

# Lending, economic growth and nonperforming loans: empirical evidences from the new EU member states

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## Abstract<sup>1</sup>

*The study aims to investigate the interaction between credit to private sector and GDP growth in the new EU member states. The analytical framework is based on the financial accelerator theory with feedback effects from the banking book quality, while the empirical component consists of a set of simplified econometric models, built applying panel data regressions using annual data. The central variable is the change in private sector credit flow in percent of GDP, as provisioned in the European Commission's macroeconomic imbalance procedure. Empirical results show that the swings in credit impulse induced by loose income policy, unfavorable sovereign risk development and euro-zone recession fuel a "W"-shaped dynamic of economic growth in CEE countries. Moreover, econometric findings show that both the persistence of a credit flow weaker than potential growth and excessive financing are associated with high levels of non-performing loans ratio two years later. Moreover, the negative feedback effect deepens recession through the credit supply channel, its elasticity to NPL evolution being slightly greater than one. Macro-prudential policy becomes a major component of economic policy mix in NMS, as containing the volatility of economic activity depends, in a decisive way, on the success of maintaining credit accelerator at around zero, while ensuring a credit flow closely related to potential growth. Nevertheless, the fulfillment of these prudential objectives is conditional on other macroeconomic policies coherence so as to avoid triggering shocks, such as (i) jumps in the sovereign risk premium driven by pro-cyclical developments of the fiscal impulse, and (ii) over-feeding the supply-demand spiral on the credit market amid pro-cyclical income policy, given their undesirable impact on some parameters of the credit – economic growth binomial.*

**Keywords:** credit accelerator, economic growth, non-performing loans, sovereign risk, pro-cyclicality

**JEL Classification:** G01, G17, G21, G32, G33

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## 1. INTRODUCTION

The rapid expansion of bank intermediation in emerging Europe countries, generally regarded as a sign of catching-up with the Old Europe, captured, just a few years before the global financial crisis, a special attention from both investors, and policymakers alike (**Sirtaine and Skamnelor, 2007**). Region's central banks research reports did not avoid the subject, putting in the spotlight the dilemma that concern everyone: are we dealing with financial deepening or unsustainable credit growth? In the absence of other stabilizers, as fiscal and income policy stance were pro-cyclical, cautious attitude of central banks and financial supervisory authorities in the CEE countries to the potential vulnerability was highlighted by supplementing the limited space for maneuver for monetary policy with the adoption of a range of prudential, sometimes unorthodox, measures (**Isarescu, 2007**). Although produced noticeable effects in the short term, measures have lost effectiveness over time (**ECB, 2010, Georgescu, 2010**), especially in the context of financial integration in the EU and persistently strong demand for loans.

Traditional models of business cycle developments are neutral to the developments in credit market, being based on **Modigliani-Miller** theory (1958), that financial markets are efficient, and information asymmetry is not present. Recent literature provides, however, important clues to the bidirectional nature of the relationship between credit and GDP growth.

The credit flow increases aggregate demand. Then, this is reflected in the formation of value added in the economy, amid a positive, but below par elasticity, of GDP to the lending dynamics. However, the financial crises of the past thirty years provide evidence that credit rationalization can have an adverse impact on the real economy. **Bernanke** (1993) and **Friedman and Kuttner** (1993) have found evidence which shows that the downturn in the U.S. in early 1990 was exacerbated by restricting the credit supply, while subsequent studies have included financial sector block as an explanatory function of business cycle dynamics. **Bernanke, Gertler and Gilchrist** (1999) developed a dynamic general equilibrium model that includes credit market frictions in explaining the evolution of the business cycle. The central element is the **financial accelerator**, the employed framework assuming that the financial system is not an independent source of volatility, but acts as an amplifier of exogenous shocks. This concept reflects the role of financial markets in magnification and spreading of macroeconomic shocks.

Not every supplement of economic growth is positive for the long-term welfare of society, especially when it is obtained through increasing indebtedness. Sustainable welfare is not created by excessive debt. The desire to rapidly advance in increasing living standards by resorting to bank loans proved to be also part of the ingredients of the unsustainable growth for a significant number of CEE countries. GDP growth above its potential, determined by the volume and quality of the production factors of a country, is the clear signal of overheated economy, which may amplify the country's vulnerability to external shocks.

Beneficiaries of bank financing, mostly individuals, have boosted domestic consumption above internal production capacity and prices have followed an upward trend masked by a pseudo convergence process, not only for consumer goods and services or real estate assets, but mostly for labor costs. Reducing the propensity of savings decreases the ability to finance investment using domestic resources. We are all aware that the pattern of growth of CEE was induced by the targets in the economic integration in the European Union, where foreign financing was the main ingredient. However, excessive dependence on external financing may be risky, given a sudden change in the foreign creditors risk perception regarding developments in economic fundamentals.

Even if the credit boom does not cause bank failures that endanger financial stability, the real economy can enter a hard landing process. When the shock wave hits the economy, adjustments for firms and households are painful and disordered, potentially creating vicious spiral and financial bottlenecks that can affect even the most robust business. With growing financial costs for companies and households, both consumption and appetite for investment are reduced, causing a major setback for added value to the economy and employment. A good example is the reverberations of transatlantic financial crisis on emerging economies in CEE. Although CEE countries have managed to maintain financial stability, some of them being bailout by the European Commission, the IMF and World Bank and being forced to conduct reforms and painful economic adjustments especially in the households sector, the vast majority were not able to avoid the economic crisis that had spread throughout the EU in 2008-2009.

GDP level exceeded by the amount of credit to the private sector seems to be an impediment to economic development (**Cecchetti and Kharroubi**, 2012), the negative consequences surpassing the favorable impact. This empirical observation is supported by results presented by **Charles R. Morris** (2012) on macroeconomic imbalances associated with developments where banking intermediation level reached 90-100 percent. Example is the Asian crisis of 1997-1998 (Thailand, New Zealand), and also the developments in some EU countries in the current period.

Whenever economic activity slows down due to exogenous shocks, such as the recession of the key external partner, the income of companies and households decline, while reducing their ability to meet obligations to credit institutions. Thus, banks willingness to lend diminishes, reducing the credit supply. **Bayoumi and Melander** (2008) explain the macroeconomic effects of financial system adjustment through bank solvency channel. Deterioration of loan portfolio quality on contraction of economic activity and households' income increases the capital requirements and erode credit institutions' own funds, compressing capital adequacy ratio. Under threat of recapitalization, bank loans supply is adjusted by strengthening credit standards. But a lower credit flow in the economy affect consumption and investment, which then causes changes in production through a multiplier effects. Feedback effect from the real economy to credit markets will further worsen the quality of bank portfolios, prolonging the persistence of macroeconomic shocks. **Cihák and Brooks** (2009) find that credit supply responds negatively to decreases in the strength of banks in the euro zone and the adjustment of bank financing has a

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negative impact on economic activity. Therefore, a new cycle of vicious spiral of credit contraction - economic recession is generated both financial risk cycle and economic cycle widening.

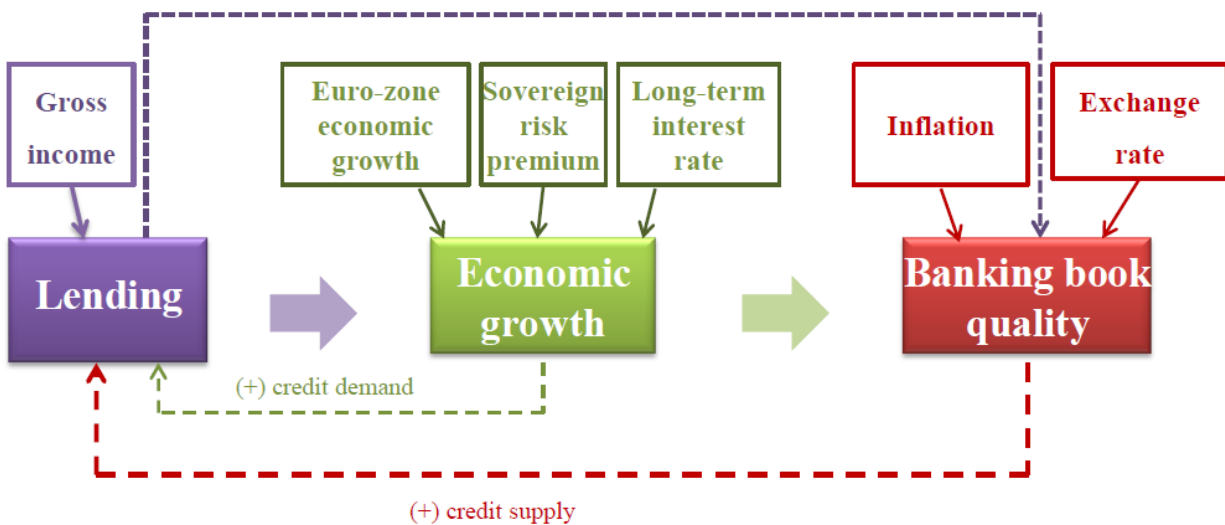
In this context, the aim of this study is to deepen the mechanism of interaction between private sector credit and GDP growth in the new EU member states in terms of the consequences that exogenous shocks can have on the quality of bank portfolios. The operational objective of the analysis is to build a set of simplified econometric models to explain the links between bank financing, growth and dynamics of non-performing loans. The central variable is the change in *private sector credit flow in percent of GDP*, as provisioned in the European Commission's macroeconomic imbalance procedure.

Research is divided into five sections, the final part being reserved for key findings and future directions of study. The first part describes the methodology underlying the study of relationships that form the credit-economic growth-banking book quality trinomial. Moreover, it presents the mechanism for assessing the consequences of shocks applied to risk factors of credit and economic growth on nonperforming loans. The second part is devoted to presenting the data used and the results of preliminary empirical analysis of bi-variate relations between the dependent variables. Third part details the main empirical findings of multivariate models, the structure of the three explanatory equations and the intensity of their reaction to shocks of key factors such as economic growth in the euro-zone or strong increases in revenue in the economy, caused by pro-cyclical policies. Fourth part presents the response of loan-growth binomial to exogenous risk factors, caused by pro-cyclical economic policies such as income and fiscal-budgetary ones.

## 2. METHODOLOGICAL FRAMEWORK

Recent transatlantic financial crisis experience suggests that the state of the banking sector and developments in real economy are strongly interconnected. Analytical framework to investigate the impact of banking system exogenous shocks on the evolution of the bank portfolio quality for EC countries via effects on the credit accelerator (Bernanke et al., 1996, Bernanke, 2007) involves studying the mutual relationship between credit growth, economic growth and bank lending performance (figure 1).

Figure 1: General framework



The first component of the credit accelerator mechanism concerns the interaction between credit and economic dynamics. On the one hand, increase of credit flow (*Credit Accelerator*) feeds consumption and investment, creating space for multiplying ( $\alpha_1 > 0$ ) the value added in the economy (see equation 1).

$$Economic\ growth_t^i = \alpha_1 \times Credit\ Accelerator_t^i + \beta_1 \times GDP_t^{EZ} + \gamma_1 \times LTY_t^i + C_1^i \quad (1)$$

The set of determinants of the economic growth in CEE countries is complemented by the euro-area GDP growth ( $GDP^{EZ}$ ) and long-term interest rate ( $LTY$ ). On the other hand, the positive development of the economy, combined with the development of real estate market generates positive balance sheet effects and form positive expectations regarding future earnings prospects in the population and businesses, resulting in demand for new loans (equation 1b).

The second component of the credit accelerator mechanism captures causality of economic dynamics and development of credit risk in the banking system (equation 2). When the economy is in the upward phase of the cycle, loan portfolio quality is improved. The situation is reversed when the economy falls into recession and repayment capacity of borrowers' decreases. Under

these conditions, the share of non-performing credit loans increases and solvency indicator of credit institutions deteriorates. Additional pressures arise following the adjustment of revenues due to the economy and inflation increase, including in the context of implementation of fiscal consolidation measures, such as reducing the public sector wage bill and / or increasing indirect taxes.

$$d(NPL_t^i) = \alpha_2 \times (Credit\ flow_{t-2}^i - Potential\ growth_{t-2}^i)^2 + \beta_2 \times Economic\ growth_t^i + \gamma_2 \times d(S)_t^i + \delta_2 \times (INFL_t^i) + C_2^i \quad (2)$$

Moreover, the dynamic of NPLs is assumed as a function of the squared deviation of credit flow from potential growth ( $\alpha_2 > 0$ ). This macro-prudential approach is consistent with recent empirical findings reported at micro-prudential level. **Altunbas et al.** (2010) noted a U-shaped relationship between the deviation of lending growth from the mean value and bank risk, while investigating the short-term impact of monetary policy changes on bank books' quality, based on information from an unbalanced panel of more than 1,100 listed banks, licensed in 16 countries.

The third component of the credit accelerator mechanism investigates the interaction between development in loan portfolio quality and growth of bank financing. Increase in the rate of non-performing credit loans leads to increased capital requirements, putting pressure on the adjustment of commercial activity of credit institutions ( $\alpha_3 < 0$ ). Thus, the supply of credit is compressed (equation 3b).

$$Credit\ flow_t^i = \alpha_3 \times d(NPL)_t^i + \beta_3 \times Economic\ growth_t^i + \gamma_3 \times dlog(Earnings)_t^i + C_3^i \quad (3b)$$

Additional pressures arise following developments on the labor market, respectively the number of employees and average income, which, along with economic growth, form the panel of credit demand factors. At the same time, slowing credit growth at modest levels and especially into negative territory, affects existing liquidity in the economy, risking the formation of financial bottlenecks. Harmful effect of the insecurity regarding the flow of funding on reimbursement of existing loans is similar to the **inefficient allocation of bank resources** (**Jakubik and Moinescu**, 2012), given the intensification of the struggle for market share and excessive lending (equation 3a), which increases the risk of financing more not-viable projects, amid relaxing credit conditions.

Functional relationships are assumed linear, except for the non-performing loans ratio dynamic equation, in case of which both linear and the exponential models were used. This approach is eligible in terms of economic reasoning which states that the relationship between the rate of non-performing loans and economic environment may present a linear form (**Boss**, 2002; **Jakubik and Schmieder**, 2008). Individual impact of macroeconomic factors on dependent variables was estimated using the least squares method, including the assumption of fixed effects in order to capture structural differences between CEE countries.

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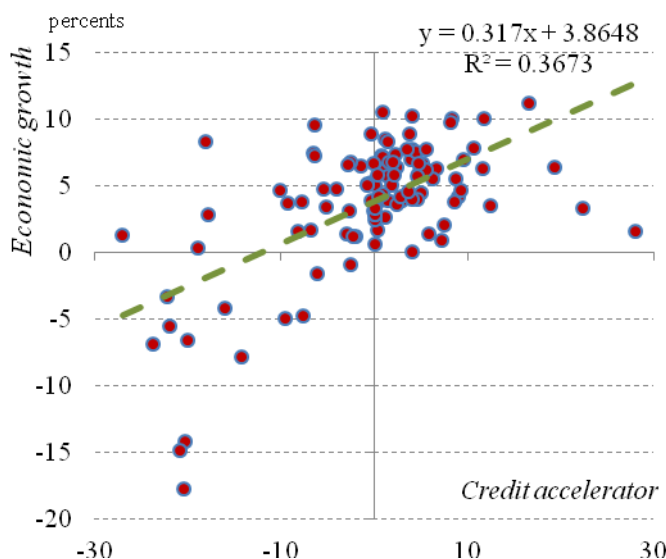
### 3. DATA

Private sector credit variable is expressed by the indicator *private sector credit flow in percent of GDP*, provisioned in the European Commission’s macroeconomic imbalance procedure. Information underlying the testing of the credit accelerator theory for the ten CEE countries, namely Bulgaria, Czech Republic, Estonia, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia and Hungary, cover data with an annual frequency, during 2000 to 2011.

The main source of information used is represented by Eurostat, where data was extracted from, concerning credit flow to private sector, economic growth, number of employees, average income in the economy, foreign direct investment, long-term interest rate, exchange rate, inflation, real estate prices in CEE and euro area GDP growth. Nonperforming loans data were extracted from the International Monetary Fund reports on financial stability indicators and sovereign risk premium was calculated based on daily information extracted from Bloomberg platform.

Preliminary empirical analysis shows that credit growth acceleration in CEE countries sustained economic growth, but the multiplier effect was below one (see Chart 1).

Chart no. 1 – Correlation between economic growth and credit accelerator

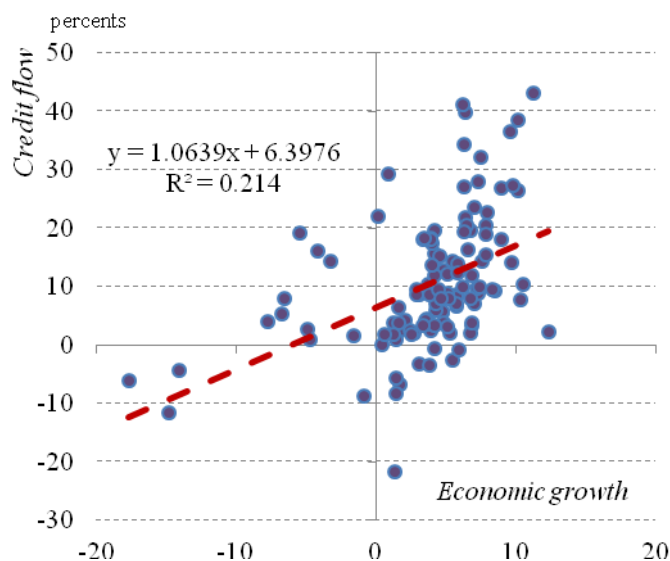


Data source: Eurostat, own calculations

Univariate assessment results show that for each additional percentage of credit flow in the economy (relative to GDP), economic activity increased by about 0.32 percent, while the nearly 37 percent of turnover growth was justified by the volatility of credit flow dynamics.

At the same time, empirical evidence from CEE countries shows that GDP growth has fueled the demand for new loans (see Chart 2).

Chart no. 2 – Correlation between credit growth and GDP growth

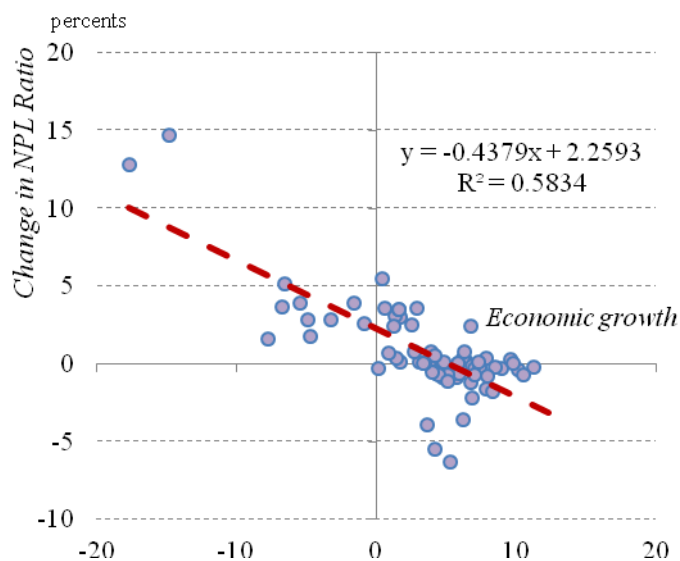


Data source: Eurostat, own calculations

Univariate tests show a slightly over-unit elasticity of lending to economic growth in the area of new EU member states in terms of explanatory power of the functional connection of more than 20 percent.

However, the contraction by 1 pp of economic growth determines credit risk increase by 0.4 percentage points in the same year (see chart 3).

Chart no. 3 – Correlation between non-performing loans dynamic and economic growth



Data source: Eurostat, own calculations

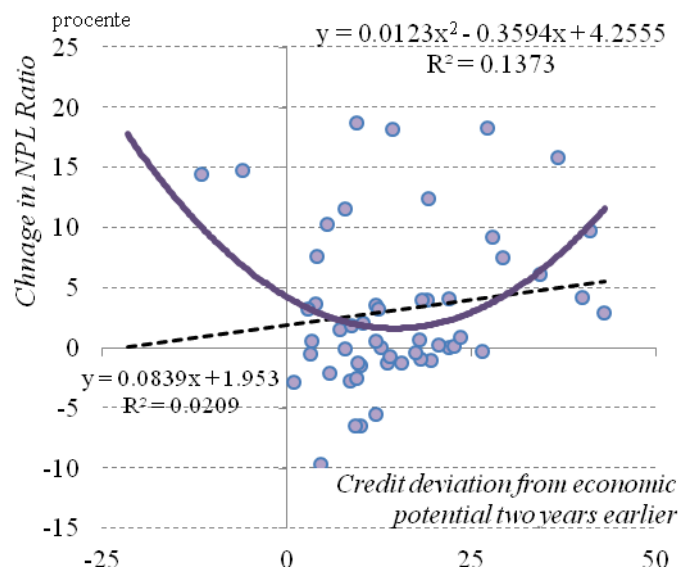
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Univariate assessment of non-performing credit loans rate dependence to economic developments indicate a strong causal linear form, both in terms of elasticity level (about -40 percent) and in the degree of determination (over 50 percent). Impact occurs within a time horizon of one year.

Additional risks to the performance of credit portfolio come from the private sector loans dynamic itself, while the large fluctuations of bank financing are associated with increases in credit risk two years later. Fundamental empirical observation in this respect is expressed by the fact that cases where private finance is poor or excessive are accompanied at two years distance by increases in the share of non-performing credit loans. Meanwhile, moderate bank funding developments, respectively the lending rates close to the economic growth potential, are beneficial in terms of cost of credit risk (see chart 4).

Chart no. 4 – Correlation between non-performing credit loans dynamics and credit deviation



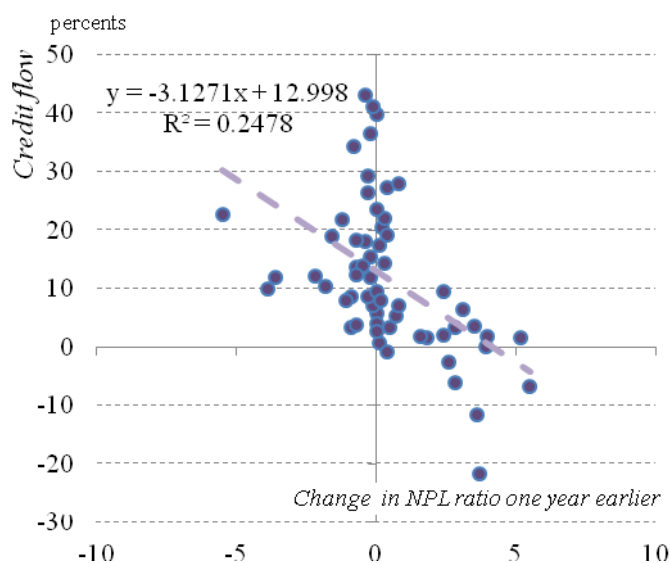
Data source: Eurostat, own calculations

Preliminary results on the empirical relationship between the loan rate deviation from the level of potential growth and credit risk dynamic at two years later clearly shows that the assumption of a quadratic functional forms could be justified to describe the interaction above.

The graphic expression presented is supported by statistics associated to the degree of determination. While for the quadratic form R-squared value is nearly 14 percent, in case of the linear relationship, the determination degree is only two percent.

At the same time, the elasticity of lending to bank portfolio quality dynamic recorded the year before is high (see chart 5).

Chart no. 5 – Correlation between credit supply and non-performing rate dynamic



Data source: Eurostat, FMI own calculations

Univariate evaluation results show that for each additional percentage of the share of non-performing loans in total loans to the private sector, credit demand is compressed by about 3 percent, while about 25 percent of the lending rate was justified by non-performing loans rate volatility.

The exogenous candidate indicators and their expected impact on the dependent variables together with the applied transformation are provided in Table 1.

Table 1. The candidate explanatory variables and the corresponding equations

	Explanatory variables	Expected sign
<b>Equation 1: Economic growth</b>		
1	Credit accelerator	+
2	Euro-zone economic growth	+
3	Foreign direct investments (log transformation)	+
4	Sovereign risk	-
5	Long-term interest rate	-
6	Number of employees (log transformation)	+
7	Inflation	-
<b>Equation 2: Change in NPL ratio</b>		
1	Squared credit deviation	+
2	GDP growth	-
3	Earnings (log transformation)	-
4	Number of employees (log transformation)	-

5	Exchange rate (log transformation)	+
6	Money market interest rate (3M)	+
7	Sovereign risk	+
8	Long-term interest rate	+
<b>Equation 3: Credit flow</b>		
1	Economic growth	+
2	Earnings (log transformation)	+
3	Number of employees (log transformation)	+
4	Change in NPLs ratio	-
5	Foreign direct investments (log transformation)	+
6	Sovereign risk	-
7	Long-term interest rate	-
8	Inflation	+

Stationarity of the considered variables was tested. All indicators were  $I(0)$  after the appropriate transformation and the first difference. Preliminary empirical analysis of interdependencies between credit growth, economic growth and bank portfolio quality was complemented by an univariate assessment of the information content of each exogenous variables considered. Candidate variables were tested individually using lags up to four years. These results are available upon request from the authors in order to save space. Following univariate filtering a short list of factors was established for the performing the multivariate analysis.

#### 4. MULTIVARIATE EMPIRICAL ANALYSIS

The operational objective of the empirical evaluation was to substantiate the credit accelerator mechanism in the Central and Eastern European countries, by taking into account the macroeconomic factors short-listed in the previous section. The analytical component consists of a set of simplified econometric models, built by panel estimates using annual data. Multivariate selection procedure of determinant factors followed the construction of a reasonable number of models, which included a high diversity as exogenous variables, in compliance with the requirements of good econometric results. Relevant macroeconomic variables were grouped in various configurations and impact intervals in explanatory functions of the lending rate growth, economic growth and dynamics of non-performing loans. Empirical evidences led to the selection of two relatively distinct specifications whose evaluations are treated by a complementary approach.

The econometric results confirm that the dynamic of economic activity responds to credit impulse, about 10 percent of the credit accelerator is transformed into economic growth (see Table 1).

Table no. 1 – Specifications for the set of explanatory models of economic growth

Explanatory variables	Model 1		Model 2	
	Coefficient	Prob.	Coefficient	Prob.
<i>Credit accelerator</i>	<b>0.121</b>	0.039	<b>0.106</b>	0.003
<i>Economic growth in euro area</i>	<b>1.159</b>	0.000	<b>1.159</b>	0.000
<i>Sovereign risk premium (CDS 5Y)</i>	<b>-1.120</b>	0.000		
<i>Long-term interest rate</i>			<b>-1.151</b>	0.000
C	3.564	0.000	8.955	0.000
Fixed effects				
BG	1.310		-0.279	
CZ	-1.561		-2.287	
EE	-0.695			
LV	0.339		1.436	
LT	0.524		1.303	
HU	-1.185		0.324	
PL	-0.037		0.948	
RO	1.749		1.518	
SL	-1.853		-2.813	
SK	1.158		-0.032	
Adjusted R-squared	0.716		0.751	

At the same time, economic growth in CEE countries reacts to the evolution of the euro area in a ratio of one to one. However, economic growth responds positively to the decrease of sovereign risk premium, for each percentage point of the compression in cost for providing long-term debt, the GDP growth is 1.12 percent. A similar result is also obtained in the case of long-term interest rate, whose dynamics is explained in a proportion of 65 per cent of evolution sovereign risk premium.

Favorable development of economic growth creates space to reduce credit risk (see Table 2).

Table no. 2 - Specifications for the set of explanatory models of non-performing credit loan rate

Explanatory variables	Model 1 ( <i>linear function</i> )		Model 2 ( <i>exponential function</i> )	
	Coefficient	Prob.	Coefficient	Prob.
<i>(Credit flow/GDP(-2)-Potential growth(-2))^2</i>	<b>0.226</b>	0.0071	<b>0.043</b>	0.0019
<i>Inflation rate</i>			<b>0.028</b>	0.0486
<i>Economic growth</i>	<b>-0.216</b>	0.0053	<b>-0.051</b>	0.0000
<i>Economic growth (-1)</i>	<b>-0.167</b>	0.0058		
<i>Sovereign risk premium change</i>	<b>0.893</b>	0.0020		
<i>Exchange rate change</i>			<b>1.318</b>	0.1105
C	<b>0.903</b>	0.0291		
Fixed effects				
BG	0.367747			
CZ	-0.222624			
EE				
LV	-1.017334			
LT	1.667043			
HU	-0.222643			
PL	-1.293736			
RO	0.556261			
SL	0.238153			
SK	0.148879			
Adjusted R-squared		0.6549		0.6170

In the same time, inflation increase affects the repayment capacity of borrowers and non-performing credit loans rate increases. A similar situation is driven by the increase in sovereign risk premium and exchange rate depreciation.

However, empirical results show that the persistence of a lower flow credit than potential growth and excessive financing are associated with high levels of non-performing loans rate two years later and the effect of this reversed reaction deepens the recession via the credit supply channel, which has an elasticity to the NPL dynamic slightly over-unitary (see table 3).

Table no. 3 - Specifications for the set of explanatory models of credit growth

Explanatory variables	Model 1		Model 2	
	Coefficient	Prob.	Coefficient	Prob.
<i>Economic growth</i>	<b>0.648</b>	0.0038	<b>0.610</b>	0.0029
<i>Non-performing loans rate change (-1)</i>	<b>-0.998</b>	0.0096	<b>-1.063</b>	0.0055
<i>Non-performing loans rate change (-2)</i>	<b>-0.859</b>	0.0338		
<i>Change in average income</i>	<b>0.663</b>	0.0002	<b>0.688</b>	0.0000
<b>C</b>	<b>5.993</b>	0.0002	<b>4.910</b>	0.0007
Fixed effects				
BG	5.232849		4.550893	
CZ	-6.893148		-7.033805	
EE	6.024496		6.850886	
LV	2.149104		1.847648	
LT	-1.719217		-2.491318	
HU	4.50033		4.734518	
PL	-5.918786		-5.382935	
RO	2.713717		1.171912	
SL	1.198754		2.111403	
SK	-7.2881		-6.3592	
Adjusted R-squared	0.65974		0.604817	

Multivariate estimation results also highlight the positive reaction in lending to positive developments in the labor market, ie average income, due to the increase in the demand for bank loans.

Macro-prudential policy becomes a major component of economic policy mix in CEE countries given that limiting volatility of economic activity and avoiding speculative bubbles in the housing market depends in a decisive way, on the success of maintaining the credit accelerator at around zero. At the same time, ensuring financial stability in CEE countries is subject to a credit flow closely related to the dynamic of potential GDP, while the non-performing credit loans react sensitively to changes in the level of intermediation. Meeting the prudential objectives which we mentioned is, however, conditional on the coherence of other macroeconomic policies so as to avoid triggering shocks, such as (a) jumps in the sovereign risk premium level driven by developments pro-cyclical fiscal impulse, or (b) over-supply of the credit market supply-demand spiral in the context of pro-cyclical income policies etc., given their undesirable impact on some determinants of the credit- economic growth binomial. This cautious behavior is more important as the elasticity of economic growth to the dynamic of euro zone is over-unitary in CEE countries, and forecasts for subsequent years are not favorable.

## 5. TESTING SENSITIVITY TO EXOGENOUS RISK FACTORS

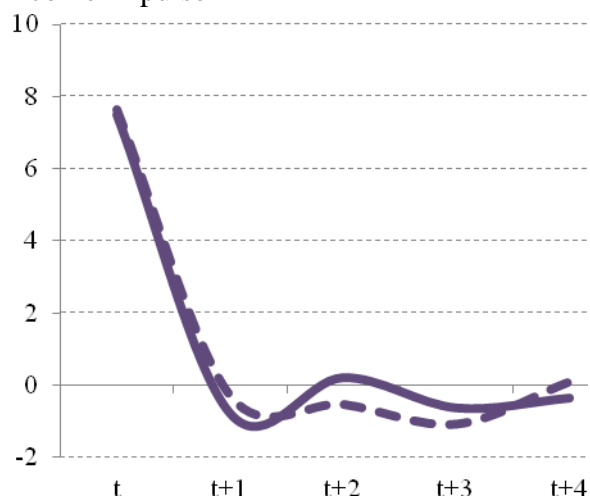
Research related to the interaction between private sector credit and GDP dynamic in the new EU Member States was performed with regard to the consequences that its exogenous shocks can have on the quality of bank portfolios, followed by feedback effects on the level of credit supply.

Testing the reaction of credit risk to credit risk factors of the credit-economic growth binomial was based on the following three scenarios: (5.1) increase by 10 percent of the net average income in the economy; (5.2) increase by 100 basis points of the sovereign risk premium, (5.3) one percentage point contraction in the level of GDP in the euro area.

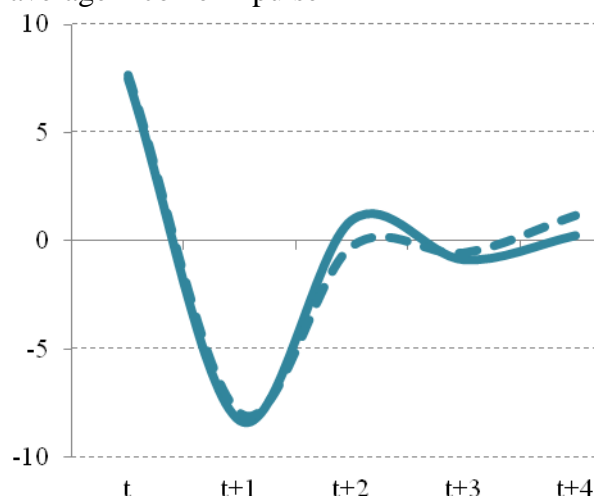
### 5.1 Consequences of an increase by 10 percent of the net average income in the economy

High sensitivity of the credit flow (see chart 6) to impulses of the average income induce strong oscillations in the credit accelerator (see chart 7).

**Chart 6** – Credit flow in terms of average income impulse

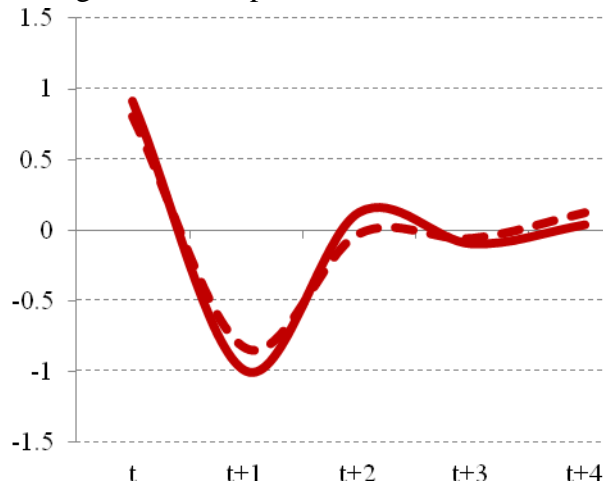


**Chart 7** – Credit accelerator in terms of average income impulse

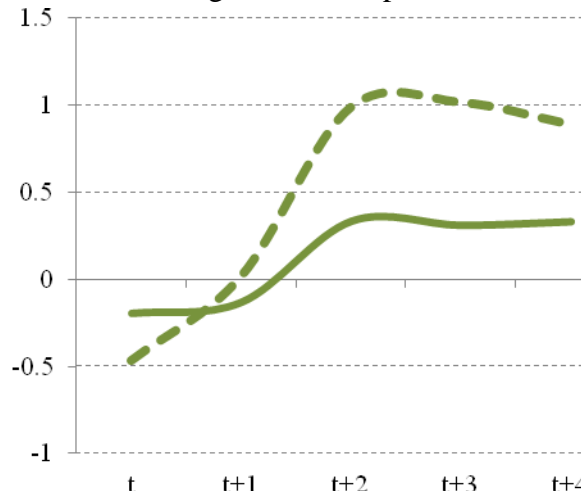


Evolution of credit impulse contributes to the amplification of economic cyclicality. Under these conditions, the advance of 0.9 percentage points in the initial period is offset by sustained correction in the following year (- 1.0 percentage points). Fluctuations of the economic growth continue over the next three years, but at significantly reduced level (see chart 8).

**Chart 8** – Economic growth in terms of average income impulse



**Chart 9** – Rate of non-performing credit loans in terms of average income impulse

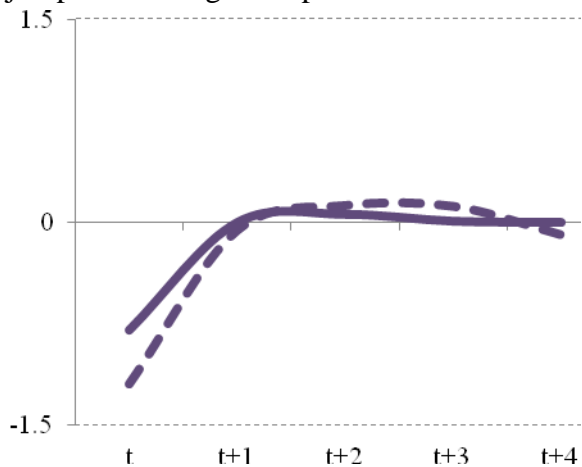


Temporary credit impulse feeds the deviation of banking finance from the potential level of economic growth, increasing the risk of inefficient allocation of resources attracted from depositors. Results of running estimated models show a jump between 0.3 and 1.0 percentage points of the non-performing loans rate to the baseline scenario, two years after the increase in average income. This upward trend contributes to economic contraction in year  $t + 1$ , whose effects propagate in year  $t + 2$ . Subsequently situation stabilizes.

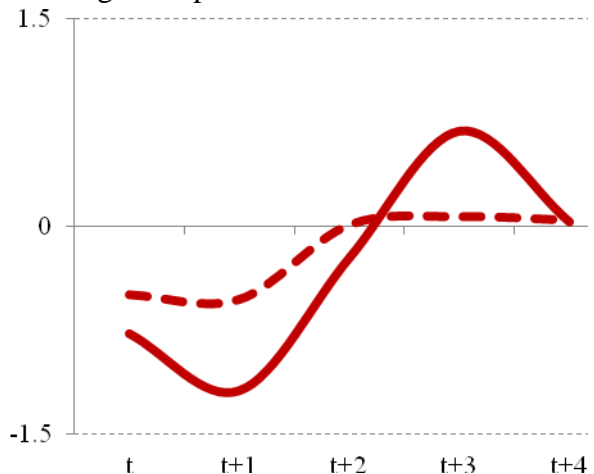
### 5.2 The impact of a permanent jump of 100 basis points in sovereign risk premium

Increase in sovereign risk premium by one percentage point instantaneously leads to compression of economic activity by values between 0.8 and 1.2 percentage points. Subsequently, economic growth returns to the baseline results (see chart 10).

**Chart 10** – Economic growth in terms of a jump in sovereign risk premium



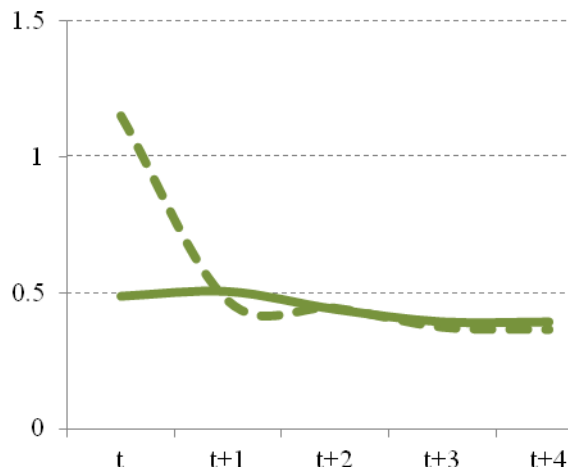
**Chart 11** – Credit flow in terms of a jump in sovereign risk premium



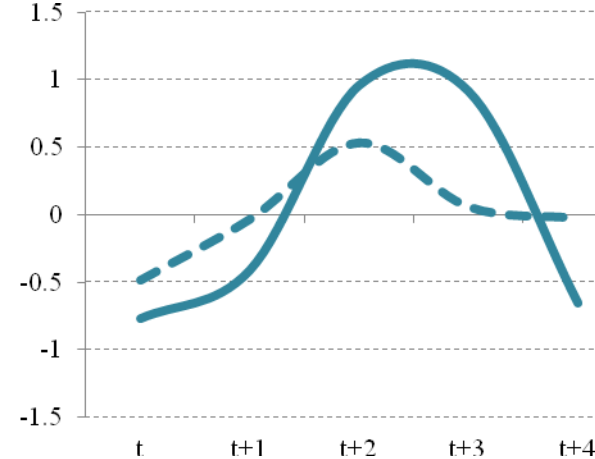


Negative developments in economic activity in the year recording the sovereign risk premium jump affects loan demand (see chart 11), and bank funding stream is compressed with values between -0.48 and -0.77 percent of GDP. Financial deleveraging would widen a year later given the increase effect with values between 0.5 and 1.15 percentage points in the rate of non-performing loans (see Chart 12).

**Chart 12** – Non-performing credit loan rate in terms of a jump in sovereign risk premium



**Chart 13** – Credit accelerator in terms of a jump in sovereign risk premium

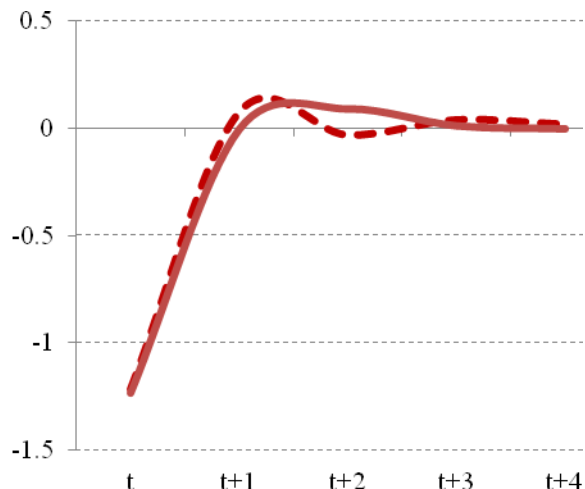


Lending rate recovers in year t2, resulting in a slightly positive development of the accelerator (see chart 13). However, while both the economic growth and lending rate return to equilibrium, the 0.5 percentage points jump of the non-performing credit loan rate remains persistent until the end of the analysis horizon.

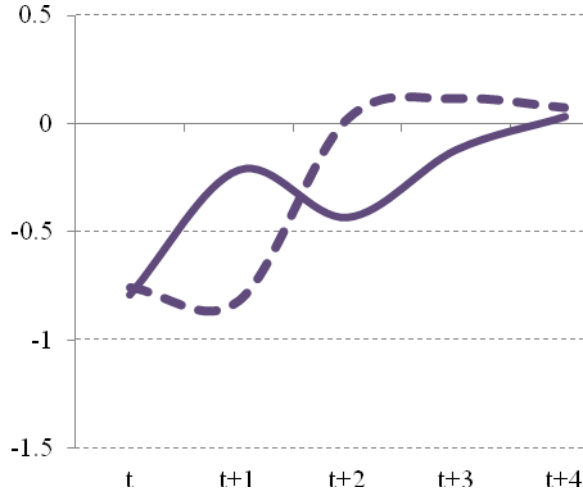
### 5.3 Effects of an economic contraction of 1percent in the euro area

The propagation of Euro-zone GDP contraction impact on credit-economic growth binomial in CEE area is similar to the impact of the jump in sovereign risk premium, the main channel being the formation of gross value added in the economy. Significantly over-unit elasticity of economic growth in the new Member States to the dynamic of GDP growth in the euro area determines a level of economic activity by 1.2 percentage points lower than that for the baseline scenario in terms of applying a shock, consisting in a contraction of 1pp in euro area (see chart 14). Unfavorable dynamic of economic activity in the same year recording the shock affects the demand for loans (see Chart 15) and bank funding stream is compressed with values between -0.21 and -0.81 percent of GDP.

**Chart 14** – GDP growth in terms of economic contraction in the euro area

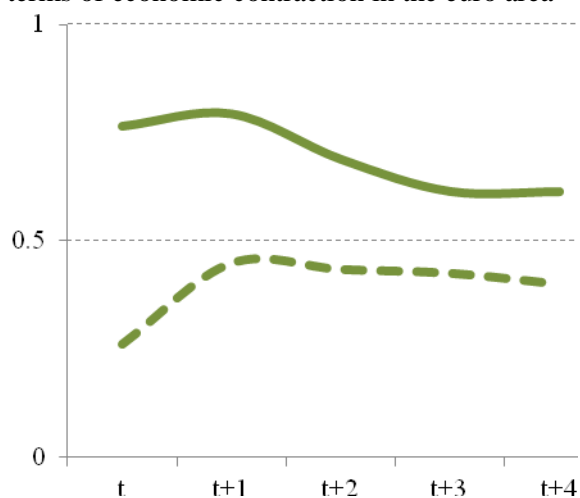


**Chart 15** – Credit flow in terms of economic contraction in the euro area

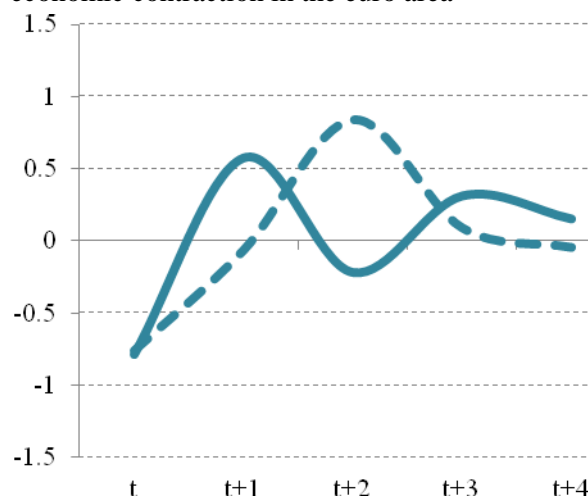


Lending rate returns to equilibrium level slower than the economic activity, and the rate of non-performing loans stabilizes close to the level of 0.5 percent over the benchmark generated by running the baseline scenario (see chart 16).

**Chart 16** – Non-performing credit loan rate in terms of economic contraction in the euro area



**Chart 17** – Credit accelerator in terms of economic contraction in the euro area



At the same time, the fluctuations' amplitude of the credit accelerator fades by the end of the analysis (see chart 17).

Given the above results, we believe that mutual enhancement of the changes in credit and economic makes lending portfolios vulnerable to exogenous shocks, no matter how small they are. Although GDP growth and lending return to equilibrium level in a medium-term horizon, deterioration of the loan portfolio is permanent, affecting effectiveness of the credit multiplier process in economics.

## CONCLUSIONS

The innovative feature of this study is to highlight the capacity of financial accelerator theory, proposed by Bernanke et al. (1996), to explain a substantial part of the dynamic of economic growth registered in the Central and Eastern European countries in the pre-and post-crisis period.

The added value of this approach consists of two elements. First, the analysis provides a quantitative mechanism for assessing the fundamental dependence of economic growth to the development in credit to private sector. Change in credit flows favors the emergence of economic swings, following a "W"- like shape. Moreover, credit growth produces effects on the quality of bank portfolios too. This additional development causes changes in the risk premiums, and, consequently, both exchange rate stability and the long-term interest rates are affected. The research also structures the functional form of the feedback mechanism from the dynamic of non-performing loans ratio to credit growth, based on the credit supply channel. Secondly, the study provides a set of macro-prudential rules meant to limit the amplitude of economic cycles, with beneficial effects on social welfare. The main macro-prudential rule suggested as a result of this research is to maintain a relatively constant rate of credit and closely correlated with potential growth. Under these conditions, real economy indebtedness is avoided and thus its exposure to financial market turmoil remains limited.

The banking sector interacts with the real economy through the credit accelerator mechanism as econometric analysis suggests that the change in credit flow explains between 30 and 70 percent of economic activity development for CEE countries. Moreover, large swings in credit flow (deleveraging or excessive financing) are associated with high levels of non-performing loans rate two years later, as the consequences of extreme values in both sides of the distribution of credit growth are similar in terms of risk level in the medium term. The feedback effects deepens recession through bank financing channel, as the credit elasticity dynamics to the change in non-performing loans ratio is slightly higher than one. Double deep recession events are visible amid the temporary economic recovery, as a result of slowing financial deleveraging and credit accelerator switching to positive values, under a favorable base effect.

Mutual potentiating between credit growth and economic growth makes loan portfolios vulnerable to exogenous shocks, however small they are. Results of testing risk factors show that, both economic growth and credit growth return to equilibrium after a period of 3-4 years of increased volatility, following the propagation of shocks through the credit accelerator mechanism. However, the jump in the non-performing loans ratio remains persistent.

Macro-prudential policy becomes a major component of the economic policies mix in CEE countries. Limiting the volatility of economic activity is dependant, in a decisive way, on the success of maintaining the credit accelerator at around zero. Financial stability in CEE countries

is also subject to a credit flow closely related to potential GDP growth, as the non-performing loans ratio strongly reacts to the square deviation of the credit flow from potential growth.

However, meeting the above mentioned macro-prudential objectives is subject to consistency with other macroeconomic policies, so as to avoid the propagation of shocks, such as: (a) the jumps in sovereign risk premium, driven by pro-cyclical developments of the fiscal impulse, as well as (b) over-supply of the credit market supply-demand spiral, amid pro-cyclical revenue policies etc., given their undesirable impact on some determinant factors of the credit-economic growth binomial.

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