, the lack of competitiveness has constituted the main factor resulting in the severe deterioration of the European public finances. The external deficits have put additional pressure upon the fiscal deficits. Practically, they entered a vicious circle. One of the main lessons of the current crisis for a country, and much more for a country which is part of a monetary union or which prepares itself to enter a monetary union, is that the public debt sustainability becomes an essential condition. The public debt stabilization to its sustainable level depends on the following: a national economy's capacity to generate primary surpluses, the interest to which the markets grant loans to the state, according to the attached risk premium, as well as its own rate of economic growth. This means that the idea of debt sustainability must be thought of in individual terms, as long as it depends on its own economic conditions. As for Romania, the risks related to the above-mentioned estimates – both scenarios – may be considered to be of medium intensity. The risks are rather related to the necessity to generate primary surplus in order to stabilize the debt at its sustainable level.

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Note

⁽¹⁾ Adapted from Llewellyn and P. Westaway, 2011.

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The lending channel and budget balance: empirical evidences from Central and Eastern European economies

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Abstract. *The study aims to deepen the analysis on the indirect dependence of government budget balance on private sector credit flow in the countries of Central and Eastern Europe. The added value of this approach consists of two elements. First, the analysis suggests developing the traditional analytical framework of assessing risks to public finance stability by including second round effects of negative fiscal impulses on credit to private sector during recession periods. Second, the study provides empirical evidence on the importance of economic growth transmission channel for the impact of credit accelerator effects on primary deficit. At the same time, nonperforming loans channel proved to be insignificant, especially in relation to the persistency of last year's budget deficit and the effects of budget allocations pro-cyclicality. However, loan portfolio quality seems to be more relevant in the case of public debt service, through its influence on the evolution of the yield on long-term government securities that is closely related to sovereign risk premium. Nevertheless, strengthening the financial safety net by the introduction of resolution funds will most probably break the link investors saw between credit portfolio quality and the impending increase in budget spending. This expected development across not only CEE countries, but at the EU level also, will facilitate the isolation of sovereign risk premium from non-performing loans' dynamics.*

Keywords: credit flow; primary balance; debt service; GDP growth; nonperforming loans; CEE economies; panel regressions.

JEL Codes: C32, E32, E44, E47, G21.

REL Code: 11C.

1. Introduction

Banking system stability and public finances sustainability are mutually reinforcing each other in the long-term. Promoting a conservative macro-prudential policy, which favors a relatively constant credit supply dynamic and close to growth potential, contributes to maintaining the cyclical component of budget revenues at around zero. At the same time, implementing a disciplined budget policy creates the prerequisites of a favorable development in the trading book value of credit institutions, where government bonds play a leading role.

The traditional approach in addressing the interaction between the budget deficit and credit to private sector has at its centre-point the crowding-out effect during recessions. The more government borrows from the local market, the lower credit supply to nonfinancial corporations and households is. Fewer private sector financing puts additional pressure on GDP contraction, which degenerates later on in lower reimbursing capacity of debtors. Hence, second round effects of crowding-out the private sector lead to both lower fiscal revenues and higher nonperforming loans in the banking sector.

Moreover, a procyclical fiscal policy during a period of economic boom can contribute to the accumulation of systemic vulnerabilities in the banking sector, by excessively feeding the demand for loans with modest multiplier effects in the economy. The rapid growth of bank intermediation in emerging Europe countries, in the context of accelerated households' income, generally regarded as a sign of economic catching up with Old Europe, captured particular and equal attention from both investors and policymakers (Duenwald et al., 2005, Sirtaine, Skamnelor, 2007), just a few years before the transatlantic financial crisis. Excessive credit growth, followed by strong contractions of private sector financing, amplifies both the economic volatility and the asset prices fluctuations. The financial accelerator mechanism reflects the role of financial markets in reinforcing and spreading macroeconomic shocks, against the background of fiscal vulnerabilities. In this respect, Bernanke (2007) shows that the financial system is not an independent source of vulnerability, but it acts as an amplifier of exogenous shocks.

The degrees of freedom fiscal policy has at its disposal to stabilise the economy by stimulating aggregate demand at the first signs of recession are strictly bounded by the level of budget deficit and that of public debt stock at the onset of the crisis. Expansionary fiscal policy on the background of vulnerable public finance is counterproductive as the increase of budget deficit is accompanied by rocketing developments in the cost of borrowing for the government, which is transmitted later on to the private sector via risk premium. Hence, although private sector's turnover benefits from stronger

public demand, the net result falls into negative territory as the financial expenses increase more than revenues.

Topical issues on fiscal vulnerabilities have marked an outstanding return on the public agenda since the beginning of the sovereign debt crisis in some of the euro zone countries (Hayes, 2011, Baldacci, MaHugh, Petrova, 2011). Large budget deficits and strong reliance on external funds were highlighted as the main early warning indicators of sovereign debt crisis. Moreover, booming public debt along with population ageing induces additional financing and solvency vulnerabilities to fiscal policy (Stoian, 2011). Furthermore, recent researches pointed the role of sovereign risk premium in linking budget balance, financial conditions, monetary policy and external position of the economy (Fouejieu, Roger, 2013).

The authorities' reaction to address challenges posed by budget vulnerabilities was represented by a mix of fiscal increases with expenditures adjustments. These solutions led, however, to depressed reimbursing capacity for households and nonfinancial companies, while banks strengthened credit standards amid deteriorating banking books. Furthermore, lower credit growth and, especially, deleveraging affects the liquidity in the economy, risking economic depression and, consequently, lower budget revenues.

Against this background, this study aims at investigating the second round effects of fiscal adjustment measures on the budget balance components, transmitted through the credit flow to private sector in Central and Eastern European countries. The operational objective consists in developing a simplified financial satellite with two equations in order to model the indirect dependence of primary budget balance and that of debt service on the credit supply, against the background of GDP growth and long term interest rate, which is strongly connected to the impact of banking book quality on the sovereign risk premium.

The remaining of the paper is organized as follows. Section two describes the methodology underlying the system of forecasting the primary balance and the debt service based on economic growth and nonperforming loans channels. Section three presents the data used in the paper and describes in detail both the economic rationale and the statistical evidence that led to the selection of the explanatory variables. Section four gives an overview of the key empirical issues on devising and testing the set of simplified macroeconomic models of budget balance. The last section presents the main conclusions.

2. The methodological framework

The recent experience of the transatlantic financial crisis suggests that the banking system stability and budgetary developments are strongly interconnected. The analytical framework, used to investigate the impact of

credit exogenous shocks on the evolution of public finance in CEE countries, employs a transmission mechanism with two components, namely economic growth and the quality of banking book (Figure 1).

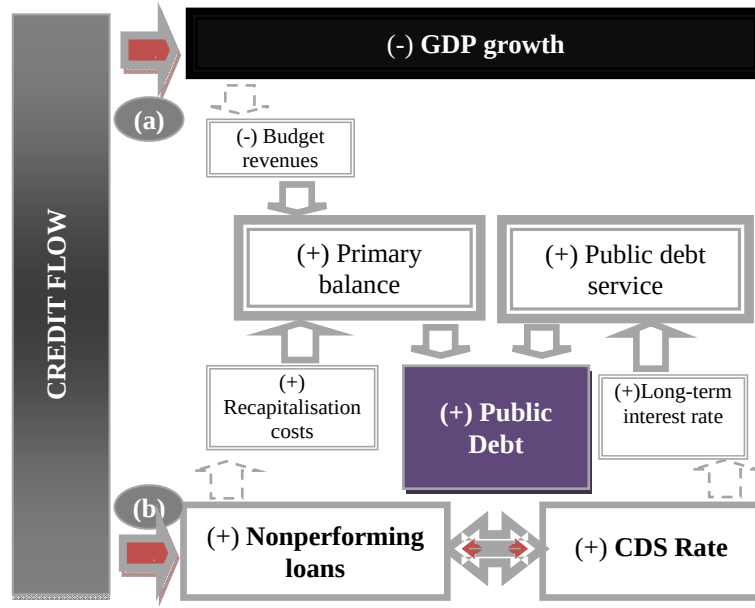


Figure 1. The conceptual model of public finance dependence on credit flow

The public finance stance is expressed exclusively by budget deficit, whose structure is detailed by: (1) primary budget deficit, and (2) public debt service. Public debt is not analyzed separately, given that it forms from the accumulation of deficits, and the 60 percent limit, stipulated by the Maastricht criteria, remains much over the NMS indebtedness level, despite the crisis effects, with one exception only.

(1) Impact on primary balance

Credit flow effects on budget stance spread using two main channels, namely: (a) economic growth, which affects directly proportional tax revenues ($\alpha_1 > 0$), and (b) non-performing loans, which can positively influence budgetary expenditures associated with bailing-out failing credit institutions amid deteriorating banking books (equation 1).

$$\begin{aligned} \text{Primary balance}_t^i &= \alpha_1 \times \text{GDP}_t^i + \beta_1 \times \text{NPL}_t^i + \gamma_1 \times \\ &\times \text{Primary balance}_{t-1}^i + \delta_3 \times M_t^i + C_{1i} \end{aligned} \quad (1)$$

The state budget primary deficit equation includes the persistency component, namely the budgetary balance recorded in the previous year, other relevant macroeconomic factors (M_t^i) as well as structural differences between budgetary policies of the countries in the CEE region, captured by the fixed effects of panel estimation (C_{1i}). Indices "i" and "t" expresses the Member State, respectively the relevant period.

(a) Economic growth transmission channel

The GDP growth transmission channel relies on the credit accelerator theory proposed by Bernanke et al. (1999), showing that increasing credit flow (*Credit accelerator*) feeds consumption and investment, creating space for multiplying the value added in the economy (see relation 2).

$$GDP_t^i = \alpha_2 \times Credit\ Accelerator_t^i + \beta_2 \times GDP_t^{EZ} + \gamma_2 \times LTY_t^i + C_{2i} \quad (2)$$

The functional form of the economic growth explanatory equation also includes the dependency on economic growth in the Euro area (GDP_t^{EZ}), the reversed relation with the level of long-term interest rate (LTY), as well as the structural differences between the economies of the CEE countries, captured through the fixed effects of panel estimation (C_{2i}). Credit accelerator represents the first order difference of the annual credit flow, expressed as a percentage of GDP.

(b) Non-performing loans transmission channel

Non-performing loans (*NPL*) transmission channel is based on the model proposed by Moinescu and Codirlasu (2012), showing that the deterioration of bank portfolio quality is determined by square deviation of credit rate from the potential level of economic growth, recorded two years earlier (see relation 3).

$$dl(NPL_t^i) = \alpha_3 \times (Credit\ flow_{t-2}^i - Potential\ growth_{t-2}^i)^2 + \beta_3 \times Macro_t^i \quad (3)$$

The harmful effect of deleveraging on the reimbursement of existing loans is similar to inefficient allocation of bank resources (Jakubik, Moinescu, 2012), given that the intensification of the struggle for market share and excessive lending increase the risk of financing more unfeasible projects, in the context of loose credit conditions.

The conceptual model for the dynamics of non-performing loans ratio implies the existence of an exponential relationship, in which the set of determinant factors also includes macroeconomic variables such as output gap, changes in average income and exchange rate.

(2) *Consequences on public debt service*

The credit flow effect on public debt service spreads through the impact on long-term interest rates, as a result of sovereign risk premium evolution closely connected with the dynamics of nonperforming loans (Moinescu, 2012). Increasing non-performance of the loan portfolio generates recapitalization needs in banks, sometimes covered only by public resources, and deteriorates investor perceptions of sovereign risk, followed by significant upward movements of CDS rate. Dynamics of sovereign risk premiums is later reflected in the yield required for the issuance of bonds (LTY^i), which, in return, increase the financial burden of the public budget over " l " years (relation 4).

$$Debt\ service_t^i = \alpha_4 \times LTY_{t-l}^i + \beta_4 \times Public\ debt_{t-k}^i + C_{4i} \quad (4)$$

Along with long-term interest rates, public debt service explanatory model also includes the dependence on public debt to GDP by " k " years before (*Public debt*), capturing the positive relationship between government indebtedness and the cost of financing accumulated public deficits. Structural differences between the economies of CEE countries are also captured through fixed effects of the panel estimation (C_{4i}).

The individual impact of macroeconomic factors on dependent variables was estimated applying the least squares method, using inclusively the assumption of fixed effects, in order to capture structural differences between CEE countries.

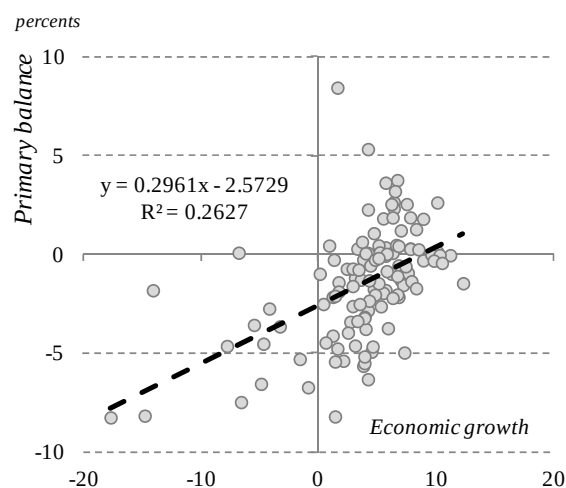
3. Data

The statistics underlying the assessment of the impact which credit has on budget balance in the ten new UE Member States (namely Bulgaria, Czech Republic, Estonia, Lithuania, Latvia, Poland, Romania, Slovenia, Slovakia and Hungary) consists in annual frequency data, covering the period 2000 to 2011.

The main source of used information is represented by Eurostat, from which were extracted data on credit flow to the private sector, economic growth, the number of employees in the economy, average income, foreign direct investment, long-term interest rate, exchange rate, average inflation rate, primary budget deficit as well as public debt service. The data on nonperforming loans rate were extracted from the International Monetary Fund reports on indicators of financial stability, while the sovereign risk premium was calculated based on daily information extracted from Bloomberg platform. At the same time, the data on potential economic growth were extracted from the AMECO database.

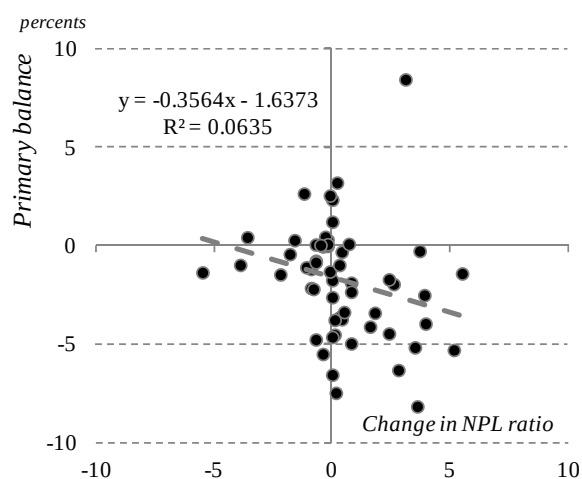
(1) Primary deficit

Preliminary empirical analysis confirms the positive reaction of primary budget deficit balance to economic growth, given that about 30 percent of GDP growth is reflected in the improving budget situation (Figure 2).



Source: Eurostat, author's calculations.

Figure 2. Correlation between primary budget balance and economic growth



Source: Eurostat, IMF, author's calculations.

Figure 3. Correlation between primary budget balance and NPL ratio dynamics

At the same time, increasing non-performing loans leads to a deepening of the primary deficit, but the functional relationship presents a rather low explanatory power (Adjusted R-squared of just slightly over 6 percent). The result is not surprising, given that support from public funds in order to recapitalize credit institutions in the CEE region was only marginally.

The preliminary set of determinant factors of the primary budget deficit was complemented by macroeconomic variables identified in specialized literature as statistically relevant, such as foreign direct investment, labour occupancy rate, the average income in the economy, inflation rate and output gap. Stationarity of the considered indicators was tested. All indicators were I(0) after the appropriate transformation and the first difference. Furthermore, the univariate OLS regression was used to make the first selection of variables based on statistical relevance. The applied procedure tested variables on one-by-one basis up to two lags, including the contemporary impact, for each explanatory variable. A short list of variables was created based on results of univariate analysis (Table 1).

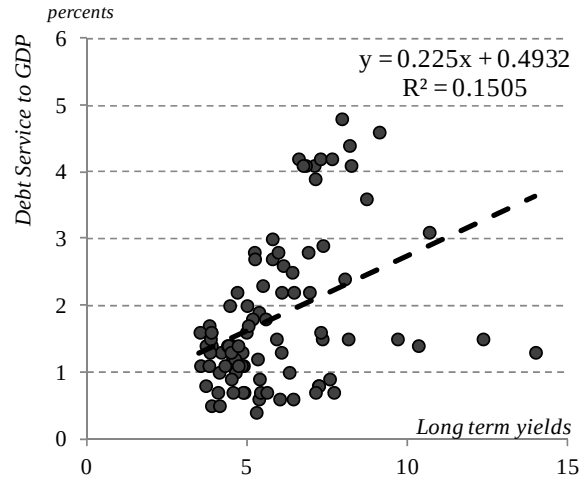
Table 1

Univariate analysis results on primary balance

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Adj. R-squared
GDP growth	0.265969	0.041183	6.458166	0.00	0.415519
Primary balance (-1)	0.566772	0.089722	6.316984	0.00	0.40433
Change in NPL ratio	-0.482034	0.097577	-4.940011	0.00	0.33993
Change in Output GAP	0.306636	0.059763	5.130856	0.00	0.312468
EMPLOYMENT (dlog)	29.96912	6.691503	4.478682	0.00	0.305039
GDP growth (-1)	0.173722	0.04599	3.777416	0.00	0.269516
Inflation	0.13531	0.046415	2.915238	0.00	0.250324
FDIs (dlog)	4.771986	1.716262	2.780453	0.01	0.22477
EARNINGS (dlog)	9.447356	3.216408	2.937238	0.00	0.203824

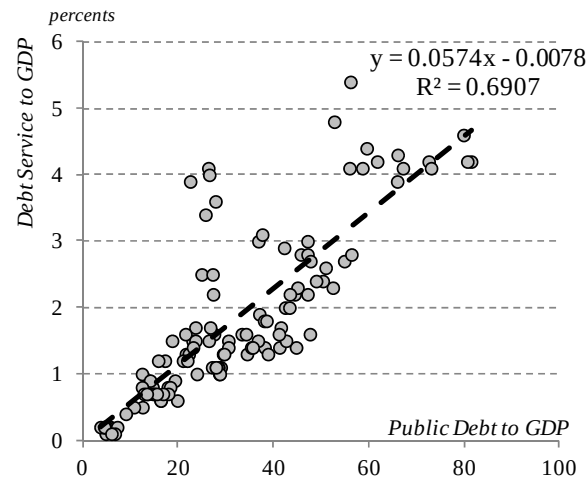
(2) Public debt service

Additional preliminary statistical results show that public debt service reacts directly proportional to the cost of financing, given that about a quarter of the long-term interest rates are reflected in the financial expenditures of the budget (Figure 4).



Source: Eurostat, author's calculations.

Figure 4. Correlation between debt service and long-term interest rate



Source: Eurostat, author's calculations.

Figure 5. Correlation between debt service and government debt to GDP

At the same time, preliminary assessment confirms the strong dependence of debt service to government indebtedness (Figure 5). This intuitive representation was completed by a univariate analysis, both at the same level as well as using first difference, in order to capture any sensitivity to the dynamic of determinant factors. Testing delayed effects used an impact period of up to

two years. In the next step, multivariate analysis was performed. For each explanatory variable contained in the short list the best of its lags of those found statistically relevant were considered, with only one exception (credit accelerator for which both the instantaneous effect and that of one year lag were selected).

4. Multivariate empirical findings

The operational objective of the multivariate empirical assessment was to substantiate the mechanism by which credit growth influences budget deficit components at the level of Central and Eastern Europe countries, by taking into account macroeconomic factors short-listed in the previous section. The analytical component consists of a set of simplified econometric models, built by OLS panel estimation.

The polynomial regression for primary budget balance (equation 1) confirms the importance of economic growth transmission channel (see Appendix 1 for details on its estimated functional form), with a strictly positive coefficient, at more than 99 percent confidence level (Table 2).

Table 2

Estimation output on the primary balance model				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.233081	0.371501	-6.010968	0.0000
GDP Growth	0.211184	0.036417	5.799064	0.0000
Primary balance (-1)	0.418426	0.080825	5.176956	0.0000
Inflation	0.118262	0.049031	2.412001	0.0177
Fixed Effects (Cross)				
_BG--C	1.336338	_HUN--C	-0.120416	
_CZ--C	-0.359051	_POL--C	-0.391813	
_EE--C	1.315453	_RO--C	-1.435136	
_LET--C	-0.568641	_SK--C	-0.542652	
_LIT--C	0.512416	_SLO--C	0.253502	
Adjusted R-squared	0.573776			

Nevertheless, the multifactorial assessment rejects the non-performing loans transmission channel hypothesis (see Appendix 2 for details on its estimated functional form). The banking book quality variable was excluded from the final regression, after running backward estimation procedure. Meanwhile, econometric results show high persistency of the previous year's deficit, given that 40 percent of its value is reflected in current year's deficit.

Budgetary consolidation efforts are affected inclusively by autonomous factors, which significantly differ from one economy to another in the sample, given that the fixed effects range from -1.43 (Romania) to 1.33 percent (for Bulgaria), around -2.23 percent level, which is the constant term of the equation. A slight release of pressure on the primary budget balance comes from the evolution of prices in the economy, given that about 10 percent of the inflation is reflected in deficit adjustment. These determinant factors together explain about 60 percent of the variance of NMS economies primary deficits.

Estimating the multifactorial model of public debt service confirms the relevance of long-term interest rates transmission channel, closely connected with investor perceptions on the correlation between sovereign risk premium and the quality of bank portfolios. The optimal lag is two years, and the coefficient is strictly positive for a 99 percent confidence level (Table 3).

Table 3

Estimation output on the debt service model				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.746909	0.176635	4.228539	0.0001
Long term yield (-2)	0.073949	0.020578	3.593633	0.0006
Public Debt to GDP (-2)	0.017973	0.005655	3.178524	0.0023
Fixed Effects (Cross)				
_BG--C	-0.589677	_HUN--C		1.748749
_CZ--C	-0.430727	_POL--C		0.605611
_EE--C	-0.337853	_RO--C		-0.288360
_LET--C	-0.622437	_SK--C		-0.154412
_LIT--C	-0.473041	_SLO--C		-0.097812
Adjusted R-squared	0.936874			

Meanwhile, approximately 1.8 percent of public debt to GDP is reflected in the level of public debt service. Fixed effects, although statistically relevant, are not major in the analyzed sample, except for one economy. These autonomous factors highlight the long-term risks of exceeding the 60 percent ceiling on public debt, pointing the need of strong adjustments of primary balance in order to offset the burden of debt service.

Conclusions

The innovative feature of this study is to highlight the indirect dependence of government budget balance on private sector credit flow in the countries of Central and Eastern Europe.

The added value of this approach consists of two elements. First, the analysis suggests that the usual analytical framework of risks and vulnerabilities to achieve balanced state budget might be enhanced by structuring the sensitivity of primary budget balance and public debt service to the pace of private sector credit. Second, the study provides empirical evidence on the importance of economic growth transmission channel for passing the credit accelerator effects to primary deficit. At the same time, non-performing loans transmission channel proved to be insignificant, especially compared to the persistency of previous year's deficit and effects of budget allocations procyclicality. However, loan portfolio quality seems to be more relevant in the case of public debt service, through its influence on the evolution of the yield on long-term government securities that is closely related to sovereign risk premium. The result reflects, however, the unfavorable investors' perception on the emerging imminent distress in NMS banking systems due to deteriorated quality of banking books and its propagation to the government financing needs, amid alleged actions of nationalising the risky banks.

Nevertheless, strengthening the banking system protection mechanisms, including through the introduction of stabilization measures and creation of resolution funds, will create the conditions for restructuring of failing credit institutions, based on the financial support provided by ex-ante accumulation of private funds. This will break the indirect contagion channel from the credit portfolio quality to the impending increase in budget spending, which during the global financial crisis seems to have contributed, together with domestic macroeconomic context and regional spillover effects, to adverse developments in sovereign risk premium of NMS.

Aknowledgements

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APPENDIX 1

Estimation output for the GDP growth model based on credit accelerator

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.163919	0.210841	10.26326	0.0000
Credit accelerator	0.140840	0.028069	5.017607	0.0000
Credit accelerator (-1)	0.193103	0.022524	8.573318	0.0000
GDP growth euro zone	1.446552	0.124521	11.61695	0.0000
Fixed Effects (Cross)				
_BG--C	0.281383			
_CZ--C	-0.809549			
_EE--C	0.779897			
_LET--C	0.800063			
_LIT--C	0.938297			
_HUN--C	-1.668096			
_POL--C	0.319000			
_RO--C	0.121189			
_SLO--C	-1.746480			
_SK--C	0.754898			
Adjusted R-squared	0.781583	S.D. dependent var		4.573569

APPENDIX 2

Estimation output for the NPL model based on credit flow

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(Credit flow (-2)-Potential growth(-2))^2	0.078581	0.013450	5.842562	0.0000
GDP growth	-0.039225	0.007103	-5.522203	0.0000
C	0.085807	0.044402	1.932494	0.0559
Fixed Effects (Cross)				
_BG--C	-0.078339			
_CZ--C	0.009405			
_EE--C	0.004229			
_LET--C	0.007337			
_LIT--C	0.151015			
_HUN--C	-0.065176			
_POL--C	-0.070052			
_RO--C	-0.029122			
_SLO--C	-0.028524			
_SK--C	0.099228			
Adjusted R-squared	0.541999	S.D. dependent var		0.447275

Heterogeneous capital and consumption goods in a structurally generalized Uzawa's model

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Abstract. *This paper proposes a growth model with heterogeneous capital and consumption goods and services. It structurally generalizes the Uzawa growth model by introducing heterogeneous capital and multiple consumption goods and services. We show the dynamic properties of the model and simulate the motion of the national economy with two capital goods and two services over time. We also examine effects of changes in preferences and technologies on the dynamic paths of the economy. The model with heterogeneous capital reveals different properties from those of the model with homogeneous capital. Our model shows the importance of introducing heterogeneous capital into the neoclassical growth theory. For instance, the comparative dynamic analysis shows that when the propensity to save is increased, the wealth per capita is increased initially but reduced in the long-term and the wage rate and national output level fall; the consumption levels of the two services fall even though the prices of the two services fall only slightly; the stock of the light capital good rises initially but falls in the long-term; the stock of the heavy capital good falls in association with rising in its price; the labor input of the heavy industrial sector fall and the labor inputs of the two service sectors rise while the labor input of the light industrial sector rises initially but falls in the long-term. Solow's one-sector and Uzawa's two-sector growth models cannot explain the structural changes with heterogeneous capital. Both Solow's one-sector and Uzawa's two-sector growth models show that a rise in the saving rate will increase the wealth per capita both in the short-term and in the long-term.*

Keywords: heterogeneous capital goods; economic structure; growth; economic dynamics.

JEL Code: D92.

REL Code: 8E.

1. Introduction

Modern economic systems are characterized of structural changes with heterogeneous capital goods and multiple services. It might be argued that irrespective of the fact that many economic models, such as input-output systems and multi-sector Ramsey growth models, economics still needs proper frameworks for examining structural changes with accumulation of heterogeneous capital. How to model economic growth with heterogeneous physical capital continues to present a challenge for modeling of economic dynamics. As emphasized by D'Agata (2009, p. 1), "any *theoretically* adequate model of structural dynamics has to explain the growth (or decay) of sectors and their technological dynamics in terms of process and production innovations as outcome of rational agents, and the changes of consumption vectors as the result of changes of consumer's knowledge." The traditional neoclassical growth theory has not adequately modeled economic structural change with heterogeneous capital on the basis of microeconomic foundation.⁽¹⁾ It is well known that most of the models in the neoclassical growth theory model are extensions and generalizations of the pioneering works of Solow (1956). The model has played an important role in the development of economic growth theory by using the neoclassical production function and neoclassical production theory. The Solow model has been extended and generalized in numerous directions. Important extensions to the case of two-sector economies were initiated by Uzawa (1961, 1963), Meade (1961) and Kurz (1963). The Uzawa model extends the Solow model by a breakdown of the productive system into two sectors using capital and labor, one of which produces capital goods, the other consumption goods (Solow, 1962). According to this model, output of the capital sector goes entirely to investment and that of the consumption sector entirely to consumption. This assumption avoids the problem of modeling consumers' choice among goods and services in growth theory. There is a single commodity for consumer in the Uzawa model. Solow's one-sector growth model and Uzawa's two-sector growth model and their various extensions and generalizations are fundamental for the development of new economic growth theories as well.⁽²⁾ It is generally recognized that it is important to develop economic growth theory of multiple sectors with heterogeneous capital in order to understand economic structural changes and other important issues. In fact, many empirical studies show that different sectors are different in their dynamic interactions with different variables in the system. As pointed out by Acconcia and Simonelli (2008, p. 3010), the early literature on empirical studies of business fluctuations implicitly assumes that "a one-sector model is sufficient in order to correctly interpret the business cycle." Nevertheless, the recent literature emphasizes the necessity of dividing production side into different sectors. For instance, Whelan (2003) considers it

necessary to treat consumption and investment differently in order to get a better understanding of business cycles.⁽³⁾

Since Uzawa published his seminal work, the Uzawa model resulted in an explosion of research in the 1960s on the two-sector growth model. Economists have made many efforts in generalizing and extending the Uzawa two-sector model by, for instance, introducing more general production functions, money, different externalities, knowledge, human capital, and fictions in different markets.⁽⁴⁾ Most of these extensions are developed within the framework of one capital and one consumption goods. As observed by Farmer and Wendner (2003, p. 773), "In multi-sector growth theory, the two-sector growth model with homogeneous capital dominates. However, economies are usually characterized by heterogeneous capital." The purpose of this study is to develop a dynamic growth model with two capital goods and any number of consumption goods and services.⁽⁵⁾ In this dynamic multisectoral model with structural change *à la* Uzawa structural change is the outcome of rational behavior of consumers and firms.⁽⁶⁾ It should be noted that in the literature of economic growth there are a few growth models of multi-sector with heterogeneous capital goods. For instance, in a study by Farmer and Wendner (2003), there are two industries, one producing investment goods only and the other both consumption and investment goods. This is different from the Solow one-sector model in which one sector produces both consumption and investment goods as well as the Uzawa two-sector model in which one produces investment goods only and the other consumption goods only. Kaganovich (1988) proposes a growth model with $(J + 1)$ -sectors, where J sectors produce capital goods, and one sector produces a consumption goods. Each of the capital sectors uses all capital goods as inputs while producing only one, sector-specific capital goods. One may consider the Kaganovich approach as an extension of Uzawa's two-sector model and the von Neumann multi-sector growth model.⁽⁷⁾ Our approach differs from Kaganovich's framework mainly in that we model behavior of consumers in an alternative way. It should be noted that this paper is an extension of a model by Zhang (2012). The paper generalizes Zhang's model in that this model considers any number of consumption goods and services while Zhang's model deals with only one consumption goods. The remainder of the paper is organized as follows. Section 2 defines the growth model with an alternative approach to consumer behavior. Section 3 examines the dynamic properties of the model. Section 4 studies effects of changes in some parameters on the economic structure. Section 5 concludes the study.

2. The two-capital and multi-service growth model

The model is based on the traditional two-sector model proposed by Uzawa (1961), although we will extend the single capital sector in the Uzawa model to the case of two capital goods and multiple services. The two capital goods sectors are called respectively the heavy and light industrial sectors. It is assumed that consumption and capital goods are different commodities. There are two capital goods sector and J consumption good (and services) sectors. Labor grows at an exogenously given exponential rate n which is assumed to be zero in this study. The assumption of zero population growth rate does not affect our analysis in the sense that we can get similar results with a positive constant growth rate (because the sectors exhibit constant returns to scale). Let subscripts h, i , and j , respectively, stand for the heavy industrial sector, the light industrial sector, and the j th's service sector, $j = 1, \dots, J$. The capital goods can be used as inputs in all the sectors in the economy. The capital goods depreciate respectively at constant exponential rates, δ_h and δ_i . A typical consumer's utility level is dependent on the consumption goods and wealth. The industrial sectors produce the capital goods, which can be used only as production inputs. The light industrial commodity is selected to serve as numeraire. Labor and capital markets are perfectly competitive and labor force and capital are fully employed. Let N stand for the fixed labor force and $w(t)$ the wage rate.

The capital good sectors

First, we describe production side of the economy. We consider that the heavy industrial sector uses heavy capital good $K_h(t)$, light industrial capital good $k_h(t)$, and labor $N_h(t)$ as inputs. We specify the heavy industrial sector's production function $F_h(t)$ as follows

$$F_h(t) = A_h \times K_h^{\alpha_h}(t) \times N_h^{\beta_h}(t) \times k_h^{\gamma_h}(t), \quad \alpha_h + \beta_h + \gamma_h = 1, \quad (1)$$

$$\alpha_h, \beta_h, \gamma_h > 0,$$

where A_h is the total productivity factor. In this study, we assume A_h, α_h, β_h , and γ_h constant. Let $r_j(t)$ stand for the interest rate of capital good j , $j = h, i$. The wage rate is denoted by $w(t)$. The marginal conditions for the heavy industrial sector are given by

$$\begin{aligned} r_h(t) + p_h(t)\delta_h &= \frac{\alpha_h p_h(t)F_h(t)}{K_h(t)}, \quad w(t) = \frac{\beta_h p_h(t)F_h(t)}{N_h(t)}, \\ r_i(t) + \delta_i &= \frac{\gamma_h p_h(t)F_h(t)}{k_h(t)}, \end{aligned} \quad (2)$$

where p_h is the price of the heavy capital good.

The production function of the light industrial sector $F_i(t)$ is a function of heavy capital good $K_i(t)$, light industrial capital good $k_i(t)$, and labor $N_i(t)$ as follows

$$\begin{aligned} F_i(t) &= A_i \times K_i^{\alpha_i}(t) \times N_i^{\beta_i}(t) \times k_i^{\gamma_i}(t), \quad \alpha_i + \beta_i + \gamma_i = \\ &= 1, \quad \alpha_i, \beta_i, \gamma_i > 0. \end{aligned} \quad (3)$$

The marginal conditions for the light industrial sector are given by

$$r_h(t) + p_h(t)\delta_h = \frac{\alpha_i F_i(t)}{K_i(t)}, \quad w(t) = \frac{\beta_i F_i(t)}{N_i(t)}, \quad r_i(t) + \delta_i = \frac{\gamma_i F_i(t)}{k_i(t)}. \quad (4)$$

The service sectors

The production function of the j th's service sector $F_j(t)$ is a function of heavy capital good $K_j(t)$, light industrial capital good $k_j(t)$, and labor $N_j(t)$ as follows

$$\begin{aligned} F_j(t) &= A_j \times K_j^{\alpha_j}(t) \times N_j^{\beta_j}(t) \times k_j^{\gamma_j}(t), \quad \alpha_j + \beta_j + \gamma_j = 1, \\ \alpha_j, \beta_j, \gamma_j &> 0, \quad j = 1, \dots, J. \end{aligned} \quad (5)$$

The marginal conditions are

$$\begin{aligned} r_h(t) + p_h(t)\delta_h &= \frac{\alpha_j \times p_j(t) \times F_j(t)}{K_j(t)}, \quad w(t) = \frac{\beta_j \times p_j(t) \times F_j(t)}{N_j(t)}, \\ r_i(t) + \delta_i &= \frac{\gamma_j \times p_j(t) \times F_j(t)}{k_j(t)}, \end{aligned} \quad (6)$$

where $p_j(t)$ is the price of the j th service.

Consumer behavior

This study uses the approach to consumers' behavior proposed by Zhang (1996). We use $\bar{K}(t)$ and $\tilde{K}(t)$ to stand respectively for the total stocks of heavy

and light industrial goods at time t . Let us denote $y(t)$ the current net income of the representative household. The net income consists of wage incomes and interest payment, i.e.

$$y(t) = r_h(t) \times \bar{k}(t) + r_i(t) \times \tilde{k}(t) + w(t), \quad (7)$$

where $\bar{k}(t) \equiv \bar{K}(t)/N$ and $\tilde{k}(t) \equiv \tilde{K}(t)/N$. We call $y(t)$ the current income in the sense that it comes from consumers' wages and current earnings from ownership of wealth. The sum of income that consumers are using for consuming, saving, or travels are not necessarily equal to the current income because consumers can sell wealth to pay, for instance, the current consumption if the current income is not sufficient for buying food and touring the country. Retired people may live not only on the interest payment but also have to spend some of their wealth. The total value of the wealth that a consumer can sell to purchase goods and to save is equal to $p_h(t) \times \bar{k}(t) + \tilde{k}(t)$. Here, we assume that selling and buying wealth can be conducted instantaneously without any transaction cost. The disposable income at any point of time is then equal to

$$\hat{y}(t) = y(t) + p_h(t) \times \bar{k}(t) + \tilde{k}(t). \quad (8)$$

The disposable income is used for saving and consumption. The value, $p_h(t) \times \bar{k}(t) + \tilde{k}(t)$ in the above equation is a flow variable. Under the assumption that selling wealth can be conducted instantaneously without any transaction cost, we may consider $p_h(t) \times \bar{k}(t) + \tilde{k}(t)$ as the amount of the income that the consumer obtains at time t by selling all of his wealth. Hence, at time t the consumer has the total amount of income equaling $\hat{y}$ to distribute between the current consumption and future consumption (i.e., saving). In the growth literature, for instance, in the Solow model, the saving is out of the current income $\hat{y}$, while in this study the saving is out of the disposable income which is dependent both on the current income and wealth. The implications of our approach are similar to those in the Keynesian consumption function and models based on the permanent income hypothesis, which are empirically much more valid than the approaches in the Solow model or the in Ramsey model. The approach to household behavior in our approach is discussed at length by Zhang.⁽⁸⁾

We assume that the utility level, $U(t)$, of a typical household is dependent on consumption good, $c_j(t)$, and savings, $s(t)$. The utility function is specified as follows

$$U(t) = s^{\lambda_0}(t) \prod_{j=1}^J c_j^{\xi_{0j}}(t), \quad \lambda_0, \xi_{0j} > 0, \quad j = 1, \dots, J,$$

in which the parameters λ_0 and ξ_{0j} are, respectively, called the propensities to save and to consume services. The disposable income is allocated for consuming and saving. The budget constrain is given by

$$\sum_{j=1}^J p_j(t) \times c_j(t) + s(t) = \hat{y}(t).$$

Households determine $c_j(t)$ and $s(t)$ at each moment. Maximizing $U(t)$ subject to the budget constrain yields

$$p_j(t) \times c_j(t) = \xi_j \hat{y}(t), \quad s(t) = \lambda \hat{y}(t), \quad (9)$$

where

$$\xi_j \equiv \frac{\xi_0}{\sum_{j=1}^J \xi_{0j} + \lambda_0}, \quad \lambda \equiv \frac{\lambda_0}{\sum_{j=1}^J \xi_{0j} + \lambda_0}.$$

Let $a(t)$ stand for the total wealth of the household. We have

$$a(t) \equiv p_h(t) \times \bar{k}(t) + \tilde{k}(t).$$

According to the definition of $s(t)$ the wealth accumulation is given by

$$\dot{a}(t) = s(t) - a(t). \quad (10)$$

The equation simply states that the change in wealth is equal to the saving minus the dissaving.

Consider now an investor with one unity of money. He can either invest in heavy industrial capital goods thereby earning a profit equal to the net own-rate of return $r_h(t)/p_h(t)$ or invest in light industrial capital goods thereby earning a profit equal to the net own-rate of return $r_i(t)$. As we assume capital markets to be at competitive equilibrium at any point of time, two options must yield equal returns, i.e.

$$\frac{r_h(t)}{p_h(t)} = r_i(t). \quad (11)$$

Assume that the labor force is always fully employed. We have

$$N_h(t) + N_i(t) + \sum_{j=1}^J N_j(t) = N. \quad (12)$$

Assume that the two capital goods are always fully employed. We have

$$\begin{aligned}
K_h(t) + K_i(t) + \sum_{j=1}^J K_j(t) &= \bar{K}(t), \\
k_h(t) + k_i(t) + \sum_{j=1}^J k_j(t) &= \tilde{K}(t).
\end{aligned} \tag{13}$$

The balance of demand of and supply for each consumption good is represented by

$$C_j(t) = F_j(t). \tag{14}$$

The change in the stock of a capital good is equal to its output minus its depreciation. We have

$$\begin{aligned}
\dot{\bar{K}}(t) &= F_h(t) - \delta_h \bar{K}(t), \\
\dot{\tilde{K}}(t) &= F_i(t) - \delta_i \tilde{K}(t).
\end{aligned} \tag{15}$$

We have thus built the model.

3. Properties of the dynamic system

This section examines properties of the dynamic system. First, we show that the motion of the economy can be expressed as three-dimensional differential equations. Before stating our analytical results, we introduce two variables

$$Z \equiv \frac{w}{r_h + p_h \delta_h}, \quad z \equiv \frac{w}{r_i + \delta_i}.$$

The dynamics is expressed with the two variables and the stock of capital goods 2 as the variables.

Lemma 1

The dynamics of the economy is described by the following differential equations

$$\begin{aligned}
\dot{\bar{K}}(t) &= \Psi_2(\bar{K}(t), Z(t), z(t)), \\
\dot{Z} &= \bar{\Psi}_1(\bar{K}(t), Z(t), z(t)), \\
\dot{z} &= \bar{\Psi}_2(\bar{K}(t), Z(t), z(t)),
\end{aligned} \tag{16}$$

where Ψ_2 and $\bar{\Psi}_j$ are functions of $\bar{K}(t)$, $Z(t)$ and $z(t)$, defined in Appendix A1. At any point of time the other variables in the dynamic system can be expressed as unique functions of $\bar{K}(t)$, $Z(t)$ and $z(t)$ as follows: $N_h(t)$, $N_i(t)$, and $\tilde{K}(t)$ by

(A15) = $w(t)$ and $r_i(t)$ by (A3) = $p_h(t)$ by (A4) = $p_j(t)$, $j = 1, \dots, J$, by (A4) = $r_h(t)$ by (A4) = $\hat{y}(t)$ by (A6) = $N_j(t)$, $j = 1, \dots, J$, by (A10) = $K_m(t)$ and $k_m(t)$, $m = h, i, 1, \dots, J$, by (A.1) = $F_h(t)$ by (1) = $F_i(t)$ by (3) = $F_j(t)$, $j = 1, \dots, J$, by (5) = $c_j(t)$ and $s(t)$ by (9) = $a(t) = (p_h(t)\bar{K}(t) + \tilde{K}(t))/N$.

This lemma implies that once we solve the differential equations, then we can determine all the other variables, such as the national output, the labor distribution, capital distribution among the sectors, the rate of interests, and the wage rate.

As the expressions are tedious, it is difficult to explicitly interpret economic implications of the conditions for existence of a steady state. In the reminder of this study, we show properties of the dynamic system by simulation. We specify the parameter values for a four-sector economy as follows

$$\begin{aligned} N &= 10, \quad A_h = 1, \quad A_i = 1.1, \quad A_1 = 0.9, \quad A_2 = 1.1, \quad \alpha_h = 0.2, \\ \beta_h &= 0.6, \quad \alpha_i = 0.25, \quad \beta_i = 0.65, \\ \alpha_1 &= 0.23, \quad \beta_1 = 0.63, \quad \alpha_2 = 0.18, \quad \beta_2 = 0.65, \quad \lambda_0 = 0.75, \\ \xi_{10} &= 0.04, \quad \xi_{02} = 0.08, \\ \delta_h &= 0.05, \quad \delta_k = 0.06. \end{aligned}$$

The propensity to save out of the disposable income is 86 percent, the propensity to consume service 1 is 4.6 percent, and service 2 is 9.2 percent. The total productivity factor of the light industry sector is higher than the total productivity factors of the other sectors. The depreciation rates of the heavy and light capital good are, respectively, five and six percent. As we have the differential equations from which we can determine the motion of the system, it is straightforward to plot the motion of all the variables over time. Following the computing procedure given in Lemma 1, we now simulate the model to illustrate motion of the system. The initial conditions are specified as follows

$$\bar{K}(0) = 5, \quad Z(0) = 1.5, \quad z(0) = 8.1.$$

We introduce the national output as

$$F(t) \equiv F_i(t) + p_h(t) \times F_h(t) + p_1(t) \times F_2(t) + p_2(t) \times F_2(t).$$

As shown in Figure 1, the system does converge to a steady state. The stock of the heavy capital good changes slightly over time, while its price falls. The value of the heavy capital good falls. The value of the light capital good also falls over time. Hence, the wealth per capita falls. The prices of the two services and the wage are changed slightly over time. The consumption levels of the two services fall. The output and input levels of the heavy industrial sector falls, while the output and input levels of the light industrial sector rises. The national output level is changed slightly in association with the structural changes.

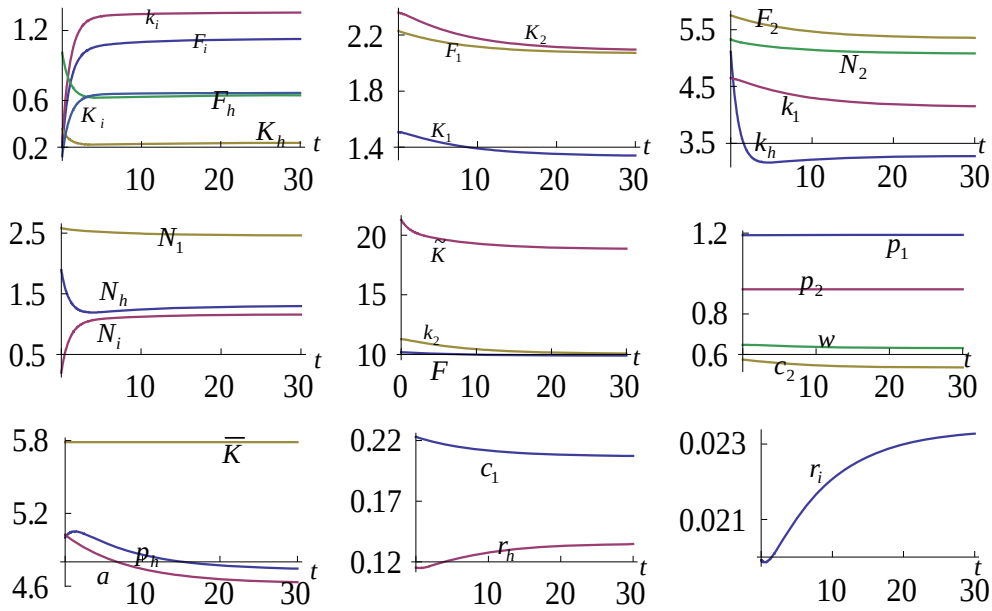


Figure 1. The motion of the economic system

Following Lemma 1, we calculate the equilibrium values of the variables as follows

$$\begin{aligned}
 r_i &= 0.023, \quad r_h = 0.137, \quad p_h = 5.84, \quad p_1 = 1.19, \quad p_2 = 0.92, \quad w = 0.63, \\
 F &= 9.86, \quad \bar{K} = 4.67, \\
 \tilde{K} &= 18.76, \quad F_h = 0.23, \quad F_i = 1.13, \quad F_1 = 2.06, \quad F_2 = 5.33, \quad N_h = 1.30, \\
 N_i &= 1.16, \quad N_1 = 2.46,
 \end{aligned}$$

$$\begin{aligned}
N_2 &= 5.08, \quad K_h = 0.64, \quad K_i = 0.66, \quad K_1 = 1.32, \quad K_2 = 2.06, \\
k_h &= 3.27, \quad k_i = 1.35, \\
k_1 &= 4.12, \quad k_2 = 10.01, \quad c_1 = 0.21, \quad c_2 = 0.53, \quad a = 4.61.
\end{aligned}$$

The system has a unique equilibrium point for the given value of the parameters. The question now is whether this equilibrium point is stable. The three eigenvalues are calculated as follows

$$-1.05, \quad -0.12, \quad -9 \times 10^{-13}.$$

The dynamic system is locally stable.

4. Comparative dynamic analysis

We simulated the motion of the dynamic system. It is important to ask questions such as how changes in the propensity to save will affect the national economy and different sectors. This section makes comparative dynamic analysis with regard to some parameters. In comparison to the one-sector growth model, as our model has a refined economic structure, we can examine possible differences in effects on different sectors.

A rise in the propensity to save

We now increase the propensity to save in the following way: $\lambda_0 : 0.75 = 0.77$. The results are plotted in Figure 2. In the plots, a variable $\overline{\Delta x_j}(t)$ stands for the change rate of the variable, $x_j(t)$, in percentage due to changes in the parameter value. As the propensity to save is increased, from (10) we see that the wealth per capita a will be initially increased. As the household saves more, the consumption levels of the two services fall. The output levels of the two services fall. The prices of the two services fall slightly as the demands fall. The stock of the light capital goods rises initially but falls in the long-term. In association with the rise in its price, the stock of the heavy capital goods falls. The wage rate and national output level fall as the household tends to save more from its disposable income. The wealth per capita and consumption levels of the two services are reduced in the long-term. This is different from what the standard one-sector growth model predicts. Both in Solow's one-sector and Uzawa's two-sector growth models with homogenous capital, a rise in the saving rate will increase the wealth per capita both in the short-term and in the long-term. As the interdependence among the variables becomes more complicated in a model with heterogeneous capital than the one in with a homogeneous capital, comparative

dynamic effects of the change in the same parameter may be different. The labor input of the heavy industrial sector fall and the labor inputs of the two service sectors rise. The labor input of the light industrial sector rises initially but falls in the long-term. The rate of interest on the heavy capital goods falls initially but rises in the long-term; correspondingly the stock of the heavy capital goods rises initially but falls in the long-term. The rate of interest on the light capital goods falls.

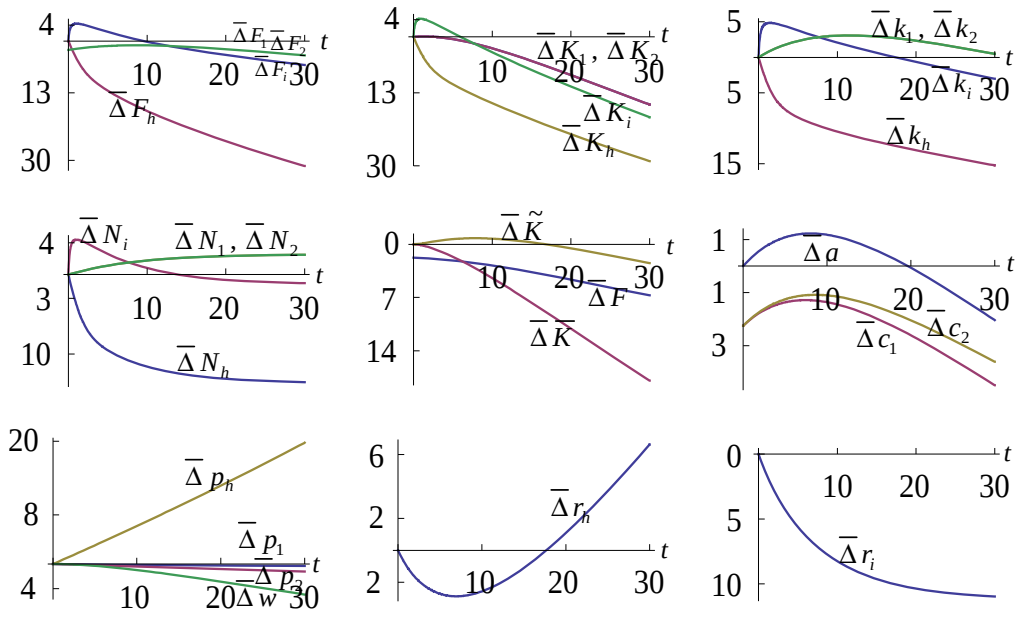


Figure 2. A rise in the propensity to save

A rise in the propensity to consume service 2

We now increase the propensity to consume service 2: $\xi_{20} : 0.08 = 0.09$.

The results are plotted in Figure 3. As the household spends more on service 2, the consumption level of service 2 is increased. As the demand for the service is increased, the price of service 2 is increased. The supply of service is also increased. The wealth per capita and consumption level of service 1 are reduced initially but increased in the long term. The wage rate is increased in association with the rising price of service 2. The price of service 1 is changed but only slightly. The output levels of the two service sectors are increased. The output level of the light industrial sector falls initially but increased in the long-term. It should be noted that the output levels of the four sectors are all increased as the propensity to consume service 2 is increased. The labor inputs of the two service sectors fall and the labor input of the heavy industrial sector rises. The labor input

of the light industrial sector fall initially but rise in the long-term. The stock of the heavy capital goods rises. The stock of the light capital goods falls initially but rises in the long term. The national output is increased over time. The rate of interest on the light capital good rises. The rate of interest on the heavy capital good falls initially but rises in the long-term.

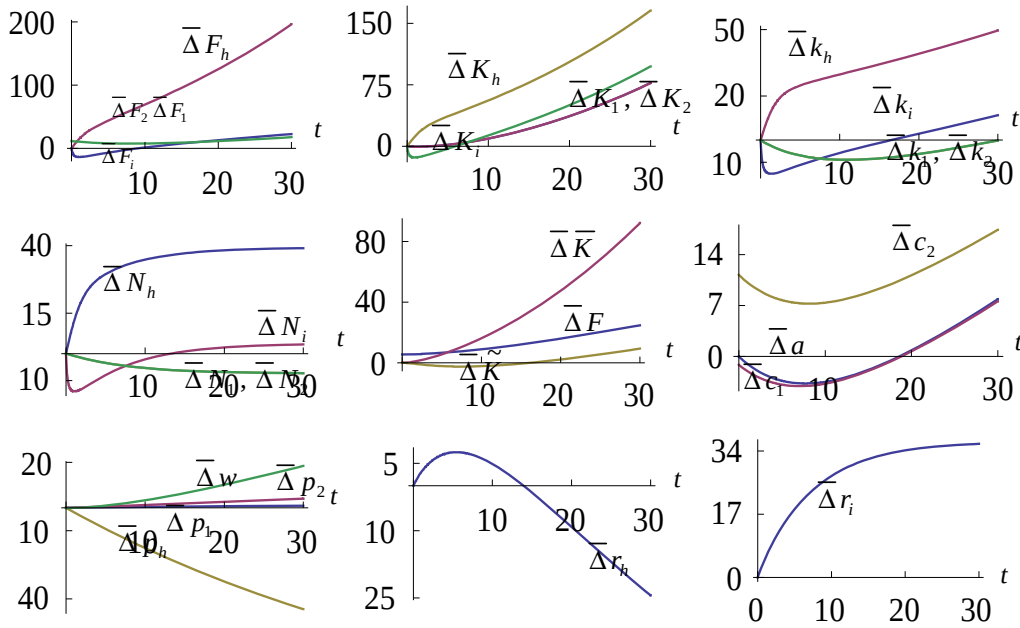


Figure 3. A rise in the propensity to consume service 2

A rise in the depreciation rate of the heavy capital good

As different capital may depreciate differently, it is important to examine how the economic structural change takes place when a specified capital good depreciates more quickly. We now increase the depreciation rate of the heavy capital good: $\delta_h : 0.05 = 0.051$. The results are plotted in Figure 4. As the capital good depreciates more quickly, the stocks of the heavy and light capital goods are increased. The rates of interest on the capital goods fall in association with the rises in the capital stocks. The wage rate is increased, the prices of the two services are slightly changed. The heavy industrial sector's output level is increased and the sector employs more labor. The national output level is increased. The consumption levels of the two services and wealth per capita are reduced initially but are affected only slightly in the long-term.

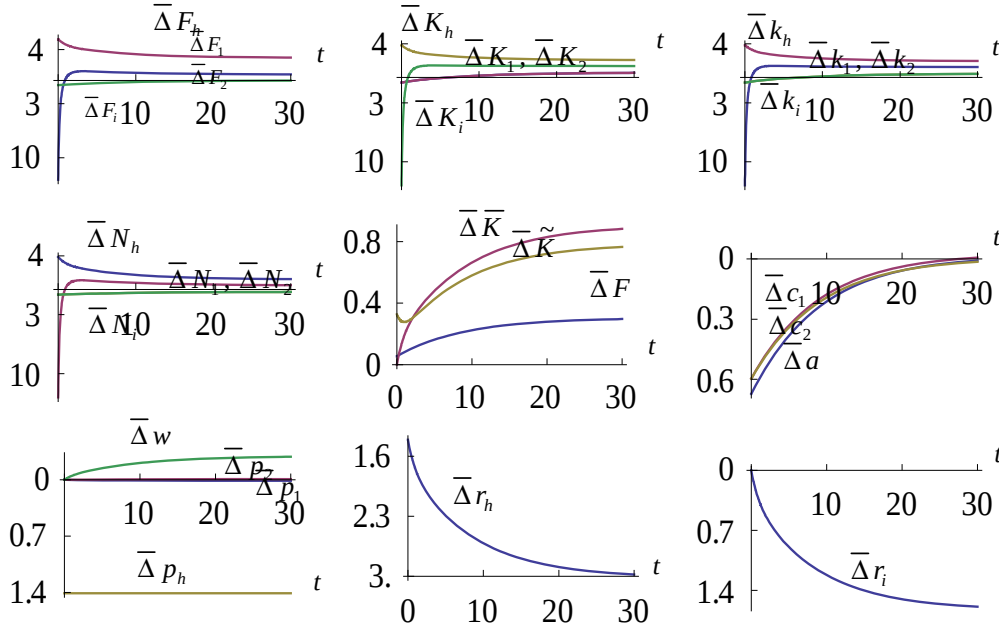


Figure 4. A rise in the depreciation rate of the heavy capital goods

A rise in the total productivity of the light industrial sector

We increase the total productivity factor of the light industrial sector in the following way: $A_l : 1.1 = 1.12$. The rise in the total productivity of the light industrial sector initially leads to the falling in all the inputs of the sector. The three inputs are increased in the long-term. Correspondingly, the output level of the light industrial sector falls initially but rises in the long-term. The output level of the heavy industrial sector and the three inputs of the sector are increased over time. The output levels of the two service sectors and the three inputs of each sector are reduced initially but increased in the long-term. The stocks of the two capital goods are increased. The price of the heavy capital goods falls and the prices of the two services rise. The consumption levels of the two services fall initially but rise in the long-term. The national output and wealth per capita are increased over time.

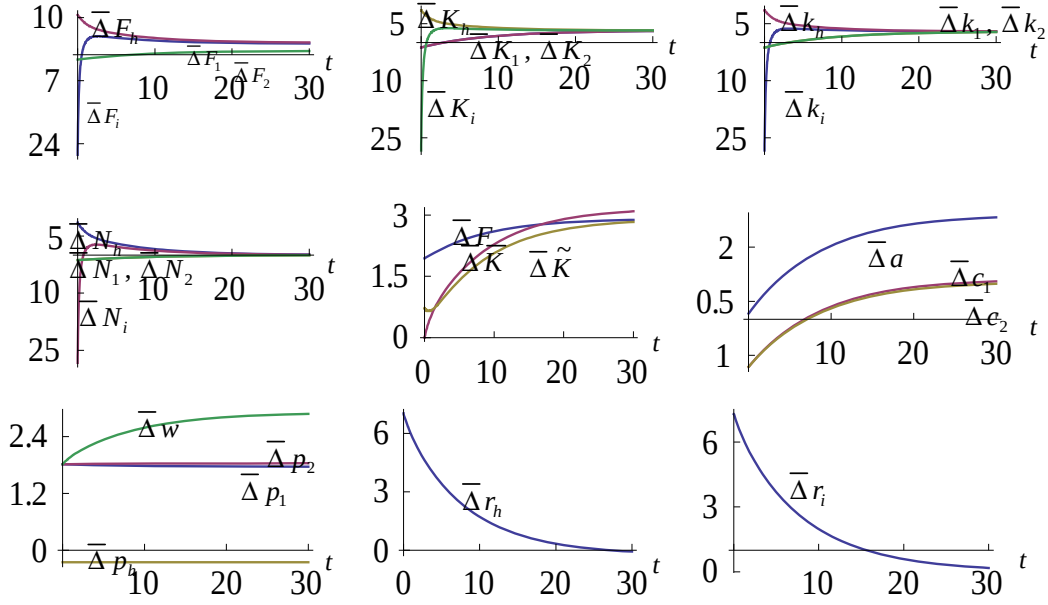


Figure 5. A rise in the total productivity of the light industrial sector

5. Conclusions

The history of economic growth theory shows that it is difficult to formally model economic dynamics with multiple capital goods and multiple consumption goods and services with micro-foundation. This paper proposed a two-capital-goods model to illustrate how economic growth with multiple capital goods can be modeled with an alternative approach to household behavior. We also analyzed changes in the parameters upon the system. Our model shows the importance of introducing heterogeneous capital into the neoclassical growth theory. For instance, in our model when the propensity to save is increased, the wealth per capita is increased initially but reduced in the long-term and the wage rate and national output level fall; the consumption levels of the two services fall even though the prices of the two services fall only slightly; the stock of the light capital goods rises initially but falls in the long-term; the stock of the heavy capital goods falls in association with rising of in its price; the labor input of the heavy industrial sector fall and the labor inputs of the two service sectors rise while the labor input of the light industrial sector rises initially but falls in the long-term; the rate of interest on the heavy capital goods falls initially but rises in the long-term; correspondingly the stock of the heavy capital goods rises initially but falls in the long-term; the rate of interest on the light capital goods falls. Solow's one-sector and Uzawa's two-sector growth models cannot explain the structural changes with

heterogeneous capital. Our model also predicts some phenomena which are different from what the standard one-sector growth model predicts. Both Solow's one-sector and Uzawa's two-sector growth models show that a rise in the saving rate will increase the wealth per capita both in the short-term and in the long-term, while our model predicts that as the propensity to save is increased, the wealth per capita is increased initially but reduced in the long-term. This occurs because the dynamic interdependence among the variables becomes more complicated in a model with heterogeneous capital than the one with homogeneous capital. It should be noted that the comparative dynamic analyses are conducted only with specified values of the parameters. If the parameter values are specified differently, the system may not have a stable equilibrium. We have limited our study to a simplified spatial structure of the economic system. There are numerous extensions of the Solow-Uzawa models. We may introduce more realistic representations of household behavior with endogenous time and multiple kinds of consumption goods. We now point out a few straightforward extensions. For instance, we may consider the economy as a small country, which implies that economy has negligible impact on the interest rate in globally open market. This assumption has been accepted in the literature of international economics.

Appendix 1. Proving Lemma 1

From (2), (4) and (6), we have

$$Z = \frac{\hat{\alpha}_m \times K_m}{N_m}, \quad z = \frac{\hat{\gamma}_m \times k_m}{N_m}, \quad m = h, i, 1, \dots, J, \quad (\text{A1})$$

where

$$\hat{\alpha}_m \equiv \frac{\beta_m}{\alpha_m}, \quad \hat{\gamma}_m \equiv \frac{\beta_m}{\gamma_m}.$$

From (2), (4) and (6), we also have

$$k_m = \frac{\gamma_m \times \hat{z} \times K_m}{\alpha_m}, \quad m = h, i, 1, \dots, J, \quad (\text{A2})$$

where $\hat{z} = z / Z$. From (3) and (4), we have

$$\begin{aligned} r_h + p_h \times \delta_h &= \frac{\alpha_i \times A_i \times \hat{\alpha}_i \times f}{Z}, \quad w = \beta_i \times A_i \times f, \\ r_i &= \frac{\gamma_i \times \hat{\gamma}_i \times A_i \times f}{Z} - \delta_i, \end{aligned} \quad (\text{A3})$$

where

$$f(Z, z) \equiv \left(\frac{Z}{\hat{\alpha}_i} \right)^{\alpha_i} \left(\frac{z}{\hat{\gamma}_i} \right)^{\gamma_i}.$$

From (A3), we see that $r_h + p_h \delta_h$, w , and r_i are functions of Z and z . From (A3) and (11), we solve

$$p_h = \frac{\alpha_i \times A_i \times \hat{\alpha}_i \times f}{Z(r_i + \delta_h)}, \quad r_h = r_i p_h. \quad (\text{A4})$$

From (5) and (6), we have

$$p_j = \frac{w \times \hat{\alpha}_j^{\alpha_j} \times \hat{\gamma}_j^{\gamma_j}}{\beta_j \times A_j \times Z^{\alpha_j} \times z^{\gamma_j}}. \quad (\text{A5})$$

From (7) and (8), we have

$$\hat{y} = (r_h + p_h) \bar{k} + (1 + r_i) \tilde{k} + w. \quad (\text{A6})$$

From (4) and (6), we have

$$F_j = \frac{\beta_i \times N_j \times F_i}{\beta_j \times p_j \times N_i}, \quad j = 1, \dots, J. \quad (\text{A7})$$

From (9) and (14), we have

$$F_j = \frac{\xi_j \times N \times \hat{y}}{p_j}. \quad (\text{A8})$$

From (A7) and (A8), we have

$$N_j = \frac{\beta_j \times \xi_j \times N \times N_i \times \hat{y}}{\beta_i \times F_i}, \quad j = 1, \dots, J. \quad (\text{A9})$$

Insert (3) in (A9)

$$N_j = \Lambda_j \hat{y}, \quad j = 1, \dots, J, \quad (\text{A10})$$

where we also use (A1) and

$$\Lambda_j(Z, z) \equiv \frac{\beta_j \times \xi_j \times N \times \hat{\alpha}_i^{\alpha_i} \times \hat{\gamma}_i^{\gamma_i}}{\beta_i \times A_i \times Z^{\alpha_i} \times z^{\gamma_i}}.$$

Insert (A10) in (12)

$$N_h + N_i + \Lambda \hat{y} = N, \quad (\text{A11})$$

where

$$\Lambda \equiv \sum_{j=1}^J \Lambda_j.$$

Insert (A1) in (13)

$$\begin{aligned} \frac{N_h}{\hat{\alpha}_h} + \frac{N_i}{\hat{\alpha}_i} + \sum_{j=1}^J \frac{N_j}{\hat{\alpha}_j} &= \frac{\bar{K}}{Z}, \\ \frac{N_h}{\hat{\gamma}_h} + \frac{N_i}{\hat{\gamma}_i} + \sum_{j=1}^J \frac{N_j}{\hat{\gamma}_j} &= \frac{\tilde{K}}{z}. \end{aligned} \quad (\text{A12})$$

Insert (A10) in (A12)

$$\begin{aligned} \frac{N_h}{\hat{\alpha}_h} + \frac{N_i}{\hat{\alpha}_i} + \Lambda_h \hat{y} &= \frac{\bar{K}}{Z}, \\ \frac{N_h}{\hat{\gamma}_h} + \frac{N_i}{\hat{\gamma}_i} + \Lambda_i \hat{y} &= \frac{\tilde{K}}{z}, \end{aligned} \quad (\text{A13})$$

where

$$\Lambda_h(Z, z) \equiv \sum_{j=1}^J \frac{\Lambda_j}{\hat{\alpha}_j}, \quad \Lambda_i(Z, z) \equiv \sum_{j=1}^J \frac{\Lambda_j}{\hat{\gamma}_j}.$$

Insert (A6) in (A11) and (A13)

$$\begin{aligned} N_h + N_i + \left(\frac{1+r_i}{N} \right) \Lambda \tilde{K} &= \Omega_1(\bar{K}, Z, z) \equiv N - \left(\frac{r_h + p_h}{N} \right) \Lambda \bar{K} - \Lambda w, \\ \frac{N_h}{\hat{\alpha}_h} + \frac{N_i}{\hat{\alpha}_i} + \left(\frac{1+r_i}{N} \right) \Lambda_h \tilde{K} &= \Omega_2(\bar{K}, Z, z) \equiv \frac{\bar{K}}{Z} - \left(\frac{r_h + p_h}{N} \right) \Lambda_h \bar{K} - \Lambda_h w, \end{aligned}$$

$$\begin{aligned} \frac{N_h}{\hat{\gamma}_h} + \frac{N_i}{\hat{\gamma}_i} + \left[\left(\frac{1+r_i}{N} \right) \Lambda_i - \frac{1}{z} \right] \tilde{K} &= \\ = \Omega_3(\bar{K}, Z, z) &\equiv - \left(\frac{r_h + p_h}{N} \right) \Lambda_i \bar{K} - \Lambda_i w. \end{aligned} \quad (\text{A14})$$

This is a linear system with N_h , N_i , and $\tilde{K}$ as variables. It is straightforward to solve this linear system as follows:

$$N_h = \Omega_h(\bar{K}, Z, z), \quad N_i = \Omega_i(\bar{K}, Z, z), \quad \tilde{K} = \Omega_k(\bar{K}, Z, z), \quad (\text{A15})$$

where we do not provide explicit functions as it is straightforward to get them but the expressions are tedious. By the following procedure, the variables in the dynamic system can be expressed as unique functions of Z , z and $\bar{K}$: N_h , N_i , and $\tilde{K}$ by (A15) = w and r_i by (A3) = p_h by (A4) = p_j , $j = 1, \dots, J$, by (A4) = r_h by (A4) = $\hat{\gamma}$ by (A6) = N_j , $j = 1, \dots, J$, by (A10) = K_m and k_m , $m = h, i, 1, \dots, J$, by (A.1) = F_h by (1) = F_i by (3) = F_j , $j = 1, \dots, J$, by (5) = c_j and s by (9) = $a = (p_h \bar{K} + \tilde{K})/N$. We can thus express the dynamics of (10) and (15) as follows:

$$\begin{aligned} \dot{a}(t) &= \Psi_1(\bar{K}, Z, z) \equiv s(t) - a(t), \\ \dot{\bar{K}}(t) &= \Psi_2(\bar{K}, Z, z) \equiv F_h(t) - \delta_h \bar{K}(t), \\ \dot{\tilde{K}}(t) &= \Psi_3(\bar{K}, Z, z) \equiv F_i(t) - \delta_i \tilde{K}(t). \end{aligned} \quad (\text{A16})$$

We will not give explicit expressions of $\Psi_j(k, Z, z)$ as it is straightforward to have these expressions by the procedure above. Taking derivatives of $a = (p_h \bar{K} + \tilde{K})/N$ with respect to time yields

$$\dot{a} = \frac{\bar{K}}{N} \frac{\partial p_h}{\partial Z} \dot{Z} + \frac{\bar{K}}{N} \frac{\partial p_h}{\partial z} \dot{z} + \frac{p_h \Psi_2}{N} + \frac{\bar{\Psi}_3}{N}, \quad (\text{A17})$$

where we also use (A16). Similarly from (A15), we have

$$\dot{\tilde{K}} = \frac{\partial \Psi_k}{\partial \bar{K}} \Psi_2 + \frac{\partial \Psi_k}{\partial Z} \dot{Z} + \frac{\partial \Psi_k}{\partial z} \dot{z}. \quad (\text{A18})$$

From (A16), (A17) and (A18), we have

$$\begin{aligned}\frac{\partial p_h}{\partial Z} \dot{Z} + \frac{\partial p_h}{\partial z} \dot{z} &= \frac{N\Psi_1 - p_h\Psi_2 - \bar{\Psi}_3}{\bar{K}}, \\ \frac{\partial \Psi_k}{\partial Z} \dot{Z} + \frac{\partial \Psi_k}{\partial z} \dot{z} &= \bar{\Psi}_3 - \frac{\partial \Psi_k}{\partial \bar{K}} \Psi_2.\end{aligned}\tag{A19}$$

This is a linear system with $\dot{Z}$ and $\dot{z}$ as variables. We solve (A19)

$$\begin{aligned}\dot{Z} &= \bar{\Psi}_1(\bar{K}, Z, z), \\ \dot{z} &= \bar{\Psi}_2(\bar{K}, Z, z).\end{aligned}\tag{A20}$$

(A16) and (A20) express $\dot{Z}$, $\dot{z}$, and $\dot{\bar{K}}$ as functions of $\bar{K}$, Z and z .

Notes

- ⁽¹⁾ A comprehensive survey on the early literature of growth theory is referred to Jones and Manuelli (1997). See Buirmesiter and Dobell (1970) and Zhang (2005) for the literature on the traditional neoclassical growth theory.
- ⁽²⁾ See, for instance, Drandakis (1963), Diamond (1965), Weizsäcker (1966), Corden (1966), Stiglitz (1967), Gram (1976), Benhabib and Nishimura (1981).
- ⁽³⁾ See also Baxter (1996), Erceg et al. (2005) and Fisher (2006).
- ⁽⁴⁾ The early extensions are referred to Takayama (1985) and Zhang (2005). Recent extensions include, for instance, Galor (1992), Azariadis (1993), Mino (1996), Drugeon and Venditti (2001), Harrison (2003), Cremers (2006), Herrendorf and Valentinyi (2006), Li and Lin (2008), and Stockman (2009).
- ⁽⁵⁾ In the rest of the paper we treat consumption good exchangeably with service.
- ⁽⁶⁾ It should be noted that before Uzawa published the two-sector growth model, there were some models of multiple sectors and heterogeneous capital (von Neumann, 1937, Koopmans, 1951, Morishima, 1964). See also Takayama (1985) and Dolmas (1996) for the literature review.
- ⁽⁷⁾ Moreover, labor is not explicitly considered in the model.
- ⁽⁸⁾ Zhang (2005) has also examined the relations between his approach and the Solow growth theory, the Ramsey growth theory, the permanent income hypothesis, and the Keynesian consumption function in details. It can be shown that the behavior generated by the traditional approaches can also be observed in Zhang's approach by specifying certain patterns of preference changes.

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Differences between the nominal values of the gross domestic product and the provisional and semi-final variant

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Abstract. *The sensitive statistical indicators, among which the gross domestic product is a significant one, have been always, mainly during the periods of economic and financial crises, analyzed from all points of view: from the data sources and construction to the processing and dissemination.*

Keywords: statistics; data; calculations; revision; aggregates.

JEL Code: E00.

REL Code: 8B.

In the international and European Union practice, as well as in the practice of the national statistics, that data concerning the gross domestic product make the subject of certain normal procedures of revision/adjustment and periodical updating. These procedures are not dictated by political factors or certain interests but are established in a professional manner by the need of an operative knowledge meant to satisfy the requirements of all the users, on one hand, and by the availability of the data sources by the time of calculation, on the other hand. Thus, according to the Regulation concerning the transmission of the macroeconomic aggregates by all the Eurostat member states according to the Accounts European System (SEC) 95, Romania is calculating and transmitting (to see also the annual Catalogue of the statistical publications and press releases, submitted at the beginning of each year to the users' knowledge and posted on the INS site) over a period of 21 months after the closing of the reference year, three estimating variants/versions for the annual indicators: provisional (at 70 days), semi-final (at 12 months) and final (at 21 months). The differences (bigger or smaller, positive or negative) between the three variants are normal and unanimously recognized. Each variant is based on the same method of calculation, the differences arising from the data sources available by the respective moment, which can be considered when calculating these indicators.

In the frame of the program of producing and disseminating the data at the national level, the National Institute of Statistics applied always, mainly during the last eight years, *ad-litteram*, professionally and consequently, the provisions of the EU regulations in the field as well as the corresponding calculation methodologies, while letting them be of public knowledge for all the users, including the procedure of revision/adjustment.

Scientifically, theoretically and practically, the differences between the gross domestic product estimated nominal values are explained further on.

1. Differences recorded by the estimated nominal values of the gross domestic product

Historically speaking, in the case of both the final and the semi-final variants of the gross domestic product, the difference is usually insignificant, as both of them are using the same sources of statistical and administrative data. Also as a rule, a bigger or a smaller difference, either as plus or as minus, may be recorded between the semi-final variant and the provisional one. For this last one, the available data sources taken into account are incomplete, circumstantial and not at all detailed which generates different estimates for the results.

This methodological procedure approach of calculation shows basically as follows:

1.1. GDP estimate in the provisional variant case

For the GDP estimate in the case of the provisional variant (at 70 days as against the reference year) there are no complete primary data sources available.

The complete primary data missing implies, as is the case in all the other countries, the utilization of indirect sources, derived indicators of entry into the process, estimated and exploited on the basis of the infra-annual data (monthly and quarterly). These are the following:

- the infra-annual inquiries concerning the indices of the industrial production, the indices of the building works, the indices of the turnover of the retail trade and services to the population, the indices of the goods and passengers route, the indices of the investments, the value indices of the turnover of the wholesale and services to the companies; the indices of prices for the industrial production, the indices of the consumption prices, the cost indices in constructions; the indices of the unit value for the foreign trade (out of the researches issued and published by INS);
- the production account of the agriculture, issued on the basis of the operative data issued by the Agriculture Ministry;
- the infra-annual inquiries concerning the wage gains and the employees number (issued by INS);
- the provisional version of the foreign payments balance (supplied by BNR);
- the provisional execution of the general consolidated budget (supplied by MFP);
- the accounting provisional balance sheets of the financial institutions (supplied by BNR);

The calculation of the gross domestic product (the gross added value + tax on product – subsidies on product) implies the separate estimation of each and every of its component elements, as follows:

The production estimation

- for the non-financial companies (enterprises), the population households and the non-profit institutions, the production has been estimated, by branches of activity (the main 10 branches), by extending in volume and price, or in value, the production of the year

2010, using the indices of volume, price and value available out of the statistical data described above;

- as for the financial companies and public administration, the production has been established directly, on the basis of the accounting balance sheets of the financial institutions and the general consolidated budget.

The intermediary consumption estimation

- for the non-financial companies (enterprises), the population households and the non-profit institutions, the intermediary consumption has been estimated by branches of activity (the main 10 branches), by applying the weight of the intermediary consumption in the production of the previous year (2010), as substitute for the actual weights of the year 2011, still unavailable. The same procedure has been applied also for the previous years, being explained also by the tendency relatively stable of those weights.
- as for the financial companies and public administration, the intermediary consumption has been established directly, on the basis of the accounting balance sheets of the financial institutions and the general consolidated budget.

The gross added value estimation

The gross added value has been calculated as balance between the production and the intermediary consumption.

The calculation of the taxes and subsidies on product has been achieved on the basis of the data out the consolidated budget.

1.2. The GDP estimation in the case of the semi-final variant

In calculating the GDP, contrary to the provisional variant, for the semi-final variant sources of primary data of higher level of exhaustivity and detailation have been used, which were not available by the time the provisional variant has been established, namely:

Statistical sources

- The structural inquiry by enterprises (ASA) – on a representative sample of 60 thousand units out of all the branches of activity;
- The inquiry of the family budgets (ABF) – representative sample of 38 thousand households;
- The inquiry of the labor force in the households (AMIGO) – representative sample of 112 thousand households;
- The Economic Accounts for Agriculture (CEA);

- The balance of the agricultural products;
- The inquiry on the labor force cost;
- Other annual and infra-annual available inquiries concerning the industrial production, constructions, services, trade; the agricultural production account etc.

Administrative sources from the Ministry of Public Finances

- The execution of the General Budget of the public administrations (budgetary reports), composed of: the Budget of the central public administration; the Budgets of the local administrations; the Budget of the social security, composed by: the Unemployment Fund, the Health Securities Fund, the Social Security Fund;
- The statements on the global income out of independent activities, submitted by the individual entrepreneurs and family associations to the MFP.

Accounting and financial sources

- The financial situations of the financial companies (available from the BNR);
- The financial situations of other economic agents (available from the MFP)

Other data sources

- The payments balance (supplied by BNR)

The GDP components for the semi-final variant have been estimated as follows:

The production and intermediary consumption have been established directly on the basis of the available data sources;

The gross added value has been calculated as difference between the production and the intermediary consumption;

The taxes and subsidies on product have been calculated on the basis of data out of the consolidated budget.

1.3. A first conclusion

The difference between the GDP semi-final variant and the provisional one are usually, including for the year 2011, established by:

- different data sources depending on the moment of the estimates achievement;

- utilisation of direct methods, on the basis of data sources, for the semi-final variant, respectively indirect methods of estimation of production and intermediary consumption, by extrapolation, for the provisional variant, mainly in the case of the non-financial companies (enterprises) and the population households.

For the year 2011, out of the analysis of the aggregated economic results on the basis of the available data, it resulted an increase of the weight of the intermediary consumption in production, from 61.3% (estimated weight for the year 2010 and used for the provisional estimation for 2011) to 64.6% (calculated weight on the basis of the data complete sources) in the semi-final data. The most significant contribution to the increase of the intermediary consumption has been brought by the non-financial companies (enterprises), which led to an increase of the nominal intermediary consumption for the year 2011 and, implicitly, to a reduction of the gross added value and the GDP by approximately 26 billion lei. This higher weight has been also recorded during the period 1995-1997. Over the following years, the intermediary consumption did not represent more than 59-62% of the production value. The increase could not be anticipated by the statistics of the provisional variant due to lack of any information concerning the actual intermediary consumptions for the year 2011.

- analyzing deeply these differences (between the semi-final and the provisional variants of the GDP estimated value) it can be observed that differences between the estimated values of the GDP deflator as well as between other values may inductively occur.

2. Differences recorded in the GDP deflator estimation

Explaining the differences recorded when estimating the GDP deflator, in the semi-final and provisional variants, implies the analysis of the GDP components.

2.1. The impact on the differences between the gross added value (VAB) deflator

In the case of the provisional variant of GDP estimation (implicitly of VAB), the utilization of the indirect sources, of the derived indicators estimated or extended in volume and price of the values of the previous years, based on the hypothesis of the constancy of the technological coefficients from one year to another, mainly in the area of the non-financial companies, led to the obtaining of volume and price indices relatively closed to each other for the production, intermediary consumption and VAB for the main 10 branches used for calculating the provisional GDP.

In the case of the semi-final variant, the estimation of the production, intermediary consumption and VAB in current prices has been done directly, on the basis of the available data sources, more complete and detailed, at the level of 88 branches (by CAEN divisions). The estimation of the production in constant prices, for calculating the dynamics, has been scientifically achieved, by using the corresponding price indices (the industrial production indices, the consumption prices indices, the cost indices in constructions, the price indices in services etc.), by branches of activity. The price indices used for deflating the intermediary consumption, by branches, have been calculated, according to the methodology in force, as weighted production indices, using as weighting elements the structure of the intermediary consumption by products, for each and every branch of activity, which structure is available from the table of the intermediary consumptions of the year 2010. Within the procedure approach, there is an analysis achieved as to the consistency of the production volume indices as against those of the intermediary consumption, aiming the correlation between the increases in volume of the production to which a relatively close increase of the intermediary consumption volume should correspond.

For the year 2011, it resulted that the acquisition prices for the raw materials, fuels, services etc., used for the production process increased more than those of the achieved products. Consequently, the resulting increase of the weight of the intermediary consumption in the production generated the decrease of the aggregated index of VAB, from 105.4% in the provisional variant to 102.8% in the semi-final variant. This aspect resulted as well from the comparative analysis of the index of the industrial production index for the domestic market as an overall, which recorded in 2011 an increase (8.1% as against the previous year), with the price index of the industrial production for the domestic market for intermediary goods (10.2%).

2.2. Differences between the deflators of the taxes on product

The following extremely important statement should be made: the data concerning the taxes on product are calculated on the basis supplied by the budgetary executions which are available in the provisional and final variants, depending on the moment these data are available.

The differences of the deflator of the taxes on product between the two variants aroused from the estimation of a lower level of the taxes on product for the year 2010, for which, in the case of the provisional variant, the data from the accounts of the public administrations, in the final variant, were not available.

3. What is to be known

- In order to know, to ground the efficient decisions and policies, the statistics is a national asset and must be protected against any pressure, except the scientific improvement with the purpose to satisfy all the users.
- The official statistic of Romania, as a member state of the EU, is and must be an independent institution from scientific point of view. In this respect, we have to underline the 15 fundamental principles of the official statistic as stated by the code of good practices and operatively monitorized in details: the professional independence; the mandate to collect the necessary data; the adequation of the necessary resources; the commitment concerning the quality of the statistic data and informations; the statistical confidentiality; the impartiality and objectivity (the statistical authorities develop, produce and disseminate by observing the scientific independence in an objective, professional and transparent manner, treating all the users in an equal mode); solid methodology, adequate statistical procedures; adequate response task for the respondents; ratio cost-efficiency; relevance, accuracy and fiability; promptitude and punctuality; coherence and comparability; accessibility and clearness. Observing these principles and implementing them cratively, the statistics cannot be otherwise but protected against pressures of any kind.
- One thing must be clear, namely that the statistic is an element of entering into prognosis and budgetary forecasts.
- The official statistic is an independent institution, harmonized to the international standards and bears the risks of its optimal activity. This is the essential reason for which the statistic did not turn of its mission, from its methodology, irrespectively of the interests of those using the outcomes of the scientific step.

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Forecasting the variance and return of Mexican financial series with symmetric GARCH models

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Abstract. *The present research shows the application of the generalized autoregressive conditional heteroskedasticity models (GARCH) in order to forecast the variance and return of the IPC, the EMBI, the weighted-average government funding rate, the fix exchange rate and the Mexican oil reference, as important tools for investment decisions. Forecasts in-sample and out-of-sample are performed. The covered period involves from 2005 to 2011.*

Keywords: volatility; variance; return; financial variables; investment decisions.

JEL Codes: C22, C52, C58.

REL Codes: 9B, 9F, 9G.

1. Introduction

The variations in the prices of any good or asset derive in the achievement of every profit or loss, to analyze and forecast the volatility of the assets has been the subject of a wide range of research, including Engle (1982), Bollerslev (1986), Nelson (1991), Bollerslev and Wooldridge (1992), Glosten, Jagannathan and Runkle (1993), Engle and Ng (1993), Rabemananjara and Zakoian (1993) and Engle and Manganelli (1999). Volatility refers to the squared root of the variance.

Engle (2001) mentions that when a data set presents heteroskedasticity, standard errors and confidence intervals are very narrow in a regression estimated by the least squares method, yielding a false sense of precision.

Autoregressive conditional heteroskedasticity models (ARCH) are due to Engle (1982) and generalized autoregressive conditional heteroskedasticity models (GARCH) are due to Bollerslev (1986), authors who inserted volatility variations to the models that describe an asset behavior; then Poon and Granger (2003) argue that from the basic ideas outlined in the preceding paragraphs there have been developed many variations of the basic models in order to improve the results or to ease the calculation by including a more refinement in the selection of the parameters. With these models the authors sought to improve the quality of the forecast of the expected volatility of financial assets.

GARCH models have the feature of analyzing the heteroskedasticity as a variance to be modeled, which corrects the deficiencies of the traditional methods such as the least squares adjustment and takes into account variations for each error term.

According to Engle and Manganelli (1999) the great financial disasters have forced the development of areas of risk analysis in the financial institutions. The use of effective tools to quantify the risks has become as important as the models that estimate the expected returns of the financial assets. It is used for decision-making and investment portfolio design, the tools are used in addition to the functions of monitoring, surveillance and control, so that all financial institutions had to modify their accounting based on historical prices to a mark-to-market valuation models which reflects the risk inherent to each of the financial assets.

According to Engle and Ng (1993), the ability to forecast the volatility in the financial markets is a requirement for the proper selection of the financial assets to structure an investment portfolio. In the literature, we find evidence that volatility is predictable in many asset markets; however it differs on how this should be modeled. Merton (1980) shows that the expected returns on the market are related to the accurate volatility forecast. Ferson and Harvey (1991) show that the forecast of the monthly returns of a portfolio is associated with

the forecast of the risk premiums. Schwert and Seguin (1990) use daily forecasts of variances from financial assets to estimate monthly forecasts of the variances of a portfolio. By the other hand, Ng, Engle and Rothschild (1992) state that the risk premium of an asset is decomposed into a dynamic component and a static component and their results show that the dynamic component has a greater influence on the risk premium of the analyzed asset. Therefore, it is relevant incorporating market variations in the GARCH model.

As pointed out by Franses (1998), asset prices present in a frequent way volatility clustering, i.e. periods of disturbance where there are wide variations and periods of calm with slight variations. That is to say, with regard to asset prices, the author observed large positive and negative variations that were clustered.

Under Glosten, Jagannathan and Runkle (1993) there has always been a relationship between risk and return when dealing with fair valuation of assets. There is a consensus that in certain period of time, the investor requires a higher yield from a riskier asset, condition that is not mandatory and that is dependent upon a particular investment strategy.

GARCH models capture the volatility clustering in asset returns. As Mandelbrot (1963) sets, there are periods of time where the returns of the assets do not show high variations and certain periods in which the variation of the returns related to their mean are high. The high and low variations in asset prices are grouped in certain periods and are followed by periods with mean-reversion corresponding to the long-term volatility.

According to Taylor (1986), the prices of financial assets continuously capture our attention. In a short period of time the prices of securities may experience dramatic increases or decreases in their original level. It is essential to monitor the behavior of prices in order to try to understand the likely price performance in the future. However, forecasting financial asset prices is far from an easy task.

This paper presents the application of forecasting techniques in financial series to anticipate future fluctuations, in both volatility and future returns, and contribute to the decision making process in selecting investments. It is also presented an out-of-sample forecast in order to verify the validity of the model.

As the first stage of the study, we worked on the transformation of the financial variables in order to make them stationary, and then we conducted tests to detect autoregressive conditional heteroskedasticity effects. Regarding the analyzed stock index, the results showed a high persistence in volatility shocks and it was found that the variance converges to a stable value, as it was observed in the case of the country risk indicator, the fix exchange rate and the Mexican oil reference, achieving the same conclusions.

The study of the variance of the weighted-average government funding rate shows that the behavior of the autoregressive conditional heteroskedasticity model does not show a clear mean-reversion.

The in-sample forecast data using the estimated GARCH models threw very similar trajectories with respect to the actual data of the analyzed variables.

The out-of-sample results verify the capacity of the GARCH models to predict and capture the behavior of the analyzed financial variables.

This paper is structured as follows. Section 2 describes the theoretical framework used in the research. Section 3 points out the financial variables included in the research and the structure of the database. Section 4 presents the results of the estimation of the GARCH model and its evaluation for each of the studied variables; section 5 shows the in-sample and out-of-sample forecasting for the financial variables. Finally, we conclude the paper.

2. Theoretical framework

The GARCH model developed by Bollerslev (1986) estimated a conditional variance that is a weighted forecast that considers three different variance forecasts. One is the constant variance corresponding to the long term variance. The second one is the forecast made in the prior period and the third one involves the new information that affects the previous forecast. The equation in the simplest case is:

$$\sigma_t^2 = \alpha_0 + \alpha_1 u_{t-1}^2 + \beta \sigma_{t-1}^2 \quad (1)$$

Equation 1 shows the symmetric⁽¹⁾ GARCH(1,1), where σ_t^2 represents the conditional variance, due to the fact that it is calculated from past information that is considered relevant. The weights of these three forecasts determine how fast the variance changes when new information arises and how fast the variance reverts to its mean.

According to the above formulation, the behavior of the squared return in time t with regard to the conditional variance is given by:

$$\varepsilon_t = u_t^2 - \sigma_t^2 \quad (2)$$

The above equation can also be expressed as:

$$\sigma_t^2 = u_t^2 - \varepsilon_t \quad (3)$$

We use the previous equation and replace it in the conditional variance formula calculated from equation 1 and we obtain:

$$u_t^2 - \varepsilon_t = \alpha_0 + \alpha_1 u_{t-1}^2 + \beta(u_{t-1}^2 - \varepsilon_{t-1}) \quad (4)$$

The prior equation leads to the following expression:

$$u_t^2 = \alpha_0 + \alpha_1 u_{t-1}^2 + \beta(u_{t-1}^2 - \varepsilon_{t-1}) + \varepsilon_t \quad (5)$$

We gather the common terms:

$$u_t^2 = \alpha_0 + (\alpha_1 + \beta)u_{t-1}^2 - \beta\varepsilon_{t-1} + \varepsilon_t \quad (6)$$

Equation 6 corresponds to an ARMA(1,1) process that contains the squared errors.

The goodness-of-fit of the GARCH model is that its use is very simple because it has a higher probability of finding non-negative constraints. The GARCH(1,1), which includes only three parameters in the conditional variance equation, is a parsimonious model since it incorporates an infinite number of squared errors in the past in order to influence the conditional variance in the present.

The GARCH(1,1) can be extended to a GARCH(p,q) where the current conditional variance is valued to depend on p lags of the squared error and q lags of the conditional variance, which is expressed in equation 7:

$$\sigma_t^2 = \alpha_0 + \alpha_1 u_{t-1}^2 + \dots + \alpha_p u_{t-p}^2 + \beta_1 \sigma_{t-1}^2 + \dots + \beta_q \sigma_{t-q}^2 \quad (7)$$

Generally, the above is summarized according to equation 8:

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^p \alpha_i u_{t-i}^2 + \sum_{j=1}^q \beta_j \sigma_{t-j}^2 \quad (8)$$

However, the GARCH(1,1) model captures data volatility clustering and we rarely use a higher superior model to estimate the financial series volatility.

The conditional variance constantly changes, nevertheless, the u_t unconditional variance is constant and is given by

$$\text{var}(u_t) = \frac{\alpha_0}{1-(\alpha_1+\beta)} \quad \text{para } \alpha_1 + \beta < 1 \quad (9)$$

If $\alpha_1 + \beta \geq 1$, then the variance is non-stationary. If $\alpha_1 + \beta = 1$ then there exists a unit root in the variance, also called integrated GARCH or

IGARCH whose analysis is beyond the scopes of this paper. In order to obtain a GARCH process with mean reversion it is required that the sum of the coefficients $\alpha_1 + \beta$ is less than one; these parameters measure the persistence of the data set volatility; therefore, the result of the sum of these parameters has a meaning, while this piece of information tends to one, the volatility will persist more while as the result tends to zero, the volatility will be closer to the long term variance with a higher speed.

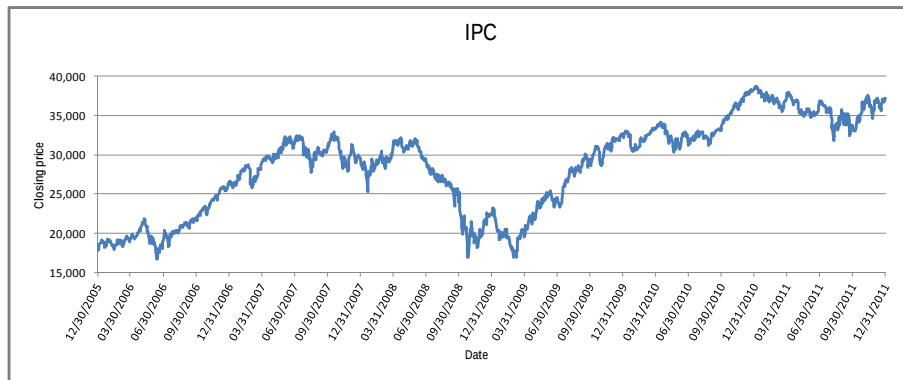
3. Database used in the research

The database that was used in the present research includes daily information that covers the period December 30, 2005 to December 30, 2011. We included 1,507 observations related to the *Mexican Stock Exchange Index* (IPC); 1,499 observations related to the *Emerging Markets Bond Index* (EMBI); 1,509 observations related to the *weighted-average government funding rate* and the *fix exchange rate*. Finally, we used 1,426 observations related to the *Mexican oil reference*. See Appendix-1 for further details.

4. GARCH model for the financial variables and evaluation of the forecasts

4.1. Symmetric GARCH model for the IPC

With regard to the IPC, we used 1,507 observations that include the daily closing price. Data are presented in Figure 1.

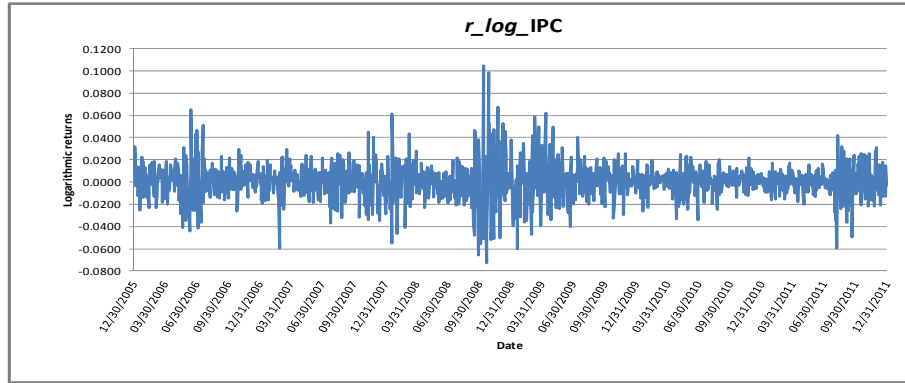


Source: Mexican Stock Exchange.

Figure 1. *IPC daily closing price*

Figure 2 shows the IPC logarithmic returns at time t according to the following formula:

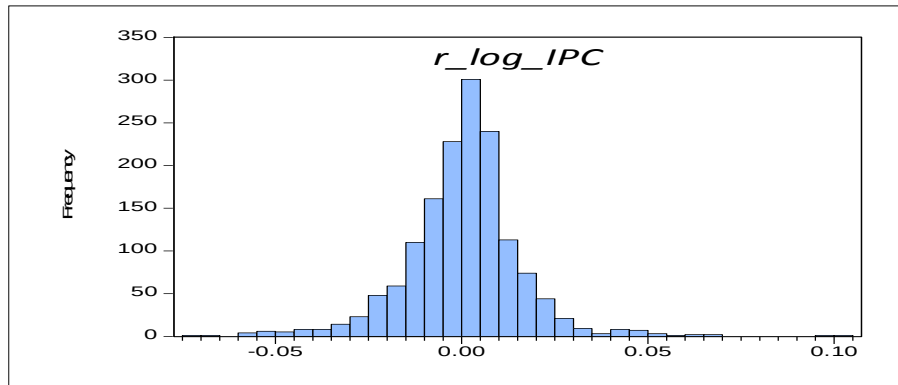
$$r_{log_IPC_t} = \log \left(\frac{IPC_t}{IPC_{t-1}} \right)$$



Source: Mexican Stock Exchange.

Figure 2. *IPC Logarithmic returns*

Figure 3 shows the frequency histogram for the IPC logarithmic returns. Descriptive statistics show a mean of 0.000487, a median of 0.001267, a maximum of 0.104407, a minimum of -0.072661, a standard deviation of 0.015513, a skewness of 0.121546 and a kurtosis of 7.803962. The Jarque-Bera test yielded a result of 1,451.856000 with a probability of 0.000000, confirming that the return series are not normally distributed.



Plotting data: Eviews.

Figure 3. *Frequency histogram for the IPC logarithmic returns*

It is noted that the distribution of the IPC daily returns presents kurtosis excess compared to a normal distribution. The value of 7.803962 for kurtosis in the distribution of the IPC daily prices returns during the observed period

confirms the presence of fat tails in the distribution. The leptokurtic distribution for the r_log_IPC series shows that there are high returns more frequently than expected.

We apply a stationarity test to r_log_IPC series and the results are presented in Table 1.

Table 1

Augmented Dickey-Fuller Test to r_log_IPC series

Null hypothesis: r_log_IPC has a unit root

		t Statistic	Probability
Augmented Dickey-Fuller test statistic		-35.54889	0.00000
Test critical values:	1% level	-3.43449	
	5% level	-2.86326	
	10% level	-2.56773	

Source: Eviews output.

From the results presented in Table 1, we can reject the hypothesis r_log_ipc series is not stationary; this allows us to state that for none of the intervals for which the result is evaluated, the series presents unit root, therefore, it is stationary.

We obtain a correlogram in order to detect problems related to autocorrelation and partial autocorrelation. Through the analysis of the correlogram, we performed the model that best fits the data series which is: ARIMA (34, 1, 30), as shown in Table 2.

Table 2

ARIMA Model

Dependent variable: r_log_IPC

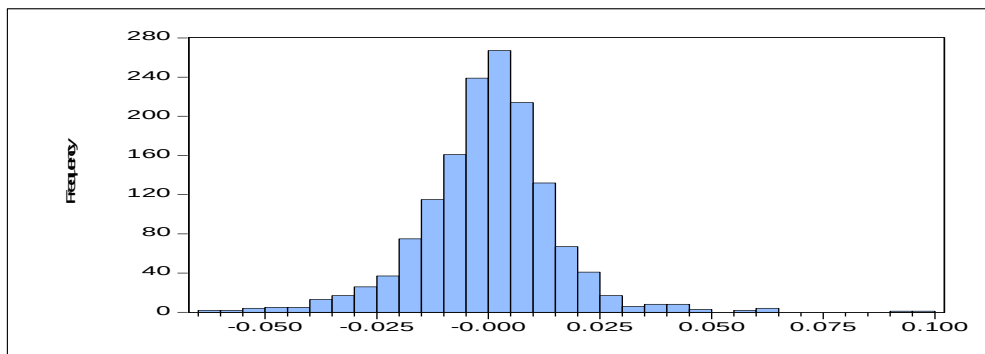
Variable	Coefficient	Standard error	t Statistic	Probability
C	0.000481	0.000389	1.235915	0.216700
AR(1)	0.072536	0.032713	2.217365	0.026800
AR(2)	-0.049913	0.025199	-1.980721	0.047800
AR(12)	0.067514	0.027937	2.416608	0.015800
AR(13)	0.068509	0.027537	2.487908	0.013000
AR(21)	0.256020	0.055284	4.631033	0.000000
AR(30)	-0.578213	0.061380	-9.420191	0.000000
AR(31)	0.060444	0.030666	1.971039	0.048900
AR(34)	-0.078108	0.027504	-2.839825	0.004600
MA(7)	-0.088359	0.024083	-3.668963	0.000300
MA(21)	-0.302324	0.053610	-5.639261	0.000000
MA(30)	0.560660	0.059149	9.478809	0.000000

Log likelihood	4,084.932000
F statistic	8.558195
Probability	0.000000
Akaike info criterion	-5.533874
Schwarz criterion	-5.490714

Source: Eviews output.

The coefficients for the proposed model are significantly different from zero at 95% of confidence level and the correlogram for the residuals shows that the autocorrelation and partial correlation values for 36 lags are between the bands, therefore, for a 95% confidence level, it is assumed that the residual series represents white noise.

In applying the Jarque-Bera testing to the residuals in order to prove normality for the developed ARIMA model of Table 2, we lead to the conclusion that we reject normality on the residuals, since the result is 1,033.885000 with a probability of 0.0. The frequency histogram for the residuals is presented in Figure 4. The skewness for the residuals is 0.194224 and the kurtosis is 7.087289.



Plotting data: Eviews.

Figure 4. Frequency histogram for the residuals

With the assistance of the ARCH-LM test we verify the existence of ARCH effects in the residuals; the results are presented in Table 3.

Table 3

ARCH test for the residuals

F-statistic	19.609230	Probability	0.000000
Observed R-squared	19.377270	Probability	0.000000

Source: Eviews output.

The probabilities for F-statistic and observed R-squared are less than 0.05; we chose one lag in order to incorporate the ARCH effect, according to the results, the null hypothesis of non existence of ARCH effects is rejected. To fit the appropriate GARCH model, we used the quasi-maximum likelihood Bollerslev and Wooldridge (1992) method, and the Marquardt optimization algorithm; the results are shown in Table 4.

Table 4

GARCH(1,1) modelDependent variable: r_log_IPC

Method: ML - ARCH (Marquardt) - Distribución Normal

$$GARCH = C(11) + C(12)*RESID(-1)^2 + C(13)*GARCH(-1)$$

Variable	Coefficient	Standard error	z-Statistic	Probability
C	0.000703	0.000282	2.491160	0.012700
AR(1)	0.061713	0.026623	2.318059	0.020400
AR(13)	0.058377	0.023648	2.468557	0.013600
AR(21)	0.386558	0.088948	4.345904	0.000000
AR(30)	-0.408527	0.080175	-5.095451	0.000000
AR(31)	0.053435	0.022347	2.391172	0.016800
AR(34)	-0.050781	0.021745	-2.335316	0.019500
MA(7)	-0.063663	0.019547	-3.256954	0.001100
MA(21)	-0.425349	0.087911	-4.838411	0.000000
MA(30)	0.406395	0.080295	5.061294	0.000000

Variance equation

C	0.000003	0.000001	2.255087	0.024100
RESID(-1)^2	0.103287	0.021300	4.849245	0.000000
GARCH(-1)	0.886654	0.022481	39.439630	0.000000

Log likelihood	4,300.61
Akaike info criterion	-5.82555
Schwarz criterion	-5.778793

Source: Eviews output.

It was found that the model with the best fit was GARCH(1,1) according to the results presented in Table 4. From the correlogram of residuals, it is noted that the autocorrelation values and the partial autocorrelation values for 36 lags were in the band of confidence of 90%. Additionally, we applied the ARCH-LM test to the residuals we obtained with the regression and results are shown in Table 5.

Table 5

ARCH test for the residuals

F-statistic	0.000501	Probability	0.982100
Observed R-squared	0.000502	Probability	0.982100

Source: Eviews output.

According to the results of Table 5, the probability for F-statistic and for observed R-squared is greater than 0.05; therefore we accept the null hypothesis and it is stated that there are no ARCH effects affecting the estimation.

From the results, we selected the ARIMA model according to the parameters we show in Table 4:

$$r_log_IPC_t = 0.000703 + 0.061713 r_log_IPC_{t-1} + 0.058377 r_log_IPC_{t-13} + 0.386558 r_log_IPC_{t-21} - 0.408527 r_log_IPC_{t-30} + 0.053435 r_log_IPC_{t-31} - 0.050781 r_log_IPC_{t-34} - 0.063663 \varepsilon_{t-7} - 0.425349 \varepsilon_{t-21} + 0.406395 \varepsilon_{t-30} + \varepsilon_t$$

We selected the GARCH(1,1) model to represent the variance as shown in Table 4.

$$\sigma_t^2 = 0.000003 + 0.103287 u_{t-1}^2 + 0.886654 \sigma_{t-1}^2$$

The sum of ARCH and GARCH coefficients is 0.989941, indicating a high persistence of volatility shocks as mentioned by Engle (2001).

4.2. Symmetric GARCH model for the EMBI

In order to forecast the EMBI, we used 1,499 daily observations. We worked with the EMBI database in the same way we managed the IPC database. Descriptive statistics for the log first difference (d_log_EMBI) showed a mean of 0.000264, a median of 0.0, a maximum of 0.215975, a minimum of -0.192034, a standard deviation of 0.043041, a skewness of 0.139464 and a kurtosis of 5.216449. The Jarque-Bera test yielded a result of 311.487000 with a probability of 0.0, confirming that the log first difference series are not normally distributed.

We selected the following ARIMA model:

$$d_log_EMBI_t = -0.000974 - 0.741352 d_log_EMBI_{t-25} + 0.791185 \varepsilon_{t-25} + \varepsilon_t$$

We selected the following GARCH(1,1) model to represent the variance:

$$\sigma_t^2 = 0.000065 + 0.101050 u_{t-1}^2 + 0.867361 \sigma_{t-1}^2$$

The sum of ARCH and GARCH coefficients is 0.968411, indicating a high persistence of volatility shocks as mentioned by Engle (2001).

4.3. Symmetric GARCH model for the weighted-average government funding rate

We used 1,509 daily observations to work with the weighted-average government funding rate. We handled the first difference between the current and previous data. Descriptive statistics for the first difference ($d_tfondeo$) showed a mean of -0.000024, a median of 0.0, a maximum of 0.005800, a

minimum of -0.007500, a standard deviation of 0.000665, a skewness of -3.734920 and a kurtosis of 56.903310. The Jarque-Bera test yielded a result of 186,072.5 with a probability of 0.0, confirming that the first difference series are not normally distributed.

We selected the following ARIMA model:

$$d_tfondeo_t = -0.000007 + 0.025967 d_tfondeo_{t-8} + \\ + 0.170460 d_tfondeo_{t-20} - 0.059123 \varepsilon_{t-1} + 0.269492 \varepsilon_{t-18} - \\ - 0.130003 \varepsilon_{t-19} + \varepsilon_t$$

We selected the following ARCH(1) model to represent the variance:

$$\sigma_t^2 = 2.886024 u_{t-1}^2$$

The ARCH coefficient is greater than one, this indicates that the variance is not stationary as mentioned by Perez (2007); therefore, a more exhaustive study for this variable is needed.

4.4. Symmetric GARCH model for the fix exchange rate

In order to forecast the fix exchange rate, we used 1,509 daily observations. Descriptive statistics for the log first difference (d_log_FIX) showed a mean of 0.000180, a median of -0.000458, a maximum of 0.073328, a minimum of -0.055975, a standard deviation of 0.007578, a skewness of 0.873978 and a kurtosis of 17.578870. The Jarque-Bera test yielded a result of 13,546.790000 with a probability of 0.0, confirming that the log first difference series are not normally distributed.

We selected the following ARIMA model:

$$d_log_FIX_t = -0.000118 - 0.495221 d_log_FIX_{t-27} - \\ - 0.234008 d_log_FIX_{t-28} + 0.476132 \varepsilon_{t-27} + 0.268737 \varepsilon_{t-28} + \\ + 0.056247 \varepsilon_{t-31} + \varepsilon_t$$

We selected the following GARCH(1,1) model to represent the variance:

$$\sigma_t^2 = 0.127192 u_{t-1}^2 + 0.869428 \sigma_{t-1}^2$$

The sum of ARCH and GARCH coefficients is 0.996620, indicating a high persistence of volatility shocks as mentioned by Engle (2001).

4.5. Symmetric GARCH model for the Mexican oil reference

In order to forecast the Mexican oil reference, we used 1,425 daily observations. Descriptive statistics for the log first difference (d_log_mezcla) showed a mean of 0.000572, a median of 0.001951, a maximum of 0.137918, a minimum of -0.118373, a standard deviation of 0.024456, a skewness of -0.198038 and a kurtosis of 7.079463. The Jarque-Bera test yielded a result of 997.434500 with a probability of 0.0, confirming that the log first difference series are not normally distributed.

$$d_log_mezcla_t = 0.001238 - 0.578694 d_log_mezcla_{t-23} - 0.052692 d_log_mezcla_{t-33} + 0.619774 \varepsilon_{t-23} + 0.056456 \varepsilon_{t-35} + \varepsilon_t$$

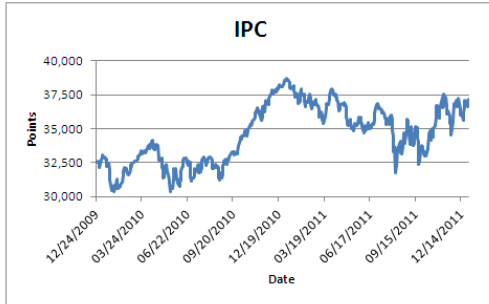
We selected the following GARCH(1,1) model to represent the variance:

$$\sigma_t^2 = 0.000005 + 0.0480380 u_{t-1}^2 + 0.939831 \sigma_{t-1}^2$$

The sum of ARCH and GARCH coefficients is 0.987869, indicating a high persistence of volatility shocks as mentioned by Engle (2001).

5. In-sample and out-of-sample forecasting

According to the selected GARCH models, we proceeded to perform an in-sample forecasting from the 1,000 data hereinafter for each of the analyzed variables, the results are shown below.



Source: Eviews output.

Figure 5. Actual closing prices for the IPC

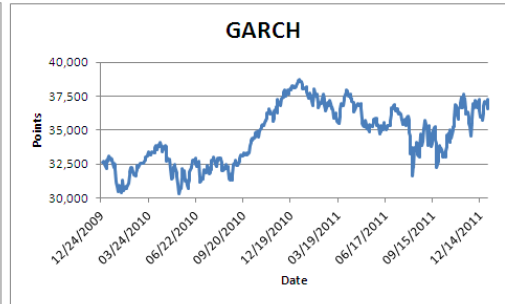
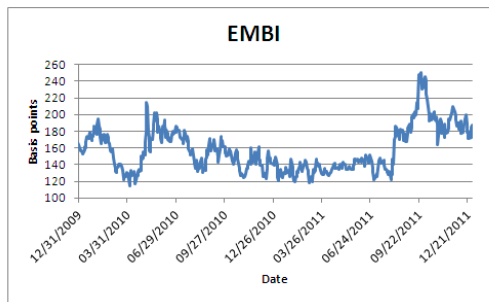


Figure 6. GARCH forecasting

As shown in figures 5 and 6, the in-sample forecast follows the same trend as the actual IPC data.



Source: Eviews output.

Figure 7. EMBI real data

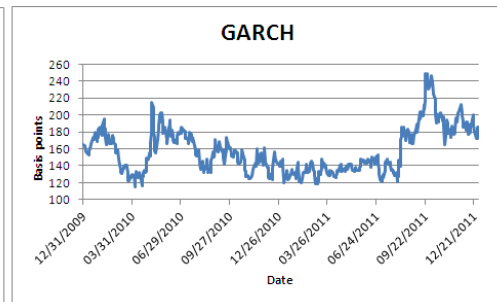
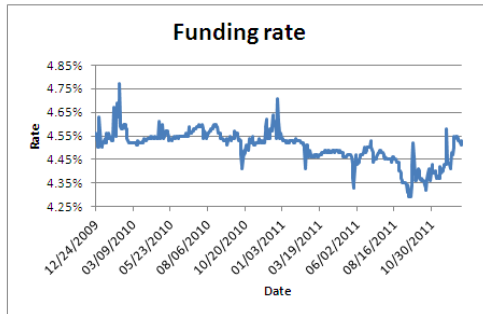


Figure 8. GARCH forecasting

Figure 7 and Figure 8 show the fact that the EMBI data and the in-sample forecast look alike.



Source: Eviews output.

Figure 9. *Weighted-average government funding rate real data*

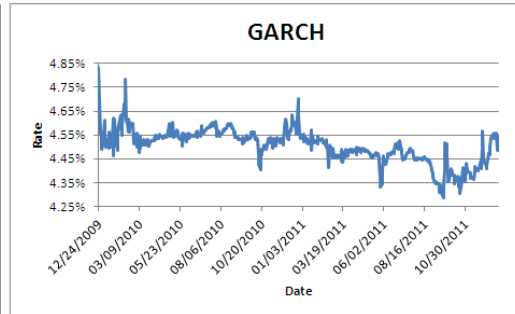
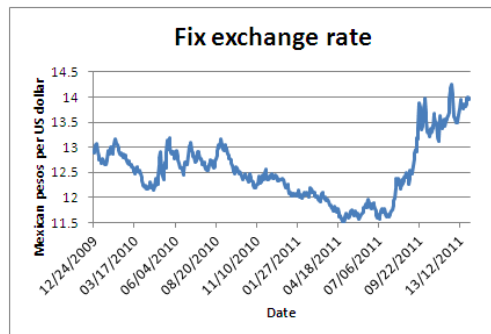


Figure 10. *GARCH forecasting*

Figures 9 and 10 show similar trajectories for the in-sample forecast and the real database for the weighted-average government funding real data.



Source: Eviews output.

Figure 11. *Fix exchange rate*

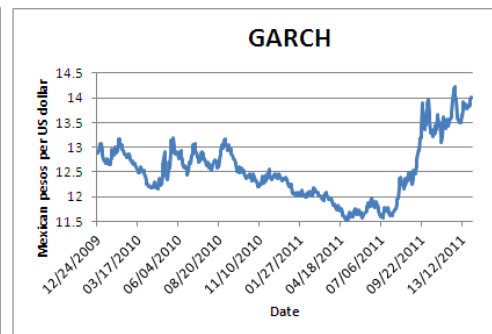
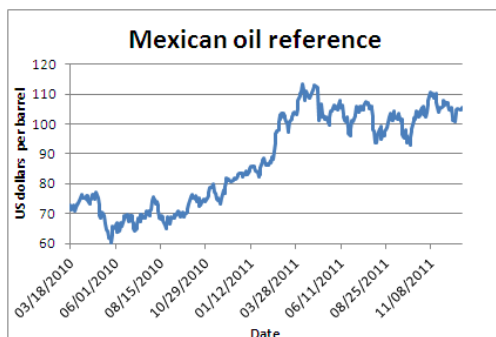


Figure 12. *GARCH forecasting*

Figures 11 and 12 show quite similar paths, one of them represents the real fix exchange rate observations and the other shows the in-sample forecast.



Source: Eviews output.

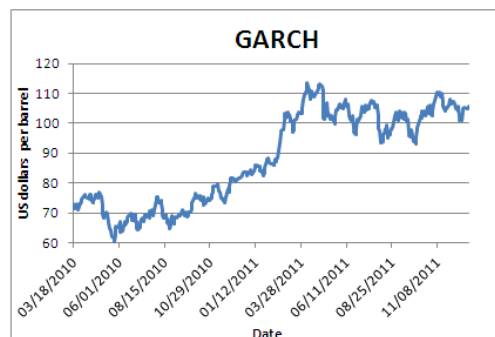


Figure 14. GARCH forecasting

Figure 13. Mexican oil reference

Figures 13 and 14 leave clear that the real information for the Mexican oil reference and the in-sample forecast follow similar trajectories.

By the other hand, we show a table for the variables we focused on where we included the most used indicators to assess the predictive capacity of each GARCH model we developed according to the methodology implemented by López-Herrera (2004) and Analía (2008).

Table 6

Evaluation of the in-sample forecast performance

INDICATOR	IPC	EMBI	Funding rate	Fix exchange rate	Mexican oil reference
Root mean squared error	368.189368	7.302710	0.000019	0.001750	1.507516
Mean absolute error	267.870842	5.470694	0.000179	0.063273	1.118887
Mean absolute percent error	0.780807	3.448249	0.397325	0.497716	1.286252
Theil inequality coefficient	0.005315	0.022939	0.003416	0.003560	0.008422
Bias proportion	0.001724	0.000641	0.000009	0.001441	0.000501
Variance proportion	0.000040	0.000004	0.005265	0.000901	0.000066
Covariance proportion	0.998236	0.999355	0.994726	0.997658	0.999433

Source: Eviews output.

Among the important results we emphasize that the root mean squared error, the mean absolute error and the mean absolute percent error for these variables represent less than 1% of the original level data. As long as the above indicators result close to zero, we obtain greater success in predicting with the referred models. The Theil inequality coefficient will always result between zero and one. The Theil inequality coefficient tends to zero for these five variables, indicating that there is an adequate fit for all forecasts. The Theil inequality coefficient is rescaled and decomposed into three proportions of inequality, the bias proportion, the variance proportion and the covariance proportion. The sum of the three proportions of inequality is equal to one.

The bias proportion is an indication of the systematic error. We expect the bias proportion is always close to zero. A large bias proportion indicates a systematic error with regard to the prediction. The research showed a minimum systematic error for the five variables.

The variance proportion should tend to zero to indicate the ability of the forecasts to replicate the variability in the variable to be forecast. The study showed the condition for each of the variables.

The covariance proportion measures the unsystematic error; this indicator should concentrate the highest proportion of the Theil inequality coefficient. The results for the five variables showed the highest concentration of the inequality in this indicator.

Next we evaluated if the forecasts can replicate the descriptive statistics for the series of interest, the results show that the statistic indicators correspond to the characteristic of the original series for the time horizon selected, so we conclude that the forecasts are adequate.

Table 7

Reproduction of the central moments of the IPC

	IPC	GARCH
Mean	34,585.000000	34,600.270000
Median	34,828.040000	34,821.530000
Standard Deviation	2,183.844000	2,186.208000
Skewness	-0.041335	-0.035855
Kurtosis	1.787480	1.791072

Source: Eviews output.

Table 8

Reproduction of the central moments of the EMBI

	EMBI	GARCH
Mean	157.108200	156.923200
Median	150.000000	149.452300
Standard Deviation	26.481260	26.467540
Skewness	0.852728	0.860356
Kurtosis	3.429933	3.459937

Table 9

Reproduction of the central moments of the weighted-average government funding rate

	FUNDING RATE	GARCH
Mean	4.503800%	4.503900%
Median	4.520000%	4.517100%
Standard Deviation	0.069000%	0.071200%
Skewness	-0.502101	-0.276739
Kurtosis	3.759659	4.262270

Source: Eviews output.

Table 10

Reproduction of the central moments of the fix exchange rate

	FIX EXCHANGE RATE	GARCH
Mean	12.533950	12.530570
Median	12.477900	12.476410
Standard Deviation	0.603213	0.600532
Skewness	0.510473	0.502088
Kurtosis	2.781690	2.779479

Table 11

Reproduction of the central moments of the Mexican oil reference

	MEXICAN OIL REFERENCE	GARCH
Mean	88.132350	88.166100
Median	86.970000	86.720420
Standard Deviation	15.632130	15.644400
Skewness	-0.074285	-0.065289
Kurtosis	1.409585	1.408882

Source: Eviews output.

From the information hereby presented, we conclude with a 95% of confidence the forecasts obtained from estimated GARCH models adequately fit.

With estimated GARCH models we performed out-of-sample forecasting, creating five estimations from the last one that makes up the original sample, these forecasts were compared to the actual data in order to evaluate the accuracy of the estimations. The selected criterion considers that while the average of the forecast data and actual data lays around 100, the out-of-sample forecast is more accurate.

The evaluation of the forecast for these studied variables is presented in the form of table for each of them.

Table 12

Evaluation of the out-of-sample forecast for the IPC

Date	IPC forecast	IPC actual	Evaluation of the out-of-sample forecast
01/02/2012	37,041.093326	37,335.030000	99.212705
01/03/2012	37,063.837889	37,384.340000	99.142684
01/04/2012	37,076.381494	37,387.630000	99.167509
01/05/2012	37,063.005552	37,017.950000	100.121713
01/06/2012	37,139.790489	36,804.050000	100.912238
Average			99.711370

Source: Based on data provided by Mexican Stock Exchange.

Table 13

Evaluation of the out-of-sample forecast for the EMBI

Date	EMBI forecast	EMBI actual	Evaluation of the out-of-sample forecast
01/03/2012	187.128440	183.000000	102.255978
01/04/2012	185.175830	183.000000	101.188978
01/05/2012	185.340877	182.000000	101.835647
01/06/2012	184.933851	187.000000	98.895108
01/09/2012	184.430168	186.000000	99.156004
Average			100.666343

Source: Based on data provided by Bloomberg.

Table 14

**Evaluation of the out-of-sample
forecast for the weighted-
average government funding rate**

Date	FUNDING RATE forecast	FUNDING RATE actual	Evaluation of the out-of-sample forecast
01/03/2012	4.528914%	4.520000%	100.197205
01/04/2012	4.519290%	4.520000%	99.984297
01/05/2012	4.524981%	4.500000%	100.555137
01/06/2012	4.535460%	4.500000%	100.787992
01/09/2012	4.526414%	4.490000%	100.810998
Average			100.467126

Source: Based on data provided by
Banco de México.

Table 15

**Evaluation of the out-of-sample
forecast for the fix exchange rate**

Date	FIX EXCHANGE RATE forecast	FIX EXCHANGE RATE actual	Evaluation of the out-of-sample forecast
01/03/2012	13.963165	13.688200	102.008775
01/04/2012	13.972604	13.714400	101.882719
01/05/2012	13.974390	13.740900	101.699230
01/06/2012	13.997323	13.722800	102.000492
01/09/2012	13.994901	13.743700	101.827757
Average			101.883794

Source: Based on data provided by
Banco de México.

Table 16

**Evaluation of the out-of-sample
forecast for the Mexican oil reference**

Date	MEXICAN OIL REFERENCE forecast	MEXICAN OIL REFERENCE actual	Evaluation of the out-of-sample forecast
01/03/2012	106.115172	108.120000	98.145738
01/04/2012	106.135333	109.300000	97.104604
01/05/2012	106.128376	108.480000	97.832205
01/06/2012	106.121772	108.200000	98.079272
01/09/2012	106.288560	107.620000	98.762832
Promedio			97.984930

Source: Based on data provided by Bloomberg.

The results clearly show the ability of GARCH models to forecast and capture the behavior of the five studied variables, enriching the knowledge of the features of the series in order to perform the accurate analysis and estimation of the trend that they will follow in the future as an essential tool for investors and analysts.

Conclusions

The empirical evidence suggested the symmetric GARCH models estimated for each variable in the research represent appropriately the behavior and trend of the series and allow to obtain accurate forecasts, we also confirmed the convergence that is presented with regard to the conditional variance forecast for the studied variables, with the exception of the weighted-average government funding rate, for which we did not find consistent evidence on the presence of mean reversion.

We confirmed that GARCH processes are mean reverting when the ARCH and GARCH coefficients sum up to a number less than one; as it is closer to one, the volatility will persist.

It was found that estimated GARCH models allow forecasting data that present similar trends to those for actual data with regard to the studied variables.

The forecast testing that we performed showed an error lower than 1%, finding that it is suitable for practical purposes. It is important to note that when we analyzed the level variables, the error can be seen high, but when we normalized the variables, the proportion is quite low.

Among the main results it is important to point out that the root mean squared error, the mean absolute error and the mean absolute percent error for these variables represent less than 1% of the original level data. The lower the values of these indicators, the higher the success of the models to forecast.

The Theil inequality coefficient tends to zero for these five variables, indicating that there is an adequate fit for all forecasts. We observed a minimum systematic error and a more concentrated non-systematic error that corresponds to the optimal levels of the Theil inequality coefficient.

It was evaluated the capacity of the models to forecast according to the reproduction of the descriptive statistic of the studied series, as important results we found that the statistical indicators correspond to the features of the original time series for the time horizon selected, findings that allowed us to conclude that the forecasts adequately fit.

The results showed the ability of GARCH models to forecast and capture the behavior and trend of the studied financial variables, providing an additional tool for investors and financial analysts in order to evaluate objectively the performance of different assets among the wide range of investment choices that exist in the financial markets.

Note

- ⁽¹⁾ The term symmetric refers to the fact that good news and bad news affect in the same way the prices of the financial assets.

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Appendix 1

The Mexican IPC index (IPC) is the main indicator which tracks the performance of leading companies listed on the Mexican Stock Exchange (BMV); it is made of a balanced weighted and representative selection of a group of shares that are listed on the Mexican stock market. The IPC is an indicator of the stock market fluctuations; an important feature is the fact that the IPC is representative and it reflects the behavior and the operating dynamics of the Mexican stock market and several shares that integrate it. The IPC is expressed in points. We consulted www.bmv.com.mx to obtain the information. We considered the closing prices.

The Emerging Markets Bond Index (EMBI) is the main indicator of country risk. It is calculated daily by the bank JP Morgan Chase, it measures the spread between the interest rate paid in bonds issued by emerging countries and denominated in US dollars and the return paid by the United States treasury bonds. The spread is expressed in basis points. JP Morgan Chase calculates the indicator for Russia, Ukraine, Brazil, Argentina, Indonesia, Bulgaria, Venezuela, Egypt, Colombia, Morocco, Nigeria, Mexico, Panama, Poland, Peru, Turkey, the Philippines, Ecuador and South Africa. We consulted Bloomberg to obtain the information with regard to the EMBI Mexico.

The weighted-average government funding rate is an indicator provided and calculated by the central bank of Mexico, Banco de México that considers the interest rate representative of the wholesale operations carried out by banks and brokerage firms. It is the average transaction-amount-weighted interest rate for one-day repo transactions with government securities settled through the system managed by INDEVAL, the Mexican securities clearing house. Transactions among institutions that belong to the same financial group and their customers are excluded. We consulted www.banxico.org.mx to obtain the information. We considered the weighted-average.

The fix exchange rate is determined by Banco de México on banking days, it is the result of an average of quotations of the exchange market of wholesale operations to be settled on the second banking day of its determination. Banco de México calculates three samples during the banking day; between 9 a.m. and 12 p.m. Banco de México informs the resulting average from 12 p.m. onward each banking day. The fix exchange rate is published by Banco de México in the *Diario Oficial de la Federación* on the next banking day of its determination. The quotation is expressed in Mexican pesos per US dollar. We consulted www.banxico.org.mx to obtain the information.

The Mexican oil reference, according to Dávila, Núñez y Ruiz (2009), is the export basket of crude oil which includes three types of oil: 1) The Olmeca, a light

crude oil of 39 degrees API (American Petroleum Institute), the indicator shows the relationship of the weight of petroleum product in relation to water. If it is lighter than water and floats on water, the API degrees are over 10. The higher the API degrees, the petroleum product is heavier. 2) The Istmo of 32 degrees API and, 3) the Maya of 22 degrees API. Participation in weighting of each of these three types of oil is determined by Petróleos Mexicanos (PEMEX), however, the Maya has the greatest influence in the weighting. The information is released to the public every banking day approximately at 6 p.m. Prices are expressed in US dollars per barrel of crude oil. We consulted Bloomberg to obtain the information.

Meanings and spreading patterns of the “positive” concept in economic thought

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Abstract. *A brief retrospective on economic thought reveals that, in the quest for the scientific status of their research, economists had to refine not only their research methods, but even the economic language itself. The use and, sometimes, the abuse of the “positive” concept in present economic discourse are clear proofs that the constant changes of economic language mark significantly economic science. Coined by Auguste Comte, who denied the very existence of economic science, the “positive” concept has become for a significant part of economists a key-term that guarantees and emphasizes the scientific status of their research. Alternatively, an important body of scholars seems to provide a different meaning for this concept and uses it in order to reveal economic facts, more precisely, economic growth. One who is not very familiar with the methodology of economics might be confused by these different meanings hidden in a single term. In this context, the present paper aims to bring more light into this issue by providing both an epistemological analysis of “positive” term and a sketch of spreading patterns of this concept via scientific publications. Consequently, the research follows two major well-defined paths: 1) the epistemological analysis of various meanings related to the “positive” term and 2) the quantitative study of occurrences in which this concept is used and cited in economic journals with high ISI citation index.*

Keywords: positive; epistemology; economic language.

JEL Code: B41.

REL Codes: 2B, 18F.

1. Introduction

After two hundred fifty years since the founding the economic science and after a millenary history of economic ideas, a very large part of the economists seem more and more certain that they found in the qualitative analysis the right path of the economic science identity and the unravel of the epistemological mystery of multilateral way of thinking and of the research methods. The systematic spread of ideas according to which the economist has to convey to empirical rules that help organize the knowledge and the research in the so called “tough” sciences does not mean anything else than submitting to the requirements of the “positive economy” or even the “normative” one, shifting the scientific interest towards “what it is” and obviously towards “what it should be”. This great controversy in the economic science appeared almost two centuries ago between the “quantitativists” and the “explicationists”. Positivists conviction in the power of the quantitative modeling to change the economic orientation goes beyond any doubt even when the “explicationists” asks: What is noticed and what is actually measured?

The obsessively repeated economic concepts associated with the positive term show the high frequency of the words “positive economy”. The term “positive economy” comes from the spreading of the influence of positivism on all areas of knowledge. In the intellectual history of ideas, the detailed analysis of positivism made by Theodor Ruysen reveals a set of trends in thinking which consider that only the analysis and knowing the real facts verified by experience can explain the phenomena of the sensorial world. The followers of positivism invoke the certainty given exclusively by the scientific experience, they reject introspection, intuition or any other form of metaphysical approach that could explain understanding the phenomena. In the 19th century, the positivism, as a logic empiricism, spread across all fields of knowledge including the economic one.

In this context, the purpose of this paper is, on one hand, to analyze the meanings given to the term “positive” in the various epistemological currents that have found their echo in the economic science and, on the other hand, to conduct a quantitative study on the occurrences of the positive term as “positive theory” and of the couple “positive-normative” in the journal *The Quarterly Journal of Economics* and *The Journal of Economic Literature* in order to estimate the frequency of the use of this term and also the common contexts in which it is used.

2. The positivist current in economy

2.1. Social positivism

Positivism was launched in the scientific community by Auguste Comte, initially in the form of scientific positivism, and since 1847 until the end of his life, he oriented positivism towards the “new law of humanity” with his own “religion” (Marietti Kremer, 1997). Auguste Comte, as every utopian from the beginning of the nineteenth century, dreamed of a society based on unified science, on positive science. In the particular manner of the Encyclopedia-tists, Auguste Comte suggests a *holistic research program* and an *ad hoc* structure of sciences: “the positive philosophy includes five or six sciences: mathematics, astronomy, physics, chemistry, biology and sociology” (Comte, 1910, p. 18). The place that each science has in the hierarchy depended on the fulfilment of certain criteria, such as: the degree of accuracy, the degree of objectivity, the degree of historical priority, the degree of precision and the degree of certainty. A study subject can be considered a science if there is a class of homogeneous phenomena, if they met the criteria of relevance and if the related phenomena could be researched using the positive method (observation, experience and measurement). Therefore, in this set given by Auguste Comte, the economic science did not take place because it did not meet the requirements to access the set of sciences. Auguste Comte went further to introduce the *Discours sur l'ensemble du positivisme*, exposes the manner in which the “Positive Philosophy decomposes in social philosophy and natural philosophy, the latter being a fundamental preamble of the former, the only object defining our real speculations” (Comte, 1848). “The positive political system” envisioned by Auguste Comte was founded on laws, among which the “positive theory of accumulation” was primordial. Resulted from the combination of subjective law – “every man can produce more than he or she consumes” – and one objective, “certain assets can be preserved beyond the time necessary for their reproduction” (Comte, 1851), the “positive accumulation theory” gives one of the meanings of the term “positive economics”, the one of economic growth”. The positive political system” generates “positive economics” and “social organism” guided by a “positivist spirit”, whose training lays in the hands of the encyclopedia education resulted from the Comtian set of sciences in order to ensure social solidarity. To achieve social solidarity, Comte analyzes the principles which determine social cohesion convinced that the social balance of the planet depended on the economic and social conditions of “social organism”

(Comte, 1848, p. 35). Auguste Comte's conclusion holds the historical method of identifying the interaction between different aspects of a society at a certain moment in time, a method that will become the symbol of historical schools of economic thought in the nineteenth century and of the famous "fight for method". *The positive economics* has found its pillars in the historical method of illustrating with facts using the description. Therefore, the interest for positive economy was caused by the expansion of historical schools, seeking a remedy to the "anemia" of economics, whose promoters were attacking hard the classics, especially "the gap between economic theory and economic reality."

To a greater or lesser extent, all the great economists of the nineteenth century engaged in economic emancipation of moral and political science have been touched by the positivist "virus". The first condition for the scientific understanding of the economic phenomena was the objectivity of the theoretical speech of the economic science and the axiological neutrality. To achieve that the economists had to forget the empirical past and the ideological context specific to the first scientific economic research. The attempt to empower the economics was strongly contested by Auguste Comte and by his English, German and French followers (Gide, Rist, 1926, pp. 525-526). Criticism was focused particularly on the impossibility to isolate the economic fact derived from a *social organism solidarity*. Thus, Comte and his followers denied the possibility of an economic science on behalf of that very intimate solidarity between different aspects of the "social organism" (Comte, 1910, pp. 274-294).

Comte's positivist vision seemed to be revived in the mid twentieth century when an economist, Milton Friedman, made even the followers of quantitative analysis startle with his *Essays in Positive Economics* (1953), where, quoting Marshall, he sustained: "the ultimate goal of a positive science is the development of a «theory» or a «hypothesis» that provides valid and meaningful predictions (meaning irreducible to truisms) about yet unobserved phenomena. Such a theory is, in general, a complex mix of two elements. On one hand, it is a "language" intended to promote "systematic and organized methods of reasoning" and, on the other hand, it is a set of hypotheses with empirical content designed to abstract essential features of a complex realities" (Friedman, 1953). The wave of confusion and protest against such manner of treating economic science could not be stopped not by the withdrawals of Friedmann or by the prestige that he has gained. However, Milton Friedman's *Essay* is one of the few explicit and under taken reactions to the Comtian positivism. The positivist vision analysts, as Angèle Kremer Marietti, gave an

equivocal verdict: “Basically, Milton Friedman presents a positive epistemology identical to that of Comte. Also, Friedman fully agrees with Auguste Comte, when he values a theory on its predictive power for the class of phenomena whom it allegedly explains, because the prediction confirms the explanation” (Kremer Marietti, 1997).

2.2. The Austrian approach

In a world of science dominated by positivism, the “research program” introduced by Carl Menger brought clarity in how to deal with economic science. Indeed, sciences have something in common, but also differ: some deal with material nature and other with human nature; the first ones derive their knowledge retrospective from experience, the latter’s do so *a priori*, in other ways than empirical. The sources of inspiration, sometimes confusing, have led the historians of economic thought towards interesting arguments, but rather uncertain. Mark Blaug, for instance, has enough courage to say: “This leads us to a seek general movement in philosophy or social sciences which have emphasized the introspection as a tool for making assumptions about economic behavior. Some authors were shocked by the revival of the Kantian philosophy in the mid-century, starting from Germany and then expanding across the continent. Back then, the “*Back to introspection and the meaning of impression*” was the slogan of the philosophical current” (Blaug, 1992, p. 335). Anyway, the efforts of Carl Menger and his followers were orientated towards two major directions defining the “*Austrian research program*”: on the one hand, to develop a quality economic theory, on the other hand, to identify the method of economic science. In this context, as Böhm-Bawerk noted, “many of the Austrian economists writings were devoted to the dispute over the method: among them, the study of Carl Menger – *Untersuchung über die Methodeder Sozialwissenschaften* (The study on the method of social science) – made the first thorough going and detailed analysis about the issues under discussion. It should be noted in this context that the “exact” method or, as I prefer to say, the “isolation” method is by no means purely speculative and non-empirical, but rather, this method always seeks and finds its foundation in experience” (Böhm-Bawerk, 1891). Indeed, in the *Economic principles* Carl Menger reiterated the idea after which the economic phenomena are, firstly, phenomena of human nature, and the economic science is a *a priori* science, thus innovating where others preferred the inertia of our “parents” tradition of economic science. Consequently, prior to the research of quantitative relations, the economic science imperative was knowing human

nature of economic phenomena, because “all things are subject to the law of cause and effect. This great principle knows no exception and we would looking vain for an opposite example in the field of experience” (Menger, 1994, p. 5).

The correspondence of that time reveals the firmness with which Carl Menger promoted his research program, but also the reservation to the enthusiasm to the mathematical formalization shared by the followers of measurement. Convinced of the relevance of measurement and formalization, Blaug cites such a situation: “in a letter addressed to Walras in 1884, Menger insisted that “mathematics cannot help the economist find the quantitative essence of the phenomena such as value, rent and profit” (Blaug, 1992, p. 331). The wickedness of Blaug's observation, that “this attitude has remained characteristic of Austrian writers who went so far as avoiding the need for mutual simultaneous determination of all economic variables” (Blaug, 1992, p. 331), does nothing but deepen doubts about the non-mathematical approaches.

The short psychology involved by the new economic way of thinking placed at the center of research not only a new fundamental theory – the theory of final utility – but a living subject – the individual – whose behaviour draw lines after which the economy moved. However, focusing the economic analysis on the human experience, on the individual preferences and choices emphasized the demarcation of the “Austrianism” from other economic concepts, particularly from those called objectives. However, Carl Menger remained to a considerable extent tributary of the intellectual heritage oscillating in the research field demarcation of economy between production of goods and individual behaviour regarding the property. His disciples followed the research program, but abstained to charge the disaccords in the master's account, accepting them as quasi-mandatory passages of the “childhood economic science”. This made Eugen von Böhm-Bawerk to change the scientific registry regarding the positive theory of capital and interest. In other words, why is the interest rate positive? Eugen von Böhm-Bawerk answer sends us to the production experience accumulated by people in time and to the time preference, meaning to the marginal utility theory (Böhm-Bawerk, 1959).

2.3. Eclectic positivism

Alfred Marshall, for the first time in the history of economic thought, made a synthesis of classicism, the German historical school and marginalism, arguing that observation and experience are needed to determine the immediate and

subsequent effects of different groups of causes, which meant that economic science was founded, in his view, on a positive review. In this context, Alfred Marshall argued for economic analysis using empirical method, which is consistent with the mission of economics and “the role of science was to assemble, collate, analyze economic facts and use knowledge obtained from observation and experience” (Marshall, 1890). Fixing a heterogeneous theoretical framework demands a proper vision of reality: economic laws should be understood as trends showed only “what is” (positive view), without showing “what should be” (normative vision), so without ethical conditions (Gélédan, 1988, p. 115). However, Marshall gave way to value judgments when he focused on the end purpose of economics, especially on its ability to solve practical problems and to establish standards of economy “economic laws and judgments are only part of the material that the consciousness of people and their common sense use to solve practical problems and to establish rules that can serve as a guide to life” (Marshall, 1890). Instead of homo oeconomicus schematized, Alfred Marshall introduces the idea of behaviors that were very different, but which should avoid excessive simplification: “instead of business activities, performed with power and skill, there is a continuous gradation based on calculations designed for along time, while ordinary people do not have the power or the will to direct their interests as businessmen” (Marshall, 1890). Therefore, economists “dealt with man as he was, not an abstract or economic man, but a man in flesh and blood” (Marshall, 1890). If the economist studies especially how man pursues its own gain, this does not mean that he tries in this way to reduce the economy to a “natural history of selfishness” for the simple reason that this behavior can be expressed in monetary terms, the effects are scientifically affordable in comparison with philanthropy, vanity and sense of duty (Marshall, 1890). Overcoming the mechanical complex, but not the evolutionist temptation, Alfred Marshall created a scientific product that quickly imposed on the market of ideas which dominated economic thinking until up to John Maynard Keynes. As noted by some analysts, from edition to edition, *the Principles* were “retouched” according to the author's desire to better reflect his thinking. At the same time, one can notice a polishing of economic philosophy of Alfred Marshall, “the preface to the first edition is dependent on the continuity principle expressed by the motto «*Natura non facit saltum*» as an element of linkage throughout the book. Looking through *the Principles* one may notice «the fundamental idea», i.e. the idea of «general theory of supply and demand balance»” (Blaug, 1992, p. 430). Instead, as Blaug notes in the preface to the

eighth edition, the author “brings a note of apology to the static nature of the analysis of *the Principles*. Despite the frequent use of the idea of «*ceteris paribus*», Marshall points out that the key element of his book is dynamics and not statics. Even if so, statics and dynamics do not represent the entire economy, «the Mecca of the economist is based more on economic biology rather than economic dynamics»” (Blaug, 1992, p. 431). At the same time, one cannot draw out marginalism from the work of Alfred Marshall for the simple reason that “the margin concept that determines the price has gained increasing importance in *the Principles* and once with it, it was revealed that margin varies against the conditions of the problem under discussion and especially with period of time referred to” (Blaug, 1992, p. 431).

2.4. Deductive positivism

The status of economic science, denied by Auguste Comte and put to doubt by skeptics, as well as the preference of many for sociology based on positivist criteria have led to serious epistemologic disputes, “yet not until Pareto’s writings would one be able to find the most consistent analysis of the articulation of economics and sociology, as well as the most refined theorization of methodologic correlations between the two disciplines” (Passeron, 2004).

Vilfredo Pareto was not only the successor of Léon Walras la Lausanne, but also the one who continued many of the latter’s ideas. To formalize and translate into mathematics economic theories were not enough to counter the accuses of historists directed towards traditional economists (including here Pareto). In the context of the controversis on method, Vilfredo Pareto (1896, 1906) brings clarifications on the nature of economic science: “There are two main categories of sciences: the ones that, like physics, chemistry, mechanics, may revert to experience, and the ones like weather forecast, astronomy, political economy which cannot or may be able with great difficulty revert to experience, and are therefore content to observe” (Pareto, 1919). Yet, in the perspective of Vilfredo Pareto, political economy, the economic science, respectively, described a gradual structure of research essentialized in the two forms: first, *Pure political economics*, which, like physics or mathematics, ensured a first approximation of phenomena and of the general conditions for balance and had own research ways – progressive reconstruction of reality (Gélédan, 1988, p. 155). The method employed by Pareto corresponded to his

scientific objective of identifying the research domain of *Applied political economics* and implied analysis and synthesis, as well as rational route from simple to complex, from concrete to abstract, borrowing from history and sociology; this was supposed to offer essence to *Pure economics*. Thus “Pareto was, probably, the founder of an explicit positivist approach in economics” (Rothbard, 1956, p. 231).

The advantage created by Pareto revealed a science emancipated not only by morality, but also by politics; the new “face” of economic science uncovered a purely deductive and non-ideological type of economics, where the laws of natural economy dictated the order. Very much aware of the importance of economics’ various implications, Vilfredo Pareto saw economics as a mechanic assembly which only functioned if provided with necessary support: “Human society appears ... as a giant aggregate of molecules, that provides service, consumes products and has restrictions in spending, of centers or glandes where economies transform into capital, and products change ones into others...” (Gélédan, 1988, p. 160). Past the dispute related to the subtlety of endeavor on the ideologic neutral, the Paretian theory seemed to gain ground be this only for this advantage. As some economic thought analysts observed: “Thus defined, political economics became purely deductive, that is, it proposed to deduce all consequence from data: initial constraints and goals the society had. Observing true behavior of agents was replaced by rationality postulate” (Grellet, 1979, p. 32). The history of economic thought retained only momentarily Pareto’s argument, political economics from a technique considered universal seemed to halt into autism that diluted the consistency of economic thought. Unfortunately, economic science depended too much, and still depends today, on the academic intellectual trend of the time, generator of enthusiasm for change. Yet, too much change can generate doubt over scientific seriousness and economic science may lose credibility. The controversies over initial data, scope and means have continued and do not seem to have ended, unless if something hard to suppose, economists would accept, without exception, without further addings, without corrections, without further developments, a common point of view on economic science. The Paretian viewpoint has dominated through logical simplicity until the fourth decade of the 20th century, although reference to Paretian arguments have been made directly or indirectly every time economics is confronted with a tough situation.

Pareto’s endeavor highlights the progress in economic science, but also the epistemological difficulty, that had not yet been surpassed, that of “cutting

out” the economic phenomenon from the global social fact without alteration or modification. Israel Kirzner, in agreement with other renowned authors, drew attention to the risks of changing research method on the go: “When the nature of economics is defined in this way, by the analysis of a unique general element in our consciousness to which only the term “economy” corresponds, then it must seem very obvious indeed that faulty definitions can seriously distort the character of the science. And when the analysis of this element has been made possible only by virtue of familiarity with the substantive content of the science itself, then its formulation into a definition can clearly take on the character of a positive scientific contribution” (Kirzner, 1996, pp. 10-11). There are at least two rules of economic research raised from the controversies around methodological issues – to isolate to analyze and to abstract to understand. The first requires a thorough knowledge of economic theory, second, to identify human actions that ensure a balance between “facts of the human nature and the external world” (Kirzner, 1996, p. 13). However, the increasing interdependence among sciences reveals more than just the need for boundaries between different areas of knowledge. It also shows the common issues between different sciences and that they all converge to a common epistemological point – scientific truth. Perhaps the actions of the two great authors – Léon Walras, and respectively, Vilfredo Pareto – to divide research from economics could be understood from this point of view. Still a question remains: In fact, how many economics we are dealing with?

2.5. Logical positivism

Rooted in European philosophical tradition of empiricism, logical positivism is one of the most widely spread and controversial epistemological school of the early twentieth century. Its main aim is to identify the extent to which knowledge has a genuine scientific meaning. In this context, scientific knowledge is only mediated by experience and uses assumptions which have a cognitive significance; this kind of knowledge can be enriched either by observation or by logical analysis. According to logical positivism, there are only two types of statements that comply with cognitive significance criterion: analytic statements (tautologies and self-contradictions which can be found in any scientific language) and synthetic statements (assumptions related to facts which may be verified by observation). On the other hand, all other statements that do not fall into one of the above categories may be considered

metaphysical, they are neither true nor false and, although they describe significant daily individual's behavior, they are placed outside of the scientific method.

Consequently, logical positivism requires that all scientific knowledge to follow this rule: there is a direct relationship between a statement and empirical observation. On the other hand, scientists found difficult to apply this rule in daily practice and they never missed a chance to highlight the vulnerabilities and limits of positivist approach which gradually eroded its basic assumptions. Despite all these difficulties, a part of the undeniable achievements of contemporary epistemology, such as hypothetic-deductive or nomologic-deductive models, were accomplished by logical positivism approach. Moreover, logical positivism seems to have drawn three specific research directions in the field of epistemology: demarcation criterion, the nature of scientific explanation and the growth of scientific knowledge. Also the most important contemporary epistemological theories started by challenging specific assumptions of positivism. This is the case of Popper's falsificationism, Khun's theory, Lakatos theory of research programs or Feyerabnd's epistemological anarchism.

Logical positivism made its way in economics mostly through Terence Hutchison paper, *The Significance and Basic Postulates of Economic Theory*, which was published in 1938, a time when economics gone through deep reconfiguration triggered by the Great Depression and the new theory of Keyenes. The very ambitious goal of Hutchinson's work is not only to restore the real scientific character of economics, but also to lay the foundations of modern economics. In Hutchinson's view, which is consistent with the positivist approach, any science is about real facts, thus all scientific statements are about an existing and observable reality. Economics was diverted from this path by the assumptions and abstract methods of traditional microeconomics.

Following logical positivism tradition, Hutchinson identifies and classifies three types of possible economic statements: 1) deductive inferences which are pure theoretical assertions equivalent to analytic statements of positivist approach, they imply that a fact is necessary logical consequence of another; 2) empirical inferences are specific to applied theory and they are equivalent to synthetic statements of positivist approach, the sestatements imply that the value of truth of the hypothesis is determined by empirical observation while the conclusion follows logically from hypothesis; 3) inductive statements are drawn based on repeated observation of a phenomenon and imply that even

though, logically, a sentence may be false, its falsity is actually a case so rare that it can be ignored.

Providing a brief analysis of these types of statements, Hutchinson assumes that only inductive inferences could provide the scientific character of a discipline whereas deductive statements are tautologies emptied by any empirical content that does not provide the link between science and observable reality. Although deductive statements seem to refer to facts, they are language constructs which only render relations between definitions and not between real facts (Hutchinson, 1938, p. 30). In addition, Hutchinson blames the excessive use of *ceteris paribus* assumption in economics which scarifies any unknown observation for a logical solution with no empirical content (Hutchinson, 1938, p. 42). Although deductive statements are not scientific statements this does not mean that they are useless. Their pragmatic objective is to create a clear language that allows an effective approach to economic facts. On the other hand, the real scientific assumptions are the statements that can be directly tested or, otherwise, can be reduced to simple sentences that can be subject to these tests. These tests are not intended to give a final verdict on the truth value of the sentence, but only to establish empirical consequences of designated truth values derived from these empirical statements (Hutchinson, 1938, pp. 9-10).

In the framework of the newly created methodology, Hutchinson launches some aggressive critics against traditional economy highlighting the lack of empirical content of the basic assumptions of traditional theories and the misuse of introspection (psychological approach) as an economic method while he further promotes the need for a frequent usage of more developed empirical methods in economics. Moreover, Hutchinson reverses the assumption traditional economy in which logic is above observation and provides a new standard for economic science: the only scientific laws are inductive inferences that, even though can be logically falsified, they were never falsified in practice (Hutchinson, 1938, p. 64).

In the view of logical positivism transferred into economics via Hutchinson, the positive character of a theory consists in its ability to operate with statements derived from empirical observations that are confirmed in as many cases as possible. The confirmation tests consist in applying more complex statistical and econometric techniques. Purely deductive statements are not excluded from economics, but they are only an interface between reality and theory that allows a formalized approach to economic facts.

3. Analysis of “positive” concept occurrences

3.1. Research methodology

The research was based on papers published in two significant economic journals: *The Quarterly Journal of Economics* and *Journal of Economic Literature*. These two journals were selected considering the mainly theoretical content of articles accepted for publication and relative influence score held by the two journals. Thus, according to the classification in January 2012 the first three journals on the economy are:

Table 1

Main scientific journals in economics						
Nr. crt.	The review	ISSN	Relative impact factor (Journal)	Reference influence score (Field)	Relative influence score (Journal)	Country
1	QUARTERLY JOURNAL OF ECONOMICS	0033-5533	5.00621	0.746	15.66488	UNITED STATES
2	ECONOMETRICA	0012-9682	3.5461	0.5965	12.93378	ENGLAND
3	JOURNAL OF ECONOMIC LITERATURE	0022-0515	6.13387	0.746	11.09115	UNITED STATES

Source: UEFISCDI.

The Quarterly Journal of Economics is the oldest journal of economics (first issue in 1886) being published by Harvard University Department of Economics. Papers published in this journal were accessed via JSTOR database, Google Scholar and Oxford Journals Full Collection 2012. A total amount of 6,111 papers were available. *Journal of Economic Literature* is one of the most significant academic journals in economics being published since 1963 by the American Economic Association. Papers published in this journal were accessed via JSTOR database, Google Scholar and ProQuest. A total amount of 9,084 articles were available for this research.

The first aim of the research was to identify the frequency of use of the term “positive” as a scientific approach (occurrences that refer to other meanings such as showing mathematical sense, quantitative or qualitative assessments, etc. were removed from research). The second goal of research was to find out the most frequent meanings associated with “positive” term. Following this objectives, the research identified, in the first instance, items containing in text or title the key term “positive theory” and, in the second phase, the research was extended by searching papers that contain in text the pair “positive”-“normative”.

3.2. Research results

3.2.1. Research of the key term “positive theory”

Searching database by term “positive theory” allowed us to identify in the two target journals a total amount of 135 papers, 36 published by *The Quarterly Journal of Economics* (QJE) and 99 published by the *Journal of Economic Literature* (JEL). Of these, a total of 77 occurrences were in the text (22 and 55 QJE published in JEL), and 58 articles include references to papers containing “positive theory” term in their titles (14 published the QJE and 44 in JEL).

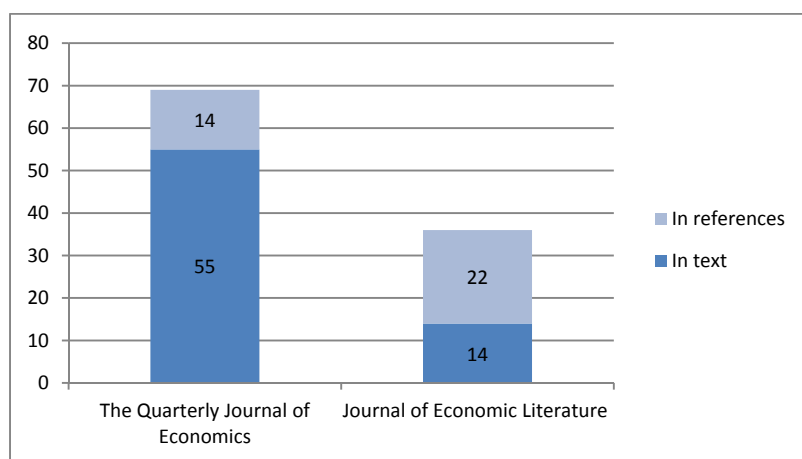


Figure 1. Papers that contain “positive theory”

Most cited papers that contain the term “positive theory” are: E. von Bohm Bawerk, *Positive Theory of Capital and Interest*, R. Thaler, *Toward a Positive Theory of Consumer Choice*, Robert J. Barro and David B. Gordon, *A Positive Theory of Monetary Policy in a Natural-Rate Model*, A. Alesina and Tabellini G., *A Positive Theory of Fiscal Deficits and Government Debt in a Democracy* and Ole Hagen, *Towards A Positive Theory of Preferences Under Risk*. The total amount of citations to these papers is presented in the chart below.

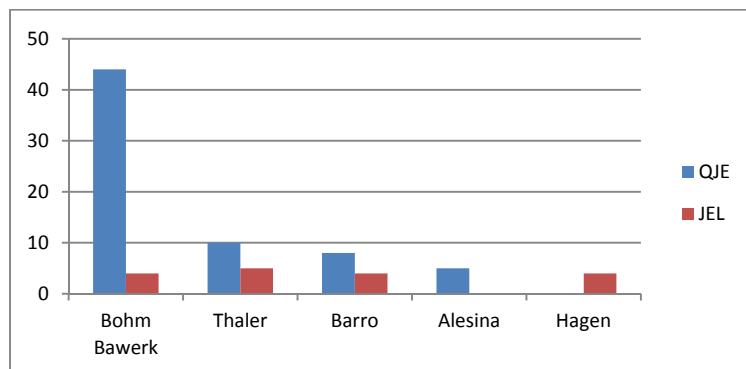


Figure 2. Most cited papers with title containing “positive theory”

3.2.2. Analysis of “positive”-“normative” dyad

The research of total occurrences of “positive”-“normative” dyad in target journals led to the identification of a total of 253 papers (151 in QJE and 102 in JEL). These papers have been the subject of an in-depth analysis of the context in which “positive”-“normative” dyad is used. Papers were classified into three distinct categories:

I. Papers in which “positive” term is either defined or explicitly associated with a meaning.

II. Works in which “positive” and “normative” terms are used without being defined or explicitly assigned with a significance.

III. Papers in which only the “normative” term is present as opposite to “positive”

The distribution of papers into the three defined categories is presented in the chart below.

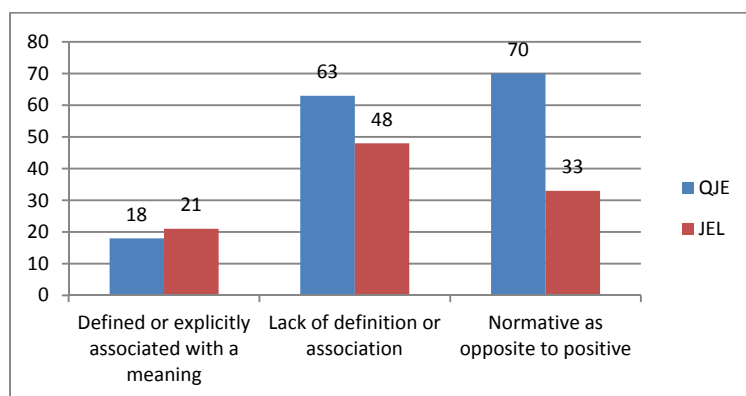


Figure 3. Distribution of papers into the defined categories

For the items falling in the first category, the research involved identifying the most common significances associated to “positive” terms. Furthermore, for this papers the total amount citations in JStor and Google Scholar data bases were quantified in order to investigate how these associations were spread among scholars. The first 10 papers are presented in the following table.

Table 2

Significances to “positive” term						
No	Author	Title	Journal-year	Associated significance	JSTOR citations	Google Scholar citations
1	Donald N. McCloskey	The Rhetoric of Economics	JEL-1983	Scientific Facts Objective Vigorous Precise	46	2417
2	Israel M. Kirzner	Entrepreneurial Discovery and the Competitive Market Process: An Austrian Approach	JEL-1997	Entrepreneurial knowledge	34	1832
3	Paul J. H. Schoemaker	The Expected Utility Model: Its Variants, Purposes, Evidence and Limitations	JEL-1982	Popper falsificationism	22	1131
4	Burton A. Weisbrod	The Health Care Quadrilemma: An Essay on Technological Change, Insurance, Quality of Care, and Cost Containment	JEL-1991	“What it is”	24	621
5	Melvin W. Reder	Chicago Economics: Permanence and Change	JEL-1982	Descriptive	16	448
6	Lazear, Edward P.	Economic Imperialism	QJE-2000	Predictive	4	399
7	Daniel M. Hausman and Michael S. McPherson	Taking Ethics Seriously: Economics and Contemporary Moral Philosophy	JEL-1993	Descriptive	18	389
8	Lawrence A. Boland	A Critique of Friedman's Critics	JEL-1979	Correspondence rules between reality and theory	19	310
9	Victor R. Fuchs, Alan B. Krueger and James M. Poterba	Economists' Views about Parameters, Values, and Policies: Survey Results in Labor and Public Economics	JEL-1998	Without value judgments	10	304
10	Robin Marris and Dennis C. Mueller	The Corporation, Competition, and the Invisible Hand	JEL-1980	Rigorous Test Consistent with empirical observation	21	227

The analysis revealed that the most frequent significances assigned to “positive” term are the “descriptive”, “what is it” or “empirical”. These meanings are consistent with positivist approach.

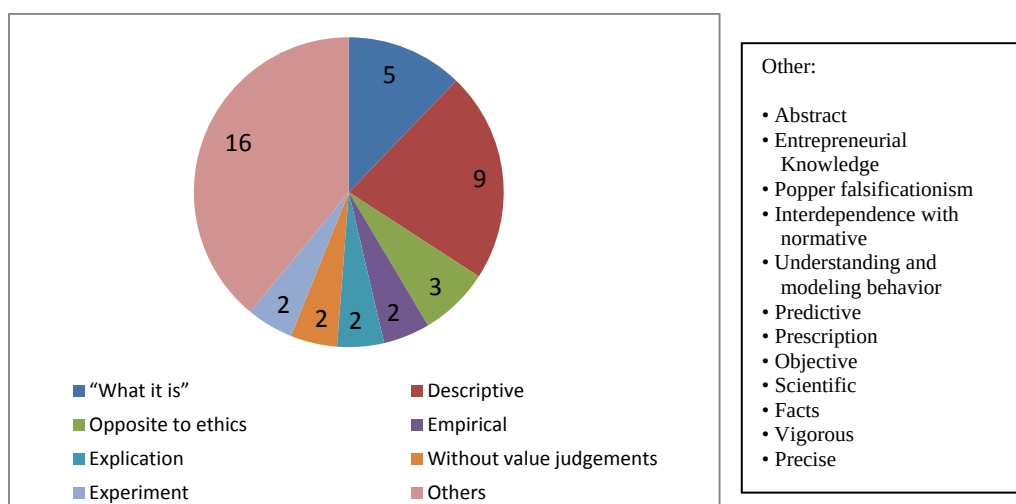


Figure 4. Significances to „positive” term

4. Conclusions

This study reveals that for a long period of time (1889-1931), most papers made appeal to “positive” term in close correlation with positive theory of capital and interest developed by Bohm-Bawerk. Thus, the term “positive theory”, although rooted in current positivist science, was brought to light in economic papers by the Austrian theory. On the other hand, there is an interesting paper published in 1901 which is distinct among many references to the positive theory of capital and interest. This paper, published by Frederick B. Hawley, provides one of the first definitions of economics in a scientific journal. In a clear positivist tradition, Hawley suggests a positive definition of economics: “Economics is the study of the interrelations of that group of egoistic human activities which are called into combined action by the expectation of a definite personal share of the purchasing power resulting from their joint activity; and of their outer relations or how these activities and their results are affected by the physical, ethical, and social environment, and by changes in the environment” (Hawley, 1901). The positivism faith in purely descriptive role of economics is revealed also by F.H. Knight who, referring to

objective standards of utility, states that “[...] Any other view carries us at once into an evaluation of the values of one individual by those of another, or by some absolute standard, which is unavoidable in the normative sciences of ethics and aesthetics, but will not do in a descriptive science of economics” (Knight, 1917, p. 70). Also, two of the most important papers published in the 30's in *The Quarterly Journal of Economics* are critics of the positivist movement against Lionel Robbins's essay, “The Nature and Significance of Economics”. First, T. Parsons notes that in his attempt to free positive economics from any metaphysical temptation, Robbins is close to radical positivist approach that eliminates the nature and significance of economics (Parsons, 1934, p. 514). Economics could keep its positive approach if all its abstract statements can be identified empirically in reality (Parsons, 1934, p. 519). In addition, positive economics assumes that there are rules which “can be expressed in terms of the balance equations. They are abstractions to be combined with other items to provide a complete explanation of reality” (Parsons, 1934, p. 520). Finally, Parsons concludes that economics cannot become a positive science by a simple analogy with physics (Parsons, 1934, p. 521). On the other hand, R.W. Souter argues against Robbins's view according to which normative is synonymous with ethical and stresses out that normative economics is different from ethics. Normative economics does not investigate the ethical content of an end in itself, it only borrows from philosophy an abstract ethical concept (e.g. social profit maximization) in order to find out the particular conditions in which that goal can be achieved (Souter, 1933, pp. 401-402). In traditional economy drawn by Robbins, positive approach refers only to individual behavior guided only by its rational rules (Souter, 1933, p. 390). Nevertheless the ultimate goal of economics is “the organic integration positive economics with normative view [...]” (Souter, 1933, p. 388).

Starting with macroeconomic approach that followed Keynesian theory, the positivist view was spreaded via the following assumption: the aim of positive economics is to analyze “what is” as opposed to normative approach that focuses on “what should be”. An example of this assumption is provided by the following statement found in one of the most influential articles on the labor market: “The distinction between positive and normative economics is, in principle, as clear cut as the difference between the questions of “What is?” and “What ought to be?” (Cain, 1976, p. 849). This approach is reinforced by the belief of some scholars that economics has become the study of the price

mechanism using mathematical, deductive and positive methods (Miller, 1997, p. 1173) and economic theory is a tool for modeling and understanding human behavior (Samuelson, 1997, p. 77).

However, there is a significant body of economics that tries to further extend positive economics beyond the strictly descriptive-empirical tradition. A particular paper that draws the attention of epistemologists is that of Donald N. McCloskey, *The rhetoric of economics*. According to McCloskey, positive science is the result of a series of contributions made in the following sequence Carnap-Kuhn-Popper-Lakatos-Feyerabend (McCloskey, 1983, p. 493). McCloskey conducts a contrastive analysis of positive and normative terms showing that positive approach is associated with concepts such as scientific, factual, objective, robust, accurate, things, cognition, strong, while normative approach is associated with terms like humanist, opinion, subjective, imprecise, vague words, intuition, soft (McCloskey, 1983, p. 510).

Therefore, in the twentieth century positivism moved far away from one or another science and became isolated in elitist metaphysics of the great intellectuals, but "positive economics" and quantitative analysis gradually conquered research, publications, universities and scientific awards. In the ocean of quantitative analysis "explicationist" researchers seem lost wandering souls, disappointed by the low position of fundamental disciplines in universities compared to disciplines that measure and quantify (Vaughn, 1993, p. 174).

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Implications of the single supervisory mechanism on ECB's functions and on credit institutions' activity

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Abstract. *The European Commission's proposal launched on September 12, 2012 for conferring the European Central Bank extended powers in the field of Euro zone banking supervision has become a hotly debated topic across EU member states. Until now, there is still strong resilience of the EU countries outside the single currency area.*

The prospects for its practical implementation raised, however, a series of questions related to its technical feasibility. Our paper intends to shed light on some issues concerning the implications of the single monitoring mechanism on the traditional functions of the ECB, on the coexistence between supranational supervision and the national one, and on various facets of the impact that the new architecture of European banking supervision will have on the business of credit institutions, in terms of performance indicators, efficiency, risk and competition.

Keywords: European surveillance architecture; ECB; banking union; single supervisory mechanism; credit institutions.

JEL Codes: E58, G01.

REL Codes: 11B, 11C.

Introduction

The recent European Commission's proposal for establishing an European banking union is part of the long-term reflections on the prospects for the European Monetary Union and the success of its functioning. This new challenge for all the levels of the European construction is projected to have a significant impact on the functions, responsibilities, powers and mandate of the ECB.

The European banking system, highly fragmented and diversified both from an institutional and balance sheet standpoint, requires a high degree of integration. ECB's statistics highlights the fact that, at the end of February 2012, the Euro area comprised 7,299 monetary financial institutions, of which 6,180 were credit institutions, 1088 were money market funds and 31 were other financial institutions. At the 27 EU member states, the number of monetary financial institutions raised at 9,311, of which 8,039 were represented by credit institutions.

Based on this fact, namely the large number of credit institutions, available now as well as in the early 90s, the Maastricht Treaty has left bank supervisory powers to the national authorities, thus acknowledging the technical and legislative difficulty of implementing a unique surveillance system in Europe.

Recent developments manifested in the banking systems, as a result of the global financial crisis, and the spread of local, national vulnerabilities to the European space, revealed strong interconnections between financial institutions and markets in the Euro area and the impairment of supervisors' ability in solving banking distress.

Therefore, it emerged a main argument in favor of creating the banking union, meaning that national banking problems can be easily managed by a unique European authority namely the European Central Bank. The banking union is an ambitious goal, but it is only a phase in the long-term vision for the economic and fiscal integration in Europe, with the purpose to restore confidence in banks and in the single currency (EC 2012a).

The abandonment of national options in terms of financial policy and banking supervision, and, hence, of national sovereignty in favor of a single European supervisory authority, brought at the core of the speeches the concept of financial trilemma. This highlights the impossibility of simultaneous fulfillment of three objectives: financial stability, maintaining national financial policies and financial integration (Constancio, 2012).

A similar approach was developed by Deutsche Bank report (2012), arguing by the concept of impossible trinity that the motivation underlying the creation of the banking union is much deeper, and it lies in the impossibility of synchronizing national surveillance objectives with financial stability and market integration.

The constituents of the banking union are:

- a) a Single Supervisory Mechanism, with responsibilities in the field of direct monitoring of banks in the Euro area, impartial and strict application of a common set of prudential regulations, risk control and prevention of crisis events;
- b) a common, pan-European system for depositors' protection, which provides the harmonization of protected deposits, faster payments, better funding of deposit guarantee schemes and a mutual borrowing mechanism (EC 2012b);
- c) an integrated framework for crisis management in the EU (entitled the European recovery and resolution framework) to establish tools for recovery or controlled banking resolution, in order to prevent crises and to manage them in an early stage (EC 2012b).

In the following, the present paper focuses on the first key constituent, namely the Single Supervisory Mechanism, as the EC's proposal (EC 2012a) statutes that it should become active, operational on January 1, 2013.

According to the text of the proposed regulation (EC 2012a), ECB's duties will be filled with tasks in the field of supervision of credit institutions established in the Euro area countries, regardless of bank size or business model, and of financial conglomerates located in the Euro area. Prudential objectives that can be better managed at the national level will remain in the responsibility of national supervisors (consumer protection, prevention of money laundering etc.).

The proposal provides a gradual implementation: banks that received public support will be monitored by ECB starting on January 1, 2013; systemically important banks starting from July 2013 and since 2014 it will be expanded to all banks in the Euro area.

It is obvious, therefore, that in front of the new challenges related to the ECB's mandate we will witness a reconfiguration of the European Central Bank's and the national supervisory institutions' tasks.

From this reason, the paper's aim is to identify how the ECB's functions will recalibrate, as a single European banking system supervisor, and to formulate a series of interrogations and answers on the institutional and regulatory framework challenges that both supervisors and credit institutions will be subject to.

In support of our views and arguments we relied upon the opinions of officials of the European banking institutions and researchers from academia, concerned about the new philosophy and practice of banking supervision that the European banking union will generate at a pan-European level.

1. Is ECB entitled to act as sole supervisor for Euro area?

The experience of the recent financial crisis has shown that the national regulations' main focus towards the micro prudential side of banking supervision proved wrong, as it relied on the implicit assumption that

monitoring individual financial institutions' soundness and solvency is a sufficient guarantee for the resilience to shocks of the entire financial system. However, prudential supervision ignored the interconnected nature of financial institutions, both at the national and cross-border interbank money market, or the systemic issues. National supervisors' failure resulted in a loss of confidence in the robustness and soundness of national financial systems.

In this context enrolls the Commission's proposal, which provides for the transfer of prudential supervisory powers from the national level to the centralized, supranational level, represented by the ECB. The takeover by the ECB of the Euro zone banking supervisory duties requires a deep rethinking of the pillars of the European construction and is a risk generating process.

As we have noted in a previous paper (Barbu, Vintila, 2006), the European banking regulation and supervision has a strong decentralized nature, that overlaps the unique monetary policy framework in the Euro area, because of two dimensions: *geographic* and *institutional*.

Deutsche Bank (2012) argues that, from an institutional standpoint, the designation of ECB as responsible for supranational supervising is not appropriate (reputational risk is just an example). It states that the European Banking Authority – EBA, the institution that addresses to all EU-27 member countries should possess such powers, but also involving the ECB in the supervisory process. Although supervision and regulation are distinct, interchangeable and complementary activities, the Deutsche Bank report suggests their exercise by a single pan-European authority. In terms of geography, the unique monitoring mechanism should include all the 27 EU countries. Only extended supervision at European level would be effective, in terms of increasingly interconnected banking systems and would ensure a high degree of financial stability.

Pisani-Ferry, Sapir, Veronica and Wolff (2012) adhere to this view, pointing out that the inclusion in the banking union of all 27 EU countries is necessary, first, to maintain financial integration within the European single market. Otherwise, the national supervisory authorities may restrict cross-border operations of banks with headquarters on their territory, to circumvent prudential requirements imposed by the ECB.

Also, the authors mentioned above argue that, given the geographical area of the banking union, it is unlikely that EBA gain competencies in the field of prudential supervision.

EBA's duties, as regulator of the entire EU, aim at strengthening cooperation between supervisory authorities designated by each EU member state and continuing the process of convergence and consolidation of best practices in prudential supervision. Also, EBA drives stress tests for European banks to identify weaknesses in bank capital structure and increase transparency in the European financial system, is involved in creating a single rulebook for

financial services in the EU and has a crucial role in the implementation of measures to recapitalize the credit institutions. In the new architecture of banking supervision, the role of EBA will be maintained and it will continue to develop a single rulebook applicable to all the 27 countries.

Thus, across the European banking union, the ECB will have the mandate to cooperate with Euro area national supervisors and EBA.

The creation of the European banking union establishes the premises for allocating new powers to ECB. The main criticism expressed on this issue is that, complementary to responsibilities for banking supervision in the Euro area, the ECB will manage a new bank resolution fund, to support insolvent banks. The ECB will also have the power to establish new arrangements by which to provide better guarantees to depositors and investors, through creating the unified deposit guarantee scheme. The estimated effect of the ECB's overlapping of responsibilities will consist in the increase of powers in influencing national budgetary and fiscal policies (Steinberg, 2012).

2. The lender of last resort role affected ECB's independence?

In response to the financial crisis, central banks have adjusted their operations in various ways: lowering the monetary policy interest rate at a level that would facilitate banks' access to overnight funds; flexible open-market operations, by increasing the maturity and extending the range of securities accepted as collateral in refinancing operations.

Also, central banks have reshaped the monetary policy instruments, adopting unconventional measures (both quantitative and qualitative easing), through which supported credit institutions, by directly purchasing their troubled assets.

The ECB's measures to support the Euro area banking system can be classified into two categories: direct purchasing of assets issued by the private sector (the ECB was the only central bank that bought covered bonds, from June 2009 till June 2010, the total value being of 60 billion Euro) and enhanced credit support to Euro area credit institutions, defined as operations that stimulate lending in a more sustained pace, than it could be achieved only by reducing the key interest rate.

The main reproach that is made relates to the quality of collateral and the interest rates charged. Although the lender of last resort role, performed by a central bank, requires the selection of beneficiaries according to the quality of collateral and charging a higher interest rate, however, developments in recent years indicated a collateral widening, by inclusion in its structure of non-investment grade assets and the practice of low interest rates for refinancing operations. In this way, there were violated by the ECB the basic principles of refinancing operations.

ECB's frequent and extensive involvement, in recent years, in buying government bonds generated, on the one hand, the accumulation of significant risks, and, on the other hand, emphasized that this institution has become an important fiscal policy player.

To reduce ECB's involvement in financing budget deficits, in 2010 the European Financial Stability Facility (EFSF) has been created, with the role of ensuring financial stability, by bailing out distressed banks. Providing financial assistance to Euro zone members helps fund their deficits by issuing bonds or other debt instruments in the capital market. EFSF can intervene on primary and secondary bond market to ensure financial stability, acting through five forms of intervention: issue bills and bonds, intervention in the primary market, intervention in the secondary markets, precautionary programs and bank recapitalizations. The HSBC report (2012) claims that these forms of intervention allow the ECB to exert its ability of lender of last resort, but only if the EFSF mechanism is activated by the governments of member countries.

Unlimited ECB intervention in the secondary bonds market may result in serious risks to national budgets. These issues call into question its independence and show the infringement of the fundamental provisions of the Maastricht Treaty that gives ECB no mandate for any direct or indirect financing of member countries governments.

3. Dual supervision (both national and exercised by the ECB) may be conflicting or redundant?

The new European banking supervisory architecture will create similarities with the US banking supervision, which is why we propose a brief foray into the dual banking supervision philosophy of the US banking system, which is considered as one of the most innovative, largely because there are two different regulatory and supervisory structures.

This is reflected by the coexistence of national banks, subordinated to the regulator and supervisor at the federal level (federal agencies), with state banks, which operate under standards and regulations imposed at the state level. This type of dual regulation dates back almost 200 years, having as foundation the legal, constitutional limits on the ability of states to control the entities created by federal authorization.

The benefits of this type of surveillance are highly predicated, highlighting banks' own option related to the supervisory authority. A system in which banks have to choose between several types of supervision leads to lower costs and increases the speed with which new banking products and services are developed and has a greater chance of eliminating outliers.

A study published in 2005 by the American Bankers Association revealed the prevalence of banks under state regulation (70%) compared with those which were under federal jurisdiction. On the size of banks, almost 80% of those which were operating under state jurisdiction were entities of lesser size than national banks, which have developed a business model compatible with this level of supervision.

In recent years, the trend has changed, many banks preferring to enter under regulation at the federal level because of sustainability of this type of surveillance. At a time when the cross-border mergers and acquisitions phenomenon intensifies, cooperation of state bodies with federal agencies is an important factor for bank flexibility and competitiveness. From the cross-examination of financial reports to detection of fraudulent transactions and the establishment of financial holding companies there is a strong collaboration between the two levels of supervision.

In this respect, the Federal Reserve Chairman Alan Greenspan (1995) stated that: *“a single regulator, charged with responsibility for safety and soundness, is likely to have a tendency to suppress risk taking. A system of multiple supervisors and regulators create checks on this propensity.”*

Therefore, besides being redundant, supervision on two distinct levels, namely at State and federal level, is the best solution in a banking system that counts, according to the statistics of the Federal Deposit Insurance Corporation (FDIC, 2012), 7,188 banks and 6,961 credit unions (National credit Union Administration, 2012) and this duality enhances stability and financial innovation.

Unlike specific regulatory and supervisory activities in the US, the European Commission's desire is that all credit institutions operating in the single European market apply, without discrimination, a single framework of prudential standards and that prudential monitoring to be conducted by a single authority, the ECB, with the logistical support and expertise of the national central banks of the Euro area member countries.

4. Is it appropriate the sharing of supervisory powers between the ECB and national authorities?

Centralization of authority at the ECB level should not be confused with operational centralization (Pisani-Ferry, Sapir, Veron, Wolff, 2012). The EC Directive proposal explicitly depicts the possibility of delegating certain tasks and operations to national supervisors.

Currently, EU national authorities base their activity on the Core Principles for Effective Supervision issued by the Basel Committee on Banking Supervision. With the implementation of the single monitoring mechanism, each national supervisory authority will have to conform and comply with

regulatory and supervisory requirements set by the ECB, which will eliminate the disparities in the legislation of Euro area countries. All banks operating in the Euro area will be subject to the same prudential requirements, and hence, references to the legislation in the country of origin (home country) versus the host country will simply disappear.

Attributions assigned by the EC proposal to national authorities are: assessing compliance with national legal framework for the authorization/withdrawal of a bank license and proposing a decision that can be enforced only by the ECB; conducting on-site inspections, in compliance with regulations issued by the ECB and its warning of any vulnerability identified; making recommendations to the ECB on the validation of internal risk models of banks; the application of sanctions is shared between the ECB and national authorities.

In our opinion, national supervisors will hold the role of an interface between credit institutions and the ECB, a beneficial situation because it allows ECB to draw on their expertise in monitoring resident credit institutions. Also, the ECB can reduce its operational costs because, although supervision at this level is feasible for large banks, with systemically important cross-border activity, there is the risk of being time consuming and requires significant financial and human resources, if it will be extended to the thousands of small and medium-sized banks in the Euro area.

In this context, Deutsche Bank (2012) show that establishing a monitoring mechanism on two distinctive levels, in which ECB monitors only systemic banks and national authorities supervise the remaining banks, is not indicated as small local or regional banks may be too at the origin of systemic crises.

Pisani-Ferry and Wolff (2012) advocate the delegation of supervision powers for small/medium sized banks to national authorities, while the ECB has legal responsibility for prudential monitoring of all banks in the Euro area, citing that, at the end of 2010, the largest 200 banks in the Euro area accounted for over 95% of banking assets.

However, in the process of defining the legal framework under which the single supervisory mechanism will work, it is required the clear delineation of the ECB's supervisory duties from those of national authorities, not to affect the balance of power between them. Thus, Gourisse (2012) draws particular attention to the ECB's role of providing or withdrawing the bank authorization, of driving directly on-site inspections or imposing administrative sanctions up to 10% of banks' annual turnover.

Therefore, the coexistence of the two levels of supervision, in a decentralized framework, in which national authorities have powers specifically set forth and defined, and the ECB benefits from decision-making, facilitate the exercise by the ECB of the single supervisor role.

5. What would be the impact of integrated supervision on systemically important banks?

Establishment of unique, supranational surveillance can help to tackle the issue of systemic financial institutions, in terms of balance sheet size, complexity or business connections with other financial markets (“too big to fail”, “too complex to fail” or “too interconnected to fail”).

Centralized supervision is more objective and less biased than the national one. Also, it will contribute to limiting the moral hazard induced by local supervision.

A study published by Demirguc-Kunt and Huizinga (2012) introduces a distinction in awarding the quality of being systemically important financial institution (SIFI). The activity of a bank can be characterized by its absolute value (the value of balance sheet and off balance sheet aggregate assets) and its systemic value (the ratio of bank debt to the country's GDP). This ratio indicates the maximum value of saving costs to be borne by the country of origin of the bank, if the bank becomes insolvent and its assets are totally damaged.

In the above mentioned context, Rohtsalu (2012) argues that, by creating the banking union, systemic size banks included in the category of being “too big to save” because the home country is not able to save them will become, by relation to Euro zone GDP, “too big to fail”, i.e. banks with large absolute value. This will change the public perception and will improve their position on financial markets.

The impact of systemic financial institutions operating across borders and become bankrupt/insolvent can be better managed by the ECB than by the national supervisory authorities. In this respect, some authors (Pisani-Ferry, Sapir, Veron, Wolff, 2012) point the informational advantages enjoyed by European authorities, at the expense of national ones.

The unification of supervision could prove beneficial because, currently, banking systems are characterized by a high share of foreign capital, which means that the parent bank operations are subject to regulation and supervision in the home country, while banks in the host country, at which they hold the majority ownership, are subject to other prudential norms.

6. In what way will be affected the current activity of credit institutions?

ECB's duties in matter of monetary policy and maintaining financial stability in the Euro area will correlate with the sole prudential supervision role. ECB shall be entitled to verify the business model adopted by credit institutions, to assess the extent to which capital requirements are adequate to the risk profile, to critically analyze the results of stress tests conducted by the

respective banks, the risk management procedures and internal control, in order to identify in an early stage the potential vulnerabilities that may affect the viability and resistance to shocks of the credit institutions' business.

In this sense, Bernanke (2010) is in favor of investing supervisory authorities with the power to limit financial institutions' engagement in risky activities.

Concrete ways in which the single supervisory authority will intervene to correct the deficiencies found still remain ambiguous: what action will the ECB adopt if the recommendations made by it to credit institutions won't be implemented? Will be imposed limits or thresholds on lending growth or performance indicators?

In light of prudential financial reporting that credit institutions have to periodically prepare and send to the national supervisory authority, it is possible that the type of information required, the level of detail and frequency multiply as a result of requests for reports which will be made exclusively for the use of the ECB. The volume of work necessary for preparation of additional documentation will require additional staff, thus increasing the human resource costs. Financial reporting activities will be even more complex in the case of Euro area banks that decide to conduct business through branches in a non-participating country at the banking union, which will be triple monitored (by the host country supervisory authority, the ECB and the supervisory authority of the country of origin) or in the case of non-participating banks that operate through branches in the Euro area (will be subject to supervision by the ECB, in addition to the monitoring of the national authority in the home country).

Also, banks will pay the fees charged by the ECB in order to cover its expenses incurred in carrying out tasks within the scope of integrated surveillance. The amount of the fees will be proportional with the bank systemic importance and risk profile.

7. What effects will have the unique supervision on credit institutions' performance and risk indicators?

The relationship between the particularities of supervisory activity and risk, performance and financial soundness bank indicators has been the subject of a series of empirical studies over the last decade. Largely, the studies circumscribed to these topics positioned in the center of the analyses and correlations the official power of banking supervisors. The empirical results are relevant and can be used as a benchmark by ECB, in the concrete exercise of the Euro zone single supervisor role. Also, in the context of the desired banking union, criticism on the risks of aggregating excessive powers by the ECB become more pronounced, so it is necessary to make a foray into approaches on this topic.

Economic literature argues that there are several channels through which the features of surveillance activity can influence banking performance.

Barth, Caprio and Levine (2004) showed that a supervisory activity which promotes better information transparency induces the development of the banking system, reflected by the increase in the share of private credit to GDP, and strengthens the efficiency of the intermediation activity, due to lower net interest margins.

A similar position is adopted in the study of Demircuc-Kunt, Laeven, Levine (2004), revealing the erosion of profitability ratios and increase of financial intermediation costs, as a result of the adoption of rigid regulations that restrict banking activity and impose barriers to financial market access.

The first comprehensive study that explored the empirical relationship between banks' financial soundness indicators and characteristics of banking supervision was conducted by Davis and Obasi (2009). The analysis included 914 largest banks, by total asset value, from a sample of 64 countries, for a period during 1995-2003. The results illustrated the positive linkage between exercising supervision by the central bank and financial health indicators: increasing the share of liquid assets in total assets, improving ROA profitability and increasing the share of loans in total assets. These results are maintained also in the event that supervision is centralized within a single entity or shared among several entities. High expertise and number of the surveillance staff correlates with a decrease in the share of loans in total assets, and hence reductions of credit risk exposure, while reducing banks' liquidity and profitability levels. The effect on leverage ratio is zero, regardless of the variables used as a proxy for surveillance features.

The same authors highlight three aspects of the supervisory authority power: the extent to which it acts promptly by taking corrective action when it finds an impairment of various components in the banking business, holding the right of discretionary intervention when it notices violations of banking regulations and the supervisory authority's power of decision occurs without the agreement of other state authorities.

The extent to which regulation and banking supervision stimulates or conversely, restricts the operational efficiency of banking activity was investigated by Pasiouras, Tanna and Zopounidis (2009). They quantified efficiency through the stochastic frontier approach, by using 2,853 observations with data for the 615-listed commercial banks in 74 countries, over the period 2000-2004. The conclusion of the analysis is that banking regulations increase market discipline, while the strengthening of surveillance powers increases both banks' cost efficiency and profit efficiency.

Another study is that of Barth, Lin, Ma, Seade and Song (2010), performed on a sample of 4,050 banks from 72 countries, for the period 1999-2007.

From the perspective of banking regulations, restricting banking activities negatively influences the efficiency (calculated with a non-parametric method), while increasing capital requirements has a marginal, but positive effect on efficiency. From a supervisory perspective, a supervisor with a high degree of independence and increased power is positively correlated with banking activity efficiency. The authors have quantified the banking supervisor power index, based on 14 variables that reflect the exercise of supervisory authority, which has been further correlated with the efficiency indicators. The result indicated that the increased power of the supervisory authority improves corporate governance and banking efficiency, but only where the authority shows a high degree of independence from political factor.

A recent research (Chortareas, Girardone, Ventouri, 2012), performed on a sample of 22 EU countries in the period 2000-2008, aimed to show whether the banking supervisory and regulatory authorities' interventions significantly affect operational efficiency and performance of banks. Empirical evidence suggested that the increased power of the banking supervisory authority can improve credit institutions' efficiency, but also it can be a signal for interventionist attitude or obstruction of banking activity, which compresses the efficiency level.

8. How will influence the competitive environment the way in which credit institutions operate?

From the perspective of competition among banks, establishing the single monitoring mechanism will generate distortions of competitive banking environment, as some prudential regulations of the countries not included in the mechanism may be more or less restrictive than the ECB's ones. There is the risk that banks resident in non-participating countries to the European banking union avoid opening subsidiaries or the taking over, through mergers and acquisitions, of banks operating in countries participating to the union, in order to evade the prohibitive legislation imposed on by the ECB.

In some studies (Pisani-Ferry, Sapir, Veron, Wolff, 2012) it is shown that any partial banking union involves a risk of regulations arbitrage and, thus, competitive distortions. In addition, it is drawn attention to the risk of undermining the business of small, local banks, operating in non-Euro zone countries, with weak economic fundamentals, in favor of banks monitored by ECB.

In other words, it is possible that the retail and corporate banking market of the non-Euro zone banks be affected, as banks that fall under the single supervision mechanism will benefit from better public perception regarding the financial health and risk-taking. We can assist to the cross border migration of customers towards supranational supervised banks, the selection criteria being

represented, ultimately, by the differentiated interest rates charged. Thus, some small banks, non-included in the single mechanism, will have to redefine business strategies, including through mergers or acquisitions procedures, or to cease doing banking business.

These perspectives for the European retail and corporate banking market overlap on the existing legislative context. According to McKinsey report (2012), the European retail banking is going through an important period of pressure on ROE, largely due to Basel 3 requirements, as well as other initiatives impacting on the level of capital and own funds. For systemically important banks in the Euro area, the ROE level fell by between 0.4% and 1.2% in the period 2010 to mid 2012, which means a significant impact of regulations on banking performance. As a result, banks are concerned about new strategies, including the repricing of the mix of products and services granted, so as to increase efficiency.

Deutsche Bank (2012) adds that not including the most important financial center in Europe, which is England, in the unique monitoring mechanism will enhance the potential manifestation of competitive distortions.

The impact of credit institutions' single supervision on ratings is perceived by Standard & Poor's study (2012) to be positive, to the extent that it will help reduce/eliminate existing disparities in national legislations dedicated to banking regulation and supervision. Uniformization of supervisory framework in the Euro area will help improve the scores calculated for the component called *institutional framework of the banking system*. As a result, ratings of banks located in countries that will join the banking union will be better than those of banks outside the union, which will create distortions of competition. These can occur both by difficulties in attracting/keeping the existing portfolio of clients, and by decreasing the attractiveness of issuing shares or bonds.

Statements that refer to effects induced by the single supervisory mechanism to the banking competition emphasize that, to be effective and equitable, it must be transparent, have a broad scope of coverage of financial institutions and be neutral for banking competition (to ensure a level-playing field) (Constancio, 2012, Deutsche Bank, 2012).

In this respect, Noyer (2009) pointed out that, during the process of reforming the regulations related to the financial sector, it should be considered the financial industry's optimal degree of diversity and to subordinate it to maintaining financial stability. In other words, it has to be found a balance between fostering competition and financial innovation, on the one hand, versus standardization and harmonization of European regulations, on the other hand.

Conclusions

European Commission's proposal to create a European banking union that comprises the Euro area member countries translates into abandoning the national options in matters of financial regulations and banking supervision, and therefore a voluntary renunciation to the attribute of national sovereignty, in favor of a single European authority. This paper, with an unconventional structure, based on the formulation of interrogations and their punctual argumentation, proposed to investigate the implications of the banking union's first pillar, namely the unique monitoring mechanism, on the traditional functions of the ECB, on the feasibility of the coexistence between supranational supervision and the national one, and on various facets of the impact that the new architecture of European banking supervision will have on the business of credit institutions, in terms of performance indicators, efficiency, risk and competition.

Table 1

Synthesis of interrogations made

Interrogations formulated by the authors	Arguments brought by official institutions and researchers	Authors' opinions
Is ECB entitled to act as sole supervisor for Euro area?	<ul style="list-style-type: none"> From a geographical standpoint, the single supervisory mechanism should include all the 27 EU countries (Deutsche Bank, 2012; Pisani-Ferry, Sapir, Véron, and Wolff, 2012). From an institutional standpoint, the designation of ECB as responsible for supranational supervising is not appropriate (Deutsche Bank, 2012). Increased ECB's powers in influencing national budgetary and fiscal policies (Steinberg, 2012). 	<ul style="list-style-type: none"> National supervisors' failure in managing banking distress events Deep rethinking of the pillars of the European construction The interconnected and cross-border nature of banking activity justifies concerns for a single supervisor Banking regulation and supervision responsibilities should be taken by a single pan-European authority (Barbu, Vintila, 2006).
Did the lender of last resort role affected ECB's independence?	<ul style="list-style-type: none"> The Maastricht Treaty gives ECB no mandate for any direct or indirect financing of member countries government debt To reduce ECB's involvement in financing budget deficits, in 2010 has been created the European Financial Stability Facility (EFSF) 	<ul style="list-style-type: none"> ECB supported the Euro area banking system by reshaping the monetary policy instruments and by modifying the size and structure of its own balance sheet. ECB's direct purchasing of assets issued by the private sector. the criteria for quantifying ECB's independence have to be rethought according to the new context generated by the financial crisis.
Dual supervision (national and exercised by the ECB) may be conflicting or redundant?	<ul style="list-style-type: none"> The experience of the dual banking supervision in the US banking system has revealed the successful coexistence of banks supervised federally with banks which operate under standards and regulations imposed at the state level (American Bankers Association, 2005). 	<ul style="list-style-type: none"> Besides being redundant, supervision on two distinct levels, namely centralised at European level with delegation of specific tasks to national level, is the best solution in a banking system that counts thousands of banks.

Interrogations formulated by the authors	Arguments brought by official institutions and researchers	Authors' opinions
	<ul style="list-style-type: none"> ▪ A system that comprises multiple supervisors won't have the tendency to suppress risk taking or financial innovation (Greenspan, 1995). 	<ul style="list-style-type: none"> ▪ ECB tends to become an institution with powers similar to that of Federal Reserve.
Is it appropriate the sharing of supervisory powers between the ECB and national authorities?	<ul style="list-style-type: none"> ▪ Centralization of authority at the ECB level should not be confused with operational centralization (Pisani-Ferry, Sapir, Véron, Wolff, 2012). ▪ a monitoring mechanism on two distinctive levels, in which ECB monitors only systemic banks and national authorities supervise the remaining banks, is not indicated as small, local banks may be too at the origin of systemic crises (Deutsche Bank, 2012). ▪ The delegation of supervision powers for small/medium sized banks to national authorities, while the ECB has legal responsibility for prudential monitoring of all banks in the Euro area (Pisani-Ferry, Wolff, 2012). ▪ The clear delineation of the ECB's supervisory duties from those of national authorities, not to affect the balance of power between them (Gourisse, 2012). 	<ul style="list-style-type: none"> ▪ National supervisory authorities apply the regulatory requirements issued by ECB. ▪ Banks operating in Euro zone will apply the same prudential requirements, hence references to the legislation in the country of origin (home country) versus the host country will simply disappear. ▪ National supervisors will hold the role of an interface between credit institutions and the ECB. ▪ Reduction of ECB's operational costs with human and financial resources.
What would be the impact of integrated supervision on systemically important banks?	<ul style="list-style-type: none"> ▪ Banks included in the category "too big to save" will become "too big to fail" (Rohtsalu, 2012). ▪ Systemic financial institutions operating across borders and become bankrupt/insolvent can be better managed by the ECB, because of informational advantages (Pisani-Ferry, Sapir, Véron, Wolff, 2012). 	<ul style="list-style-type: none"> ▪ Centralized supervision is more objective and less biased than the national one. ▪ It will contribute to limiting the moral hazard induced by local supervision. ▪ The high share of foreign capital in national banking systems is another argument in favor of unifying supervision.
In what way will be affected the current activity of credit institutions?	<ul style="list-style-type: none"> ▪ Bernanke (2010) is in favor of investing supervisory authorities with the power to limit financial institutions' engagement in risky activities. 	<ul style="list-style-type: none"> ▪ ECB shall be entitled to verify the banks' business model, to assess the capital adequacy to the risk profile, to analyze the results of stress tests, the risk management procedures and internal control. ▪ Ambiguity surrounds the concrete ways the single supervisory authority will intervene to correct the deficiencies ▪ Enhancement of the level of detail and frequency of prudential financial reporting sent to ECB, thus increased costs with human resources. ▪ Fees requested by ECB will add to banks' current operational expenses.

Interrogations formulated by the authors	Arguments brought by official institutions and researchers	Authors' opinions
What effects will have the unique supervision on credit institutions' performance and risk indicators?	<ul style="list-style-type: none"> ▪ A transparent supervisory activity strengthens the efficiency of the intermediation activity (Barth, Caprio, Levine, 2004). ▪ Rigid regulations erode profitability indicators and increase the financial intermediation costs (Demirgüç-Kunt, Laeven, Levine, 2004). ▪ Davis and Obasi (2009) depict the positive link between banks' financial soundness indicators and characteristics of banking supervision. ▪ A highly independent supervisory authority, with increased powers, is positively correlated with bank efficiency (Pasiouras, Tanna, Zopounidis, 2009, Barth, Lin, Ma, Seade, Song, 2010, Chortareas, Girardone, Ventouri, 2012). 	<ul style="list-style-type: none"> ▪ The empirical results reported by economic literature can be used as a benchmark by ECB, in the concrete exercise of the Euro zone single supervisor role.
How will influence the competitive environment the way in which credit institutions operate?	<ul style="list-style-type: none"> ▪ Any partial banking union involves a risk of regulations arbitrage and, thus, competitive distortions (Pisani-Ferry, Sapir, Véron, Wolff, 2012). ▪ Not including England in the unique monitoring mechanism will enhance the potential manifestation of competitive distortions (Deutsche Bank, 2012). ▪ Ratings of banks located in countries that will join the banking union will be better than those of banks outside the union, which will create distortions of competition (Standard & Poors, 2012). 	<ul style="list-style-type: none"> ▪ Banks resident in non-participating countries to the European banking union avoid opening subsidiaries or the taking over, through mergers and acquisitions, of banks operating in countries participating to the union, in order to evade the prohibitive legislation imposed on by the ECB. ▪ Cross border migration of customers towards supranational supervised banks. ▪ Some small banks, non-included in the single mechanism, will have to redefine business strategies, including through mergers or acquisitions procedures, or to cease doing banking business. ▪ The European retail banking will be exposed to increased pressures on ROE, due to Basel 3 requirements and renunciation at bank recapitalization through state support.

Empirical evidence we have summarized does not clearly, unambiguously indicate a significant positive impact of initiatives to reform the banking supervisory framework in recent years at both the European and international level. However, there are clearly expressed several highlights that should be taken into account in the implementation by the ECB of the single oversight mechanism.

Since the ECB's role as lender of last resort and financier of budget deficits questioned the independence of this institution, it is necessary to redefine the criteria for assessing the independence of central banks in exceptional

circumstances, such as the financial crises. Also, we report the many technical deficiencies that will result from the correlation of ECB's duties as unique supervisor to those of EBA as sole regulator and the national authorities.

The advantages of the unique surveillance mechanism will consist in unifying the supervisory framework, with direct and immediate effects on the monitoring of systemically important financial institutions, but relying on the expertise and contribution of each national authority in their monitoring approach.

From the perspective of the supervised credit institutions, they will have to face additional costs generated by the new prudential financial reporting requirements, the fees charged by the ECB and additional human resource. The increase in credit institutions' operating expenses will have a direct impact on profitability indicators, to the extent that banks will bear all of these costs. If they choose to further transfer all or part of these costs to customers, by incorporating them in the final cost of financial products and services offered, it is possible that we assist at the erosion of their client portfolio, through customers' migration to banks subject to single supervision, that offer the best remuneration for deposits and lowest credit costs.

All these can be offset by the beneficial effects enhanced by the single surveillance of the Euro area geographical space: effects on operational efficiency and financial stability.

Relative to the impact on bank competition, we subscribe to the viewpoints that signal the potential for competitive distortions between banks included under the dome of unique supervision and the non-participating ones. It is therefore possible to assist at a comprehensive process of mergers and acquisitions involving small and medium sized banks, which will lead to a reconfiguration of the banking systems' institutional capacity.

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Analysing movements in investor's risk aversion using the Heston volatility model

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Abstract. *In this paper we intend to identify and analyze, if it is the case, an “epidemiological” relationship between forecasts of professional investors and short-term developments in the EUR/RON exchange rate. Even that we don’t call a typical epidemiological model as those ones used in biology fields of research, we investigated the hypothesis according to which after the Lehman Brothers crash and implicit the generation of the current financial crisis, the forecasts of professional investors pose a significant explanatory power on the futures short-run movements of EUR/RON. How does it work this mechanism? Firstly, the professional forecasters account for the current macro, financial and political states, then they elaborate forecasts. Secondly, based on that forecasts they get positions in the Romanian exchange market for hedging and/or speculation purposes. But their positions incorporate in addition different degrees of uncertainty. In parallel, a part of their anticipations are disseminated to the public via media channels. Since some important movements are viewed within macro, financial or political fields, the positions of professional investors from FX derivative market are activated. The current study represents a first step in that direction of analysis for Romanian case. For the above formulated objectives, in this paper different measures of EUR/RON rate volatility have been estimated and compared with implied volatilities. In a second timeframe we called the co-integration and dynamic correlation based tools in order to investigate the relationship between implied volatility and daily returns of EUR/RON exchange rate.*

Keywords: implied volatility; smile volatility; dynamic correlation; error correction model.

JEL Codes: D81, G11.

REL Code: 11B.

1. Introduction

One of the most interesting and highly debated topics in economic theory is related to the stochastic properties of exchange rate, its links to the fundamental variables and the ability to forecast its short-run movements. Since 1983, Meese and Rogoff provide a seminal work about this debate whose results were published in two stages. They showed that macro fundamental variables have no explanatory power on the future changes of the exchange rate, which means the exchange rate pose the random walk property. In order to achieve these results they made use of the out-of-sample fits for several benchmark models of exchange rates. The result of Meese and Rogoff remained standing until 2005, when the fundamental work of the Engel and West brought a new light in regard with these topics. Engel and West showed that within a rational expectations Euler equation based model, the exchange rate, viewed as an asset price as Obsfeld and Rogoff (1996) underlined, follows a process which is at least near-random walk model under certain circumstances. These circumstances are given by the $I(1)$ property of fundamentals and the discount factor located very closed to 1. In this context, it is not surprising that short-run exchange rate movements are almost impossible to predict under a very large discount factor and $I(1)$ macro-variables. Rime, Sarno and Sojli (2007) studied the relationship existing between order flows and the daily movements of the exchange rates. Their estimates emphasized that order flows represents a good predictor for exchange rates return and also that order flows contains significant information on the current and the expected future states of macro variables. On the other hand, Xavier Gabaix suggests to Barro (2005) that a possible way to account for disaster probabilities is to use prices recorded by far *out-of-the money* options. Therefore, in the Gabaix's view, options characteristics bear important information on the macro states. Coming back to the fundamentals of Engel and West, Cochrane (1989) and Akerlof and Yelen (1985a, 1985b) noted that economic agents may adopt near-rational behaviours because it is too cheap to situate near-rationality (Cochrane) or because the agents don't have the proper tools to elaborate accurately evaluations. But later, Sargent (1993) and De Grawe (2010) assumed under different form that agents are learning during the time from their past decisions and have at least rational-expectation based intentions. De Grawe accentuated the role of heuristic rules. In that sense, Carroll (2001), using an epidemiological style model, underlined its high performance in forecasting inflation and unemployment. Later, Carroll (2003) showed that the economic agents try to be rational-expectations through the interpretation and use of the information provided by professional forecasters, which in turn are rational agents.

Summing-up all these considerations and based on recently elaborated analyses by Alupoaiei, Codîrlăşu and Săndică (2012), we investigate the case of existing “epidemiological” relationship between forecasts of professional investors and short-term developments in the EUR/RON exchange rate. Even if we don't call a typical epidemiological model as those ones used in biology fields of research, we investigated the hypothesis according to which after the Lehman Brothers crash and, implicit, the generation of the current financial crisis, the forecasts of professional investors pose a significant explanatory power on the futures short-run movements of EUR/RON. How does it work this mechanism? Firstly, the professional forecasters account for the current macro, financial and political states, then they elaborate forecasts. Secondly, based on that forecasts they get positions in the Romanian exchange market for hedging and/or speculation purposes. But their positions incorporate in addition different degrees of uncertainty. In parallel, a part of their anticipations are disseminated to the public via media channels. Since some important movements are viewed within macro, financial or political fields, the positions of professional investors from FX derivative market are activated. The current study represents a first step in that direction of analysis for Romanian case. For the above formulated objectives, in this paper there have been estimated different measures of EUR/RON rate volatility and compared with implied volatilities. In a second timeframe we called the co-integration and dynamic correlation based tools in order to investigate the relationship between implied volatility and daily returns of EUR/RON exchange rate.

2. Theoretical model

In this section we will briefly present the theoretical background of volatility smile concept of implied, stochastic and conditional volatility. Once we establish a base for the volatility features in Romanian FX market we move further to analyze the co-integration and dynamic correlation in order to investigate the relationship between implied volatility and daily returns of exchange rate.

2.1. Smile volatility

Currency options are in general used for strategies on foreign exchange rate movements. One type of strategy is risk reversal, which implies a long position on call and short position on put, the call having a higher strike than put. That strategy represents a measure of the relative value of options with strikes above or below the current at the money forward rate, actually expressing the skew that might exist in the volatility smile.

Forward looking financial indicators represents informative predictors of the behaviour of the asset price; therefore those options gained attention in recent years. Neftci (2008) explained how risk reversal represents a measure of the bias in a volatility smile, since a symmetric smile implies that zero cost risk reversal could be achieved.

The measure of an option's *moneyness* is called delta, such as *at the money* (ATM) options have a delta around 50 and the following relationship holds:

$$\sigma(25 - \text{deltaRR}) = \sigma(25 - \text{deltaput}) - \sigma(25 - \text{deltacall}) \quad (1)$$

Where $\sigma(25 - \text{deltaRR})$, $\sigma(25 - \text{deltacall})$, $\sigma(25 - \text{deltaput})$ represents the implied volatilities of a *risk reversal*, namely the 24 delta call and 25 delta *put*.

The curvature of the smile can be measured using *butterfly* strategy. One way to construct a *butterfly* is a long straddle which forms a V-shaped head of the *butterfly* and short position a strangle that creates the flattened wings.

$$\begin{aligned} \sigma(25 - \text{deltacall}) \\ = \sigma(25 - \text{delta ATM}) + \sigma(25 - \text{deltaBFY}) + 0.5 \times \\ \times \sigma(25 - \text{deltaRR}) \end{aligned} \quad (2)$$

$$\begin{aligned} \sigma(25 - \text{delta put}) \\ = \sigma(25 - \text{delta ATM}) + \sigma(25 - \text{deltaBFY}) - 0.5 \times \\ \times \sigma(25 - \text{deltaRR}) \end{aligned} \quad (3)$$

Nakisa (2010) plot the implied volatility for ATM options on the S&P 500 index against expiry term and determined two term structure curves: the first one for January 24th 2007, which had a low level of volatility, respectively the second one for November 20th 2008, which was just after the collapse of Lehman Brothers when volatility was across the entire term structure.

2.2. Implied volatility

In 1993, Heston proposes the first model with diffusion defined as state variable and follows a stochastic process. The main advantage of using this model is the calibration of the volatility "smile". Once the implied volatility is obtained, we have compared it with the stochastic and conditional volatility and with con on the same time frame.

2.2.1. Stochastic volatility

The stochastic volatility has been calculated using a Metropolis-Hastings algorithm. This uses multivariate normal proposals with mean the posterior mode in order to estimate the parameters. This algorithm performs a sequence of iterations summarized by the following steps:

1. Set starting values for $\beta = (\beta_0^{(t-1)}, \beta_1^{(t-1)}, \beta_2^{(t-1)}, \beta_3^{(t-1)})$;
2. Propose new values $\beta^* = (\beta_0^*, \beta_1^*, \beta_2^*, \beta_3^*)$ from normal distributions;
3. Calculate acceptance probability $\alpha = \min(1, \frac{f(y|\beta_0^*, \beta_1^*, \beta_2^*, \beta_3^*)f(\beta_0^*, \beta_1^*, \beta_2^*, \beta_3^*)}{f(y|\beta_0, \beta_1, \beta_2, \beta_3)f(\beta_0, \beta_1, \beta_2, \beta_3)})$;
4. Update $\beta^{(t)} = \beta^*$ with probability α or keep the same values with probability $1-\alpha$;
5. Repeat Steps 2,3 and 4 T times;
6. Take the average of the T draws $(\beta_j^{(1)}, \dots, \beta_j^{(T)})$, $j = \overline{0,3}$.

Considering a simple stochastic volatility model:

$$\begin{aligned} y_t &= \epsilon_t \sqrt{\exp(\ln h_t)} \\ \ln h_t &= \ln h_{t-1} + v_t \\ v_t &\sim N(0, g) \end{aligned} \quad (4)$$

where h_t is time-varying variance.

Jacquier et al. (2004) suggest applying a Metropolis Hastings algorithm at each point in time to sample from conditional distribution of h_t which is given by $f(h_t|h_{-t}, y_t)$, where $-t$ represents all other dates than t . The authors argue that because the transition equation of the model is a random walk, the knowledge of h_{t+1} and h_{t-1} captures all relevant information about h_t

$$f(h_t|h_{-t}, y_t) = f(h_t|h_{t-1}, h_{t+1}, y_t), \quad (5)$$

The density is a product of a normal density and log normal density and has the following form:

$$f(h_t|h_{t-1}, h_{t+1}, y_t) = h_t^{-0.5} \exp\left(\frac{-y_t^2}{2h_t}\right) \times h_t^{-1} \exp\left(\frac{-(\ln h_t - \mu)^2}{2\sigma_h}\right), \quad (6)$$

where

$$\mu = \left(\frac{\ln h_{t+1} + \ln h_{t-1}}{2}\right), \quad \sigma_h = \frac{g}{2} \quad (7)$$

The algorithm starts sampling h_0 and accepting the draw:

$$f(h_0 \setminus h_1, \cdot) = h_0^{-1} \exp \left(\frac{-(\ln h_0 - \mu_0)^2}{2\sigma_0} \right) \quad (8)$$

$$\mu_0 = \sigma_0 \left(\frac{\bar{\mu}}{\bar{\sigma}} + \frac{\ln h_1}{g} \right), \sigma_0 = \frac{\bar{\sigma}g}{\bar{\sigma}+g} \quad (9)$$

Jacquier et al. (2004) suggest sampling the final value of h_t using the following modified candidate generating density

$$q(\phi^{G+1}) = h_t^{-1} \exp \left(\frac{-(\ln h_t - \mu)^2}{2\sigma_h} \right); \quad (10)$$

where:

$$\mu = \ln h_{t-1}, \sigma_h = g$$

2.2.2. Conditional volatility

If an autoregressive moving average model (ARMA model) is assumed for the error variance, the model is a generalized autoregressive conditional heteroskedasticity (GARCH, Bollerslev(1986)) model. In that case, the GARCH (p, q) model (where p is the order of the GARCH terms σ^2 and q is the order of the ARCH terms ϵ^2) is given by

$$\begin{aligned} \sigma_t^2 &= \alpha_0 + \alpha_1 \epsilon_{t-1}^2 + \dots + \alpha_q \epsilon_{t-q}^2 + \beta_1 \sigma_{t-1}^2 + \dots + \beta_p \sigma_{t-p}^2 \\ &= \alpha_0 + \sum_{i=1}^q \alpha_i \epsilon_{t-i}^2 + \sum_{i=1}^p \beta_i \sigma_{t-i}^2 \end{aligned} \quad (11)$$

The Glosten-Jagannathan-Runkle GARCH (GJR-GARCH) model proposed by Glosten, Jagannathan and Runkle in 1993 captures the asymmetry in the ARCH process. The suggestion is to model $\epsilon_t = \sigma_t \times z_t$ where

$$\sigma_t^2 = K + \delta \sigma_{t-1}^2 + \alpha \epsilon_{t-1}^2 + \phi \epsilon_{t-1}^2 I_{t-1} \quad (12)$$

$$\begin{aligned} I_{t-1} &= 0 \quad \text{if } \epsilon_{t-1} \geq 0 \\ I_{t-1} &= 1 \quad \text{if } \epsilon_{t-1} < 0 \end{aligned} \quad (13)$$

2.3. Correlation and error correction model

The main problems in the modeling of multivariate processes of volatility are related to the large number of parameters which have to be simultaneously estimated and the positive definiteness of covariance matrix. In this spirit, Bollerslev, Engle and Wooldridge (1988) proposed the first GARCH representation of conditional covariance matrices, defining the so called VEC-model.

The general multivariate GARCH (p,q) model is given as:

$$VEC(\Sigma_t) = C + \sum_{i=1}^q A_i \times vec(\varepsilon_{t-i} \times \varepsilon'_{t-i}) + \sum_{j=1}^p B_j \times vec(\Sigma_{t-j})^{(1)} \quad (14)$$

The fact that the model described by the above equation requires the estimation of a large number of parameters led to a development of the simplified diagonal VEC model by Bollerslev, Engle and Wooldridge (1988), where the A and B matrices are forced to be diagonal. The model can be written as follows:

$$\sigma_{ij,t} = c_{ij} + \sum_{h=1}^p a_{hij} \times \varepsilon_{t-h,i} \times \varepsilon_{t-h,j} + \sum_{h=1}^q b_{hij} \times \sigma_{t-h,ij} \quad 1 \leq i \leq j \leq k \quad (15)$$

The diagonal VEC model is represented by the following equation:

$$\Sigma_t = C_0^* + \sum_{i=1}^m A_i^* \Delta (\varepsilon_{t-i} \times \varepsilon'_{t-i}) + \sum_{j=1}^s B_j^* \Delta \Sigma_{t-j} \quad (16)$$

where m and s are non-negative integers, and Δ denotes Hadamard product⁽²⁾. Σ_t must be a parameter matrix and Silberberg and Pafka in 2001 demonstrated that a sufficient condition to ensure the positive definiteness of the covariance matrix Σ_t is that the constant term C_0^* is positive definite and all other coefficient matrices are positive semi-definite. For a multivariate GARCH model to be plausible, Σ_t is required to be positive definite for all values of the disturbances. In order to solve this problem Engle and Kroner (1995) proposed a quadratic formulation for the parameters that ensured positive definiteness. This model is known as BEKK and has the following form:

$$\Sigma_t = C_0 \times C_0' + \sum_{k=1}^K \sum_{i=1}^q A_i' \times \varepsilon_{t-i} \times \varepsilon'_{t-i} \times A_{ki} + \sum_{k=1}^K \sum_{i=1}^p B_{ki}' \Sigma_{t-i} B_{ki} \quad (17)$$

The BEKK(1,1,1) model, $\Sigma_t = \Omega + A' \varepsilon_{t-1} \times \varepsilon_{t-1}' A + B' \Sigma_{t-1} B$, can be written as a VEC model:

$$\text{VEC}(\Sigma_t) = \text{VEC}(\Omega) + (A \otimes A)' \text{vec}(\varepsilon_{t-1} \times \varepsilon_{t-1}') + (B \otimes B)' \text{VEC}(\Sigma_{t-1}) \quad (18)$$

An error correction model is a dynamical system with the characteristics that the deviation of the current state from its long-run relationship will be fed into its short-run dynamics.

Given a VAR (p) of I(1) x's

$$x_t = \Phi_1 \times x_{t-1} + \dots + \Phi_p \times x_{t-p} + \epsilon_t \quad (19)$$

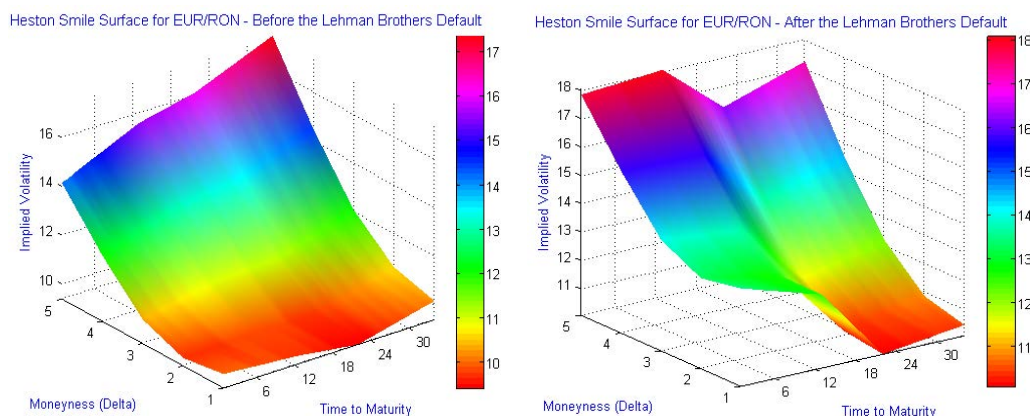
There always exists an error correction representation of the form

$$\Delta x_t = \Pi x_{t-1} + \sum_{i=1}^{p-1} \Phi_i^* \times \Delta x_{t-1} + \epsilon_t \quad (20)$$

where Π and the Φ_i^* are functions of the Φ . When $\Pi = 0$ then there is no cointegration⁽³⁾.

3. Empirical results

The current analysis started from the empirical work of Alupoaiei, Codîrlașu and Săndică (2012) that investigated how the expectations of professional investors from the local⁽⁴⁾ Romanian are changing across an important event. The so called important event was set to the moment of Lehman Brothers default. In fact, the event of Lehman Brothers bankruptcy is considered by experts as the official start of the current financial crisis. They showed that, in the face of crucial event at global scale, the expectations of professional investors quoted as implied volatilities changes especially for the short horizons of time as we can observe from the following plot:



Source: Alupoaiei, Codîrlășu and Săndică (forthcoming).

Figure 1. Heston smile surface for EUR/RON rate calibrated on one-month data before the Lehman Brother default

Figure 2. Heston smile surface for EUR/RON rate calibrated on one-month data after the Lehman Brother default

Given these results, we extended the philosophy of the above study in a dynamic manner. More exactly we called two classes of econometric techniques in order to obtain information on the relationship between investors expectations expressed as implied volatilities and the evolution of the EUR/RON rate.

On the first ground, we begin our analysis by getting as reference a common practice in trading activities. It is well known that, in derivative markets, investors actually trade volatility. In that sense, traders usually use the difference between forecasted volatility and implied volatility for hedging purposes. Taking into account these considerations, we firstly estimated the historical volatility of EUR/RON rate and expressed it in annual terms. In order to avoid limits implied by different methods of volatility fit⁽⁵⁾, it has been restored two different approaches. The first method used to estimate the historical volatility is based on a conditional mixture model of the form AR (2)-GJR (1, 11). The selection and the usage of this model are made based on the study of Alupoaiei (2010). There are several studies that underlined the existence of fractional structures within the volatility of EUR/RON exchange rate with d parameter from FIGARCH model closed to 1. Starting from these facts, Alupoaiei empirically showed that when increasing the order of AR equation, the fits provided by the mixture model AR (2)-GJR (1, 1) approximate pretty well those ones provided by FIGARCH model. Alupoaiei's investigation was motivated by the complexity of using FIGARCH model in exercises of simulation or forecasting.

The second approach that we called here is based on a stochastic formulation on the volatility of underlined process. We used two different approaches for fitting historical volatility in order to assure robustness for the final results. For simplicity, we compare the fitted realized volatility in place of forecasted volatility with the implied volatility.

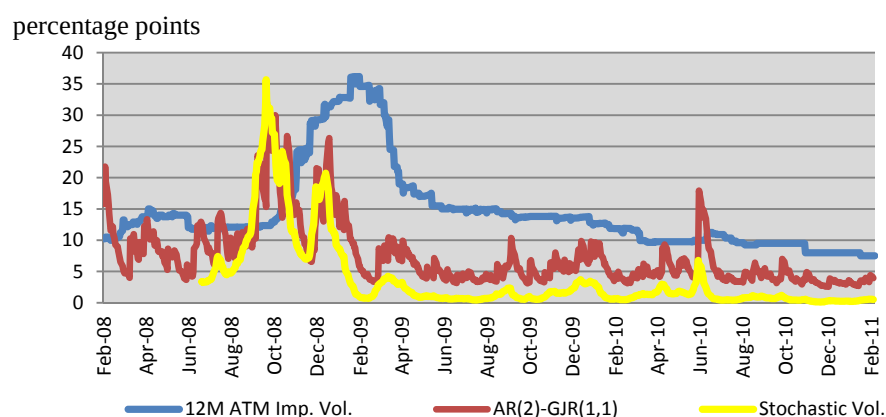


Figure 3. *Evolution of conditional, stochastic and implied volatilities*

In fact, the implied volatility represents the forecast of conditional volatility. Taking into account the shapes of estimated realized volatility shown in Figure 3, perhaps the predicted volatility would likely be a one step push before of the realized volatility. Looking at the above plot, we can observe that, almost every time, the implied volatility is situated above the realized one, with the exception of the period after Lehman Brothers crash. The trading practices in derivative markets states that if the implied volatility is above forecasted historical one, professional investors should enter on short position on EUR/RON, except the case when in the local exchange rate market is a lot of uncertainty regarding the future evolution of domestic currency. The main key insight of this analysis is the shock felt after the starting of current financial crisis posted permanent effects on implied volatility.

Therefore, in the second timeframe we come to analyse the link between implied volatility and the evolution of EUR/RON rate. We treat this problem econometric in two ways, namely through the usage of co-integration and the dynamic correlation between the two series. Using a VECM model, we determined how much the implied volatility and EUR/RON returns co-integrate in an econometric sense.

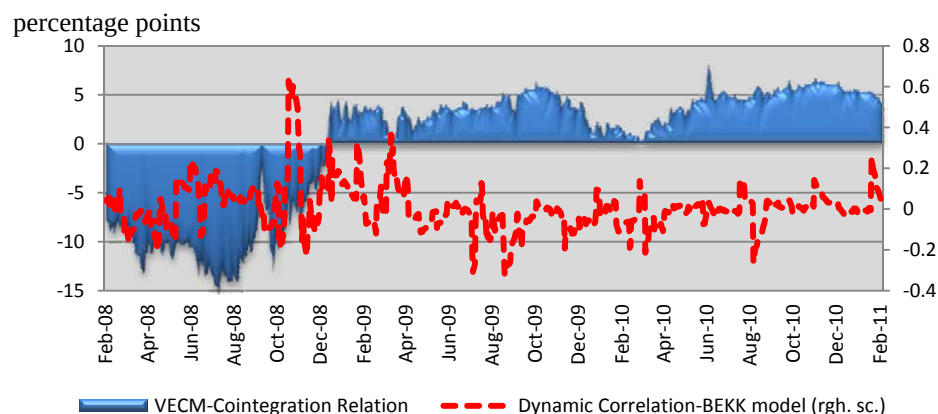


Figure 4. *Evolution of cointegration and correlation between 12M ATM implied volatility and EUR/RON evolution*

Estimated results showed that cointegrations between the two series became positive definitively after the Lehman episode, which means the EUR/RON returns had to increase in order to achieve the equilibrium. On the other hand, the dynamic correlation between 12M ATM implied volatility and EUR/RON evolution, estimated with BEKK model, fluctuated a lot within the interval $+0.2\%$ and -0.2% . Exception makes the period between October-December 2008, when the level of correlation ranged within $0.6\% - 0.7\%$.

4. Conclusions

In this paper we intend to identify and analyze, if it is the case, an “epidemiological” relationship between forecasts of professional investors and short-term developments in the EUR / RON exchange rate. We used two different approaches for fitting historical volatility in order to assure robustness for the final results. The first method used to estimate the historical volatility is based on a conditional mixture model of the form AR (2)-GJR (1, 1). The second approach that we called here is based on a stochastic formulation on the volatility of underlined process. From the first analysis we conclude that, almost every time, the implied volatility is situated above the realized one, with the exception of the period after Lehman Brothers crash. The trading practices in derivative markets states that if the implied volatility is above forecasted historical one, professional investors should enter on short position on EUR/RON, except the case when in the local exchange rate market is a lot of uncertainty regarding the future evolution of domestic currency. The main key

insight of this analysis is the shock felt after the starting of current financial crisis posted permanent effects on implied volatility.

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Even the obtained results require further investigation in order to be able to talk about the structural relationship between implied volatility and the evolution of EUR/RON rate, this paper represent a first stage for this type of analysis focused on the Romanian exchange rate market and should be treated accordingly.

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Notes

- (1) The VEC operator vectorizes a matrix by stacking its columns.
The Kronecker product of two matrices, A and B, where A is $m \times n$ and B is $p \times q$ is defined as: $A \otimes B = \begin{pmatrix} A_{11}B & A_{12}B & \cdots & A_{1n}B \\ \vdots & \vdots & \ddots & \vdots \\ A_{m1}B & A_{m2}B & \cdots & A_{mn}B \end{pmatrix}$ which is an $mp \times nq$ matrix. There is an important relationship between the Kronecker product and the VEC operator: $vec(A \otimes B) = (B^T \otimes A)vec(X)$
- (2) For two matrices of the same dimensions, $X, Y \in R^{m \times n}$ the Hadamard product $X \odot Y$ is a matrix of the same $X \odot Y \in R^{m \times n}$ with elements given by $(X \odot Y)_{i,j} = (A)_{i,j} \times (B)_{i,j}$. Note that the Hadamard product is a principal sub matrix of the Kronecker product.

- ⁽³⁾ If a linear combination of I (1) series is stationary, i.e. I (0), the series are called cointegrated. If there are 2 processes x_t and y_t are both I(1) and $y_t - \alpha x_t = \epsilon_t$, with ϵ_t trend-stationary or simply I(0), then x_t and y_t are called cointegrated.
- ⁽⁴⁾ Here the term local denotes that our analysis is concentrated only on the transactions ruled out on Romanian exchange market.
- ⁽⁵⁾ For example, the obtained conditional volatility with a model from the ARCH class it is sensitive to the conditional mean.

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The labour market in the post-crisis economy: the case of Spain

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Abstract. *The current financial and economic crisis has led to imbalances in the labour market, imbalances manifested worse in some economies. The paper aims to analyse the causes of these imbalances, especially the case of Spain, the country with the highest level of unemployment in the European Union. Thus, the characteristics of the labour market in Spain will be highlighted in order to identify the factors responsible for the worsening of the crisis.*

Keywords: labour market; crisis; unemployment; Spain.

JEL Codes: J08, J21, J31, H12.

REL Codes: 8G, 10G, 12G.

1. Introduction

While the crisis started around the same time in most regions of the European Union, its manifestation and depth proved to be very heterogeneous. Some countries have overcome the crisis more easily, while others have experienced inflationary, employment problems and increased economic downturn.

Studies show that the performance of labour markets during the crisis depends on the following factors: state of the economy at the beginning of the crisis, the structural characteristics of the economy and labour market policies (Aiginger, Horvath, Mahringer, 2011).

Even though some countries have recovered faster from the crisis, they still experience an affected labour market (the US), others have suffered large losses following the crisis, but have had a better performance of the labour market (the case of Germany).

In terms of labour productivity, the current crisis has led to widening the disparities between the EU and the US economy and even the gaps between the EU states. The challenge for the European economy is to get out of the vicious circle of unsustainable public spending, the state of disturbance that characterizes the financial markets and the job losses. Labour market reform should be pursued by increasing labour productivity and by labour market reintegration of the unemployed people affected by the crisis.

Such measures will have a positive impact on budget consolidation, generating higher tax revenue and reducing public expenditure on social transfers as well as the risk of future macroeconomic imbalances (Trașcă, Popa, Dudian, 2011).

The economic performance of a country depends on the labour market response to the crisis, demonstrating by economic analysis that there is a direct correlation between economic performance and labour market performance. Economists Aiginger, Horvath, Mahringer, (2011) conducted a research highlighting the connection between *output performance*, at national level, analyzed by several indicators such as real GDP growth, current account balance and *labour market performance*, analyzed by the evolution of employment and unemployment, before and after the crisis. The authors classify countries into four categories from this point of view: 1) countries where economic performance is linked to labour market performance (Norway, Switzerland, France, the Netherlands, Belgium, Austria, Poland), 2) countries with low economic performance and poor labour market performance (Ireland, Iceland, Great Britain, Finland, Hungary, Spain), 3) countries with high economic performance, but poor labour market performance (the US, Portugal) and 4) countries with low economic performance, but high labour market

performance (Germany, Italy, Slovakia, the Czech Republic). The study results emphasize that high labour market performance achieved by some economies after the crisis began depended on several factors, particularly on employment protection and on active policies. Given that during crisis, amid increasing uncertainty, companies could significantly reduce the number of employees, one should consider the long-term effects of these measures, which may mean loss of human capital, which could result in additional costs in adapting the company to the structural changes in the long-term. Therefore, policies to stabilize employment, to seek employment protection and adoption of active measures can help overcome the recession faster, with lower social costs.

2. Labour market in Spain – characteristics and particularities

The labour market in the EU countries has been more or less affected by the current crisis. Overcoming the effects of the crisis on employment depends not only on the measures and the policies adopted during the crisis, but also on the characteristics of each economy, on the specificity of each labour market.

Spain, along with Portugal and Greece are part of the Mediterranean employment pattern. Thus, the Spanish labour market is characterized by low flexibility, and reduced employment security. Labour market is segmented, with low internal mobility of labour, characterized by wage rigidities. Both flexibility at company level and employees' security are relatively low, and unions play an important role in the labour market. It is a model that is characterized by a high share of social protection expenditure, stiff employment protection legislation and a high level of early retirement.

Labour market analysis requires knowledge of the economic and social background, as well as the macroeconomic outcomes that the economy has because there is a close connection between these factors and labour market developments.

Spain's economic performance before the crisis was high, with a GDP per capita level above the EU-27 average in 2007. During this period of prosperity, labour market greatly expanded, absorbing an impressive number of new workers, particularly women and immigrants. Economic growth was mainly determined by construction and tourism sectors, as well as by the strong growth in consumption. For example, 25% of the newly created jobs were created in the construction sector in the period 1998-2007. Spain's vulnerabilities to the crisis that started after 2007 were determined by the high external debt and the level of household indebtedness, by the relatively low labour productivity and by the fact that the economy depended mainly on small enterprises (Eurofound, 2010).

Before the crisis, Spain had one of the lowest public debts in the Euro area and budget surplus. Extending credit, especially to the construction

business (The Bank of Spain announced that 60% of loans were for construction), made the recovery of loans granted by banks become an issue. Therefore, the banks are facing financial problems and Spain's economy has suffered due to reduced economic activity, increased public debt and imbalances in the labour market. In addition to the construction sector, other sectors in Spain have also experienced a decline, namely automotive industry and even tourism, affected by a lower European living standard.

One of the features of the Spanish labour market is related to the experience of immigration in recent years. Among the OECD member countries, only the US exceeds it in absolute terms from this point of view, also being among the first OECD countries with the highest percentage of foreign-born labour force, after Luxembourg and Switzerland (in 2008). The vast majority of immigrants come mainly from the developing countries (around 90%), mainly from Latin America (53.3%) and Eastern Europe (26.7%) and the average age is around 31 years old. Most immigrants completed high school (45.4%) and were interested in working under temporary contract of employment (70,8%) (Simon, Ramos, Sanroma, 2011).

This high level of immigration in Spain is explained by the fact that Spain, like other European countries, is facing population decline and immigration replaces this natural decrease, so that the population does not suffer dramatic changes.

Before the current financial and economic crisis, in order to avoid the natural decrease of population, some countries encouraged immigration, using as reservoir the labour force from the Eastern European countries, including Romania. After the crisis started the countries' reactions to immigration usually manifested by a desire to reduce immigration, especially temporary immigration to reduce unemployment among their own people. These migratory movements generate effects both in the country of origin and in the country of destination. These effects are manifested economically, socially, demographically, affecting quality of life and economic growth (Roman, Voicu, 2010).

For destination countries, the flow of foreign labour is beneficial in supporting economic activities that cannot be covered by domestic labour market, either because there is a shortage of skilled workers in these areas or due to a lack of interest in these industries (Pociovălișteanu, 2012).

Regarding the Romanians left to work abroad, most went to Spain and Italy, especially for unskilled work. The current crisis has reduced the number of people who go to work abroad due to the problems caused by the low volume of economic activities, especially in construction.

The openness of the Spanish labour market before the crisis, the structural characteristics of the economy and labour market policies have led to significant increases in unemployment in this country.

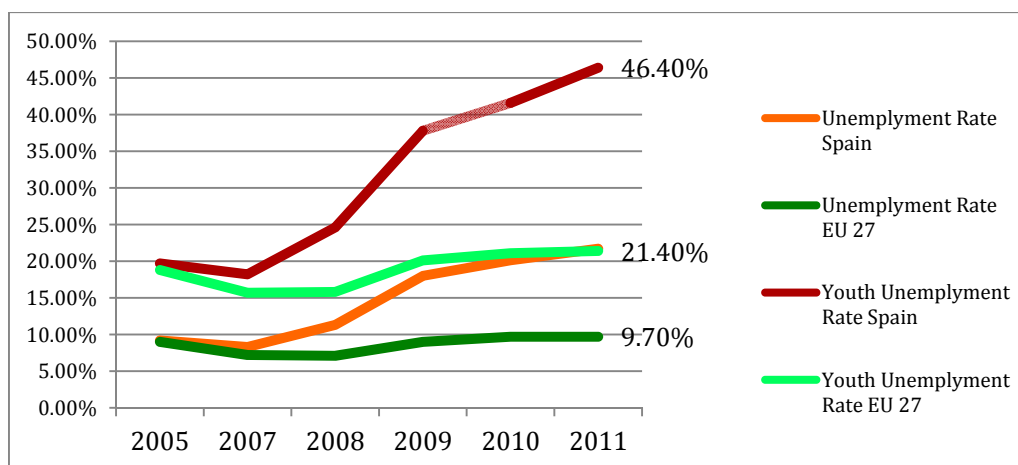
The unemployment rate in Spain has currently reached the highest level in the European Union. Increases in unemployment rate show a worsening economic situation despite all measures taken to return to a level of acceptable employment.

At the end of October 2012, the data in *The Economically Active Population Survey*, conducted quarterly by *The Spanish National Institute of Statistics*, showed that Spain saw a new record in the number of unemployed: 5,778,100 people, and the unemployment rate reached 25.02%, according to the same data.

Eurozone crisis has seriously affected the Spanish economy, manifesting itself in particular by rising unemployment and low budget revenues. The measures taken to reduce the budget deficit, especially government expenditure, have deepened the social crisis, with negative effects especially for those with low income.

In Spain, all age groups have been affected by unemployment, especially youth and women, and those with low educational level (Casado, Fernández, Jimeno, 2012).

The chart below captures the difference recorded in Spain, compared to the EU average in terms of evolution of unemployment and youth unemployment. It is noted that the unemployment rate in Spain recorded an upward trend after 2007. Youth unemployment rate was higher, exceeding by 2.16 times the youth unemployment rate registered in the European Union. In 2011, Spain's unemployment rate reached 21.7%, and youth unemployment rate was 46.4% (Eurostat, 2012).



Source: Eurostat, 2012, <http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/>

Figure 1. Unemployment Rate & Youth Unemployment Rate-less than 25 years % (Spain and EU-27)

Rising youth unemployment at EU level is explained in the literature as a result of a weak correlation between workforce training and labour market requirements. If we look at the educational situation in Spain in 2011, we notice that Spain is on first places in European rankings (Eurostat) in terms of people who drop out of school early (26.5% in Spain compared to the EU-27 average of 13.5%) and people who completed only primary education (46.2% in Spain compared to 26.6% EU-27 average). This may explain the increase in youth unemployment in Spain, because young people are not trained enough, therefore they cannot adapt to labour market requirements (Eurostat, 2012).

In order to overcome these problems, John Edmunds, Professor of Business at Babson College in Wesley, Massachusetts, considers that Spain needs to improve its tax base and invest in workforce education.

3. The causes of unemployment in Spain

The causes of these imbalances in the labour market in Spain are determined by several factors, such as the measures and the policies adopted to overcome the effects of the crisis, the structural characteristics of the labour market in Spain, employment legislation and the results achieved at macroeconomic level.

Spain, Greece and Portugal have followed the following steps to reduce the effects of the crisis: wage cuts, public social spending cuts, privatization of certain public transfers (pension system) or public services (health care). The most affected people are those with low incomes and especially those who have to pay back loans.

Professor Vicente Navarro (2012) considers that the main causes of the current crisis in Spain are related to the way in which Spain joined the Euro area. In order to reduce the public deficit according to the requirements imposed by the Stability Pact, special measures were taken to reduce public spending (especially social spending) rather than measures to increase taxes, which led to an increase in social spending deficit. On the other hand, during the housing bubble before the crisis, which led to rapid economic growth, measures aimed at reducing taxes were adopted (especially corporate taxes). Therefore, when the crisis started, the effect of these measures was also felt, amid economic downturn. Thus, the measures adopted focused mainly on public spending cuts (pensions, health and education spending and wages were reduced), as well as corporate tax cuts. Cuts in public spending and wages also reduced demand directly affecting the economic activity.

Vicente Cunat (2012) considers that the main problems facing the labour market in Spain related to job market duality, wage rigidity and conditions to conclude labour market contracts.

Job market duality refers to the relation between permanent and temporary contracts. Approximately 60% of employees have permanent employment contracts. This means that there are legal restrictions to being fired, high severance pay and a safe work environment.

The remaining 40% work under fixed term, often short-lived, *temporary* contracts, with no severance pay or other benefits. Firms prefer to hire workers on temporary contracts, especially young and low-skilled people. Amid the current crisis, this measure somehow has helped companies reduce their costs, especially because they have not invested in continuous training, being interested only in reducing labour costs and hiring/dismissal flexibility.

Thus, this job market duality affects social welfare, leading to increased volatility of the labour market, which complicates the implementation of macroeconomic stabilization policies affecting labour productivity by the fact that the people employed on short-term contracts did not benefit from training and specialization (Costain, Jimeno, Thomas, 2010).

Given the current economic climate, amid rising unemployment, one can say that most of those who work on temporary contracts have had to accept this situation, sometimes without taking into account their level of skills or their needs. On the other hand, temporary employment may reduce incentives so that employers provide training and development opportunities to employees because believing that they do not stay in the same company for a long time (Şerban, 2012).

Wage setting is also an important issue. It is based on negotiations between unions and employers. Collective bargaining covers a wide range of issues, from wage determination to establishing working time and training. Nevertheless, these negotiations are not satisfactory for all firms in a particular sector, because some firms would be willing to pay more to attract well-trained people, while other companies may seek salary cuts and freezes. Thus, a single negotiation must match both types of firms. Therefore, there are viewpoints (Ramos, 2011) that claim that wage setting must be less centralized and should depend on market supply and demand, on economic conditions. Salary may also be influenced by internal labour migration, which is very low in Spain. This is explained by the tradition and culture of the Spaniards who are attached to their family and the place where they live and do not easily accept the change of address, even for a better salary.

The minimum wage was introduced in Spain in 1963 and is set annually by the government, after consulting the social partners, taking into account the consumer price index, the average national productivity, the labour share in national income and the economic situation. The minimum wage applies to a number of 40 hours worked per week, and if the number of hours worked is less than 40, the minimum wage is reduced proportionately. In 2012, the minimum monthly wage in Spain is 748.3 Euros. The highest monthly minimum wage is paid in Luxembourg, reaching a value of 1,800 Euros, and the lowest is in

Bulgaria (138 Euros) and Romania (161 Euros) (Eurostat, Monthly minimum wages – country-specific information, 2012).

The legal working time in Spain is 40 hours per week, close to the EU-27 average. In the last decade, people have sought to reduce working time in Europe in order to achieve a better balance between work and family life.

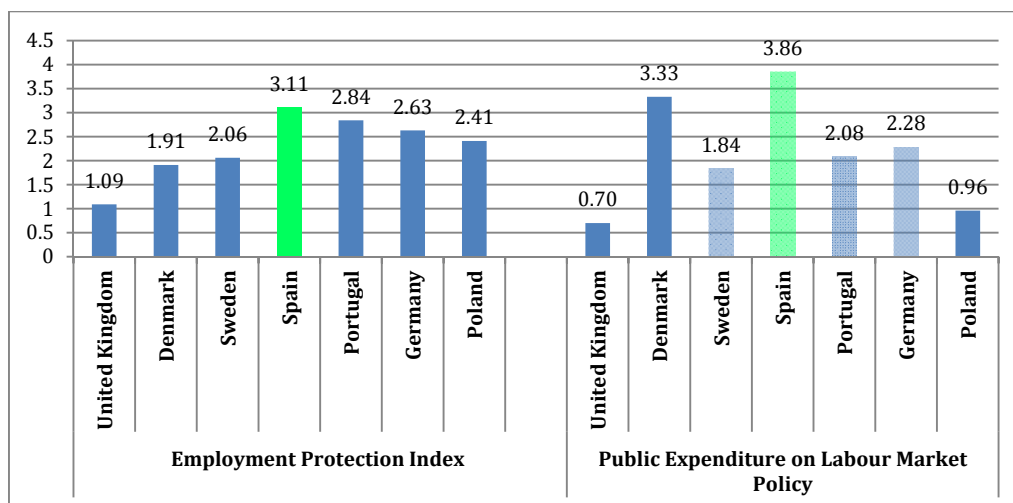
In Spain, employers' organizations and trade unions are not only involved in collective bargaining; they play a key role in social dialogue, having a great ability to influence economic and social policies.

In Spain, hiring and firing are administratively costly and complex because there are many legal forms of employment contracts, each with its own specific rules. There are also numerous lawsuits, which involve additional economic costs.

Labour market reform in Spain intends among other things to reduce employment protection for permanent contracts, as it is the case in most EU countries. This measure could reduce the gap between the two types of contracts (permanent and temporary). However, according to some economists it would not solve the duality problem (Cunat, 2012).

4. Spain's position in the major employment patterns

Analysing the main indicators underlying the employment patterns namely employment protection, generosity of unemployment benefits, expenditure on labour market policies, especially on active policies and tax burden, we can see Spain's position in relation to the other Mediterranean and European countries.



Source: OECD, 2010 www.oecd.org/employment/employmentpoliciesanddata/42768860.xls & Public expenditure and participant stocks on LMP (Labour Market Policy), 2010, <http://stats.oecd.org/Index.aspx?DatasetCode=LMPEXP#>

Figure 2. *Employment protection index & public expenditure on labour market policy*

The index of employment protection refers to the protection level of employment, conditions of employment and dismissal. The Mediterranean employment pattern records the highest level of this indicator and the Anglo Saxon and Nordic one the lowest. Among the countries surveyed, the highest value of this indicator is registered by Spain (3. 11). The higher the employment protection index is, the less flexible the regulations on employment are. Thus, according to the data from the figure above, the United Kingdom, Denmark and Sweden register high flexibility in terms of occupational regulation, and Spain registers the lowest flexibility from this point of view.

Regarding public expenditure on labour market policies in recent years, these expenses have increased to support the labour market affected by the crisis. However, some countries have increased expenditures especially on active policies while others have focused on passive policies. Spain is among the countries with the highest values of this indicator; however, with regard to Spain passive measures occupy the highest share in these expenses. The Nordic countries have paid special attention to the active measures, while the Mediterranean countries have considerably increased the costs of passive policies. This may be the result of increasing the number of persons assisted (unemployed), while reducing the volume of economic activity.

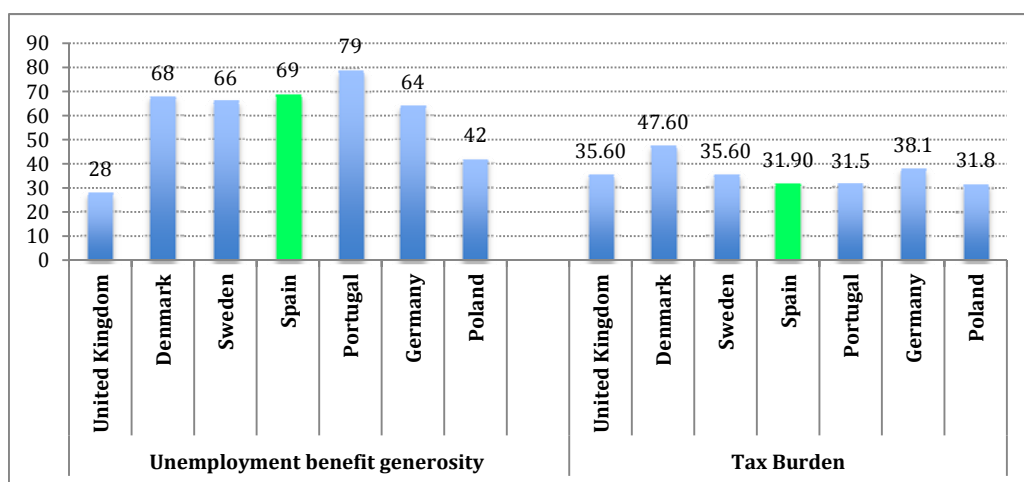
Even though the share of passive expenditure on labour market is high in Spain, there is also a high level of unemployment. The generosity of unemployment benefits, which refers to both the size of unemployment benefits and the granting period, is the highest in Portugal, Spain, Denmark, Norway and the Netherlands.

The duration of unemployment benefit is the highest in Belgium (unlimited time) and Denmark (48 months). In most countries, a social assistance programme follows unemployment benefit.

Spain has a very generous unemployment protection system. In Spain, those who lose their jobs receive 75-80% of the final salary for a period of two years, as *redundancy pay*. After those two years, the unemployed people receive *unemployment benefit* of 600 Euros per month for another nine months. Moreover, those who have not reached the minimum contribution period to have right to unemployment benefit (360 days in the last six years) may apply for *additional unemployment benefits*. Spain's government also extended the life of a 400-Euro monthly payment for jobless people whose unemployment benefits come to an end. There are also other benefits granted such as the active insertion income of 426 Euros per month for long-term unemployed. All these aids are costly for the Spanish economy, especially because some people have chosen to become unemployed or remain unemployed, under crisis, a fact that has reduced the economic activities. These high and long-term aids do not make the unemployed seek work. On the other hand, Spain's economic decline and rising debt in recent years have put pressure on unemployment and increased labour market problems.

The much too generous social protection system definitely needs to be reformed to take into account economic performance, labour productivity and tax level. However, this reform cannot be achieved during the current crisis that is already causing numerous complaints and strikes.

Spain is also facing problems with the banking system, currently pursuing the recapitalization of banks in order to smooth bank loans for both the population and the entrepreneurs. Certain economists (J. Stiglitz) do not see that this measure would have a beneficial result because the Spanish government and banks continue the vicious circle of mutual support.



Source: OECD EMPLOYMENT OUTLOOK, 2010

<http://www.oecd.org/social/socialpoliciesanddata/43728718.pdf>, &

Taxation trends in the European Union, Eurostat, 2012,

http://ec.europa.eu/taxation_customs/resources/documents/taxation/gen_info/economic_analysis/tax_structures/2012/report.pdf.

Figure 3. Unemployment benefit generosity & tax burden

Tax burden considered as a percentage of GDP shows a high level of taxes especially in the Nordic employment pattern. The lowest tax burden is recorded by the Mediterranean countries. On the one hand, there is a link between the possibility to support labour market policies and the share of taxes as a percentage of GDP, meaning that a high level of taxes increases the support for these policies. This correlation is clearly visible, especially for the Nordic countries, which are recognized as effective in terms of effects of labour market policies, but which are characterized by high tax burden. On the other hand, taxes should not obstruct entrepreneurship and business. In most European countries, taxes have increased in recent years in order to support government expenditures during the current crisis.

Tax burden in Spain is lower than in the Nordic and the continental countries amounting to 31.9% of GDP. Nevertheless, Spain is a country with a generous social protection system, which has become increasingly unbearable, given the current crisis, the high budget deficit and the reduced volume of economic activities.

5. Conclusions

The current crisis has affected different European economies and created bigger and smaller labour market problems, depending on the characteristics of each economy, the economic situation existing before the crisis, the structural characteristics of the economy and the policies adopted to overcome the crisis.

The Spanish labour market has been severely affected by the current crisis, particularly as a result of the structural imbalances in the labour market, of the measures taken to reduce government expenditure, of wage rigidity, of job market duality, of low internal migration, of high immigration, of the much too generous social policies for the unemployed, of a sharp fall in economic activity and of low investment in education and continuous training.

Spain, like other European countries, has applied various austerity measures in order to reduce the effects of the crisis, manifested by reduced government expenditure, reduced wages, reduced public social spending and privatization of public transfers (pension system) or public services (health care).

The austerity measures implemented in Spain, but also in other European countries, are considered by some economists to be counterproductive. This idea is also supported by the economist Joseph Stiglitz, Nobel Laureate, who considers that the excessive austerity “will mean the suicide of the Euro area”. He agrees with budget cuts, but to the extent that they are supported by economic recovery measures. “The measures taken by the EU so far are minimal and in the wrong direction because the austerity measures aimed at risk reduction affect economic growth and increase debt” (J. Stiglitz, *Revista Business* 24, 2012). For the specific case of Spain, the American economist believes that external funding could allow the development of new industries that would compensate for the gap left by the real estate bubble.

Consequently, future employment policy and labour market reforms to combat unemployment and its persistence must take into account the characteristics and features of each economy. However, the experience of countries that have had success in overcoming the crisis can be used by the countries seriously affected by the crisis, even if a particular employment pattern cannot be fully incorporated.

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Liberalisation and regulation in the financial crisis – is behavioural economics a solution?

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Abstract. *The causes of economic crisis are a subject of intense debate, most opinions of economists ranging from the liberalization of the market to its regulation. We believe that usually there is “sufficient state” and that a change in its level does not have the expected effects. Although on the long term the reduction of the state presence would be preferable, on the medium and short term this would have negative effects, such as the reduction of the number of employees. One solution would be abandoning the simplistic neoclassical economic models, and replacing them with models developed in behavioural economics that would allow state and companies to develop more effective strategies.*

Keywords: financial crisis; liberalization; government intervention; behavioural economics; homo oeconomicus.

JEL Codes: D03, G01, K20.

REL Codes: 5K, 17E.

1. Introduction

The economy, like the rest of the social sciences, is concerned with the study of the most spectacular and unstable element: the human being! The particularities and uniqueness of the subject does not allow the creation of a valid general theory. The diversity of human beings makes the analysis even more difficult because unlike the exact sciences we cannot make observations in the laboratory. This is why there are difficulties in explaining real situations using various economic theories.

This article aims to constitute a brief insight into the structure of the complex phenomena of financial crises. The paper also seeks to understand if feasible solutions can be found both on traditional neoclassical branch, and the new branch of thought in economics, namely behavioural economics.

2. Approaches on the fundamentals of the current crisis and potential solutions

In principle, regarding the financial crisis of recent years, in the scientific world there are two major views (Braun, Rallo, 2011):

- Of the economists who believe the crisis is caused by excessive government regulations. Whether we speak of the libertarians or the liberals, the view is the same: the excess of state stifles free market and hence entrepreneurs' initiatives. This is because:
 - The excess of regulations hampers the initiatives of entrepreneurs;
 - Public companies (of the so-called public interest) that disrupt the distribution of resources (problem compounded in the case of scarce resources) and prevent "optimal development"⁽¹⁾ of the market supply are protected by the state.

The solution proposed by the proponents of this idea is to limit the state and increase market freedom.

- The economists who believe that the insufficient public intervention is precisely the causes of the crisis. Thus, economists from neo-Marxist and Keynesian schools of thought believe that the crisis is another proof, to those of the past⁽²⁾ that the economy cannot function without state intervention. Guilty, in their opinion, is the free market and the solution to this problem is to increase the role of the State, by implementing expensive programs designed to create artificial demand in the market. Interestingly, in most cases when this solution fails they don't seek an alternative but to increase public spending.

Discussions regarding this dispute seem to have no purpose and as written literature for and against these views are generous enough not to dwell on these issues, we will focus below on our issues of interest.

The fact that none of the visions did succeed to impose itself as irrefutable dogma encourages us to bring into question as a direction and possible solution to these shortcomings, behavioural economics. We believe especially that it can be a viable solution in the elaboration of strategies for both private firms and government.

Our conviction is based on the belief that the statist and the liberal vision are wrong by attitude to individuals. This is, for most theorists, followers of one of the two directions, a standard unit, deprived, largely, of the characteristics that distinguish it from the masses.

An interesting example for the analysis of relations between the two directions and behavioural economics is precisely the role of individuals in the economic crisis (Murphy, 2008, pp. 2-3). It was established that bubbles caused by toxic products in the financial market led to the crisis of recent years and that, in general, representatives of the two visions have accepted this and focussed their discourse on one major direction, as follows:

- Interventionists considered that the world states must direct their efforts to save the financial institutions that are too big to fail. For this purpose they appealed to financial programs of hundreds of billions of dollars, without taking into account the effects that could generate inflationary pressures on the economy. And without a serious concern about the fact that, in this case, those who end up bearing the costs are individuals;
- On the other hand, most followers of liberalism have relied on the fact that these institutions are unhealthy results of State intervention and that their failure would be preferable because it would allow a faster healing the economy and it would not affect individuals in the same extent.

Cases where individuals have benefited from aid for survival the crisis period are very rare. Why chose helping financial giants at the expense of individuals, while the latter policies were those that generated the power crisis? Any answer is elusive. Products of these institutions made the individuals negligent and to borrow amounts of money that they could not allow returning. Somehow the individual was the victim of the system created by the state and the financial institutions.

Although individuals were most affected by the crisis, government efforts were directed towards rescuing all those who manipulate the market, leaving individuals to pay for it, because the great rescue programs are paid for by

increases in taxes, depreciation of currencies national and so on, resulting in a spiral that does nothing but affect actual purchasing power of individuals.

Publicized rescue programs of national economies did not have the desired effect. Saving companies “too big to fail” was not sufficient to cause individuals to act on the market. Saving banks and budgetary limitations affected the income of individuals in such an extent that they significantly changed their behaviour, assuming far less risk (Scherer, 2010). In part this behaviour is explained by the decrease in purchasing power and the realization that they cannot forecast future income trends.

Concerned with salvation and hastening the bankruptcy of financial institutions, followers of the two visions have omitted a major factor of the crisis: the individual. Interestingly, although financial institutions were those that offered individuals unhealthy financial instruments that allowed them to live in an unsustainable manner (Crotty, 2008), they cannot be considered absolute guilty because they have not used force to sell their toxic products.

3. Homo oeconomicus in search of satisfaction

We believe that the economy should be concerned to explain widespread non-economic behaviour of the period before the crisis, to explain why individuals have indulged in behaviours that are not within the rules of *homo oeconomicus*, why they were suitable actions that are not economically rational.

If individuals acted reasonably (not even perfectly rational) they might have sought to restrict the loans and would have avoided to increase the amounts borrowed at a level that would have allowed him to support. Reality is different because many risk their safety to get instant gratification. However, in the acceptance of von Mises (2002 [1966]) the individual is rational because it acts in order to satisfy their needs.

From the perspective of behavioural economics we can accept the idea of a rational individual if we reformulate it and accept that the *homo oeconomicus* of neoclassical taught, when seeking to maximize utility, does not seek to achieve the highest possible monetary⁽³⁾ compensation at the end of the day, but the highest satisfaction possible (Etzioni, 2011). It is therefore natural to see individuals who give up successful careers to activities that make them happy.

In principle we can accept that individuals are rational in the short-term but this is not always valid for a longer period. Even if people choose, at present, the actions that bring them maximum satisfaction (for example, to enjoy a home involving a 30-year mortgage) their effects can reduce future satisfaction (mortgage payment after the loss of employment). This happens because individuals have a limited ability to forecast (Camerer, 2005, pp. 8-10), and they cannot really predict how many years they will work, how will evolve their

revenue, when will they retire or lose their job or when will they die. Often, this limited capacity of forecasting makes them act irrationally on a long-term and commit to loans to enable them achieving major satisfactions in the shortest time possible. So their behavior is not based on a realistic forecast but one idealistic.

Even though it may seem extreme, our belief is that individuals who acted without taking into account the real financial power are guilty, along with financial institutions. But unlike the latter they deserve another chance because after all they are “too small to fail”. Knocking out on the basis of economy, individuals who dictate the market proved to be aggravating the crisis. Thus, all forecasts, to date, on the global economic recovery were denied because individuals simply do not have enough purchasing power.

Both liberalism and interventionism in economic models are based on some abstract individuals: selfish and perfectly rational, on the one hand, and free of any trace of selfishness, always ready to sacrifice for the welfare of society, on the other. In fact, the real individual is captured better the vision behavioural economics, where he is a complex person, with actions that are reflected in failures, and behaviour incomprehensible to the economy (Berg, 2010, pp. 861-863). It is true that this complex individual hampers economic development models, but its use would allow a real reduction of the revealed lacks of these models.

Does behavioural economics allow us to determine individuals to stop risky loans? Certainly not, for all that can be done is to facilitate the identification of certain patterns of behaviour that allow a better explanation of economic problems and finding more appropriate solutions.

Conclusions

Behavioural economics is not a miracle solution that has the ability to replace Keynesian or liberalism, but its use can improve the theories and models of both schools of thought. Rethinking theories and strategies in accordance with the essential features of individuals allows a major change of vision. Now, the discussion has shifted decisively from somewhat dry concepts of state and market to the one of individual.

It should be noted, however, that the Liberals, with eternal homo oeconomicus, are those who were closest to the individual vision Behavioural School. Later von Mises was able to provide a much more realistic picture of the economic individual acting not to obtain financial compensation but to increase its satisfaction, whether it is expressed or not monetary.

In the long-term behavioural economics is a solution to contemporary economic problems. It is characterized by the concern for the individual and for his role in gearing the economy. A model of economic integration, of the real individual, would increase the realistically part of this science.

Notes

- (1) By optimal development we mean the maximum demand that could be achieved in the absence of government intervention in a market.
- (2) In principle, most crises from the imposition of liberalism until today have been attributed to the excess of freedom.
- (3) A perfectly rational homo economicus would always be informed and able to choose the optimal route actions to assure the highest possible monetary benefits.

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