CREDIT FLOW, OUTPUT GAP AND INFLATION: NOMINAL CONVERGENCE CHALLENGES FOR THE EU NEW MEMBER STATES

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ABSTRACT

Complementary to research on the importance of real convergence for a sustainable euro adopting process, this study analyzes the complexity of the mechanism by which credit growth may become a threat to meeting the inflation rate criterion. The added value of this approach consists of two elements. First, the analysis provides a quantitative mechanism for assessing the fundamental dependence of the output gap on credit development in the economy, econometric results of this study showing that about 15 percent of the credit flow is reflected in the deviation of economic growth from its potential level. Secondly, the study shows that macroprudential policy can contribute to meeting the price stability criterion, especially given that monetary policy instruments have limited effectiveness in countering excessive lending, econometric results showing that about 15 percent of the output gap changes into inflation in the new EU Member States. Thus, even if there are no financial stability indicators among the Maastricht criteria, at least the credit growth represents a macroprudential area with important implications on nominal convergence.

Key Words: average inflation, credit accelerator, output gap, nominal convergence, panel regressions, emerging economies

INTRODUCTION

The price stability criterion is the centrepiece of nominal convergence to the euro area of new Member States. The generalized evolution of prices is regarded as the main benchmark of the broader macroeconomic conditions and fulfilling the inflation criterion creates the premises of meeting the requirements for the other two monetary criteria, namely long-term interest rate and exchange rate stability.

Central and Eastern European (CEE) economies have made remarkable progress in economic catching up with the euro area, until the international financial crisis. But convergence with European living standards has created challenges in terms of macroeconomic stability and of external competitiveness for most of the regional economy

(**Isarescu**, 2007). While the economy was convergent in real terms, nominal parameters were evolving out of the benchmarks provided by the Maastricht treaty. Specialized literature (Egert, 2007, Lein-Rupprecht et al., 2007; Borys et al., 2008) is focused on the role of the Balassa-Samuelson effect in feeding inflationary pressures in the NMS. Alignment of wages dynamics in non-tradable sector to export tradable sector, without corresponding increases in productivity, degenerates into the rapid growth of prices, local currency depreciation and external indebtedness. However, the desire to rapidly advance and increase living standards by resorting to bank loans proved to be also part of the ingredients of the unsustainable growth of a significant number of CEE countries. **Bernanke**, **Gertler** and **Gilchrist** (1999) highlighted the role of the financial accelerator, in explaining the evolution of the U.S. business cycle, and CEE lending rate in the first decade of the new millennium provides indices of a similar phenomenon in the NMS. GDP growth above its potential level, determined by the volume and quality of the production factors of a country is the clear signal of an overheating economy, which may amplify the country's vulnerability to external shocks (**Georgescu**, 2010). Amplification of domestic consumption over internal production capacity, by resorting to bank loans, fuels the forming of a price increase spiral, masked by a pseudo convergence process. In this context, the aim of this study is to identify and assess the threats to the sustainability of the euro adoption process, associated with private sector lending. The operational objective of this research is to investigate the interrelationship between credit flow and price stability, by developing a simplified financial satellite model, integrating the credit accelerator theory with the reputed Phillips curve, in order to model the inflation rate.

The rest of the paper is structured as follows. The second section shows the underlying methodology of the analytical framework, used for assessing the risks induced by credit growth to the success of the euro adoption process by CEE, highlighting key functional forms. Section three presents the data used in the study and describes in detail both economic foundation and statistical results that lead to the selection of explanatory variables. Section four provides an overview of key empirical issues in developing a financial satellite model, favoring impact estimation, which credit has on meeting the price stability criterion.

1. METHODOLOGICAL FRAMEWORK

The international financial crisis experience has brought in foreground the role of macroprudential policy in ensuring macroeconomic stability, while the real and financial economy have become increasingly interdependent. Analytical framework to investigate the impact of credit on the evolution of inflation for CEE countries is based on a transmission mechanism with two components. The first step is the effect of lending on GDP deviation from its potential level. The second step is the Phillips curve mechanism that shapes the dynamics of prices in the economy according to the output gap, along with expected inflation (see Figure 1).

Figure 1: An X-ray of risks and vulnerabilities induced by credit growth to price stability
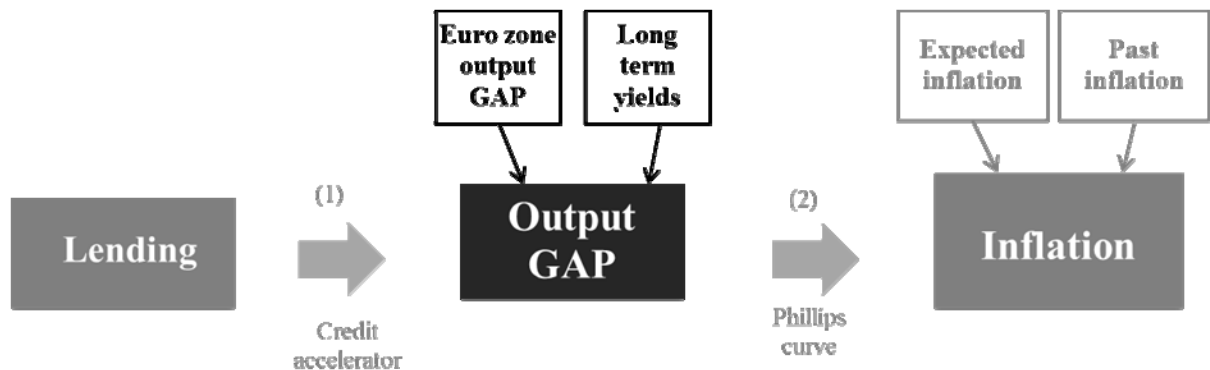
1.1 Credit impact on Output GAP

Transmission channel of the output gap (GAP) is based on the credit accelerator theory (**Bernanke**, 2007), which shows that credit flow feeds consumption and investment, creating space for multiplying the value added in the economy (see Equation 1).

$$GAP_t^i = \alpha_1 \times Credit\ Flow_t^i + \beta_1 \times GAP_t^{EZ} + \gamma_1 \times LTY_{t-1}^i + C + FE^i$$

1)

The functional form of the output gap explanatory equation also includes the dependence of economic growth in the euro area (GAP_t^{EZ}), the reversed relation to the long-term interest rate (*LTY*) as well as the structural differences between the economies of the CEE region, captured by the fixed effects of the panel estimation (*FE*).

1.2 Impact of output gap on inflation

Accelerating lending induces an increase over potential GDP and the economy enters into a process of overheating, which favors the generalized increase of prices in the economy.

The conceptual model for the average rate of inflation is expressed through augmented Phillips Curve expectations (see Relation 2).

$$INFL_t^i = \alpha_2 \times E[INFL]_{t+1}^i + \beta_2 \times GAP_t^i + C_2$$

2)

There is a positive relationship between the output gap and inflation ($\beta_2 > 0$). Along with the output gap, the functional form of the explanatory inflation equation includes dependence on inflation expectations for the next year ($E[INFL]_{t+1}^i$).

Expectations can be adaptive, depending only on the past history of the economy (e.g. $INFL_{t-1}^i = E[INFL]_{t+1}^i$) and rational, i.e. people form expectations based on all available information. Methodological framework of this study assumes that (see Relation 4) expected inflation is a linear combination between rational component ($E^R[INFL]_{t+1}^i$) and the adaptive inflation, ie inflation registered a year ago ($INFL_{t-1}^i$).

$$E[INFL]_{t+1}^i = \gamma_2 \times E^R[INFL]_{t+1}^i + (1 - \gamma\alpha_2) \times INFL_{t-1}^i$$

3)

Replacing the term $E[INFL]_{t+1}^i$ in relation (2) with the form described by relation (3), the explanatory model of inflation is as follows:

$$INFL_t^i = \alpha_2 \times \gamma_2 \times E^R[INFL]_{t+1}^i + \alpha_2 \times (1 - \gamma_2) \times INFL_{t-1}^i + \beta_2 \times GAP_t^i + C_2 + FE^i_t$$

4)

Last term in relation (5) captures the structural differences between the economies of the CEE region countries, through the fixed effects panel estimation (*FE*).

2. DATA

The private sector credit variable is expressed by private sector credit flow indicator (as % of GDP), provisioned in the European Commission's macroeconomic imbalance procedure. The private sector credit flow represents the net amount of liabilities (loans and securities other than shares) incurred over a year by the three sectors comprising nonfinancial corporations, households, and non-profit institutions serving households. Definitions regarding sectors and instruments are based on the ESA 1995 definitions.

The inflation rate variable is represented by the average inflation rate HCPI, prescribed by the Maastricht criteria. Of the nominal convergence criteria, long-term interest rate has been used also.

The information underlying the assessment of the impact which credit has on inflation rates in the CEE Member States is represented by annual frequency data, covering the period 2000 to 2011. The countries under consideration are Bulgaria, Czech Republic, Hungary, Latvia, Lithuania, Poland, Romania, as well as Estonia, Slovakia and Slovenia, having in mind that the last three countries were not euro zone members for the largest part of the sample.

The main source of used information is represented by Eurostat, from which were extracted data on credit flow to the private sector, average inflation rate, the number of employees in the economy, foreign direct investment and long-term interest rate. Expected inflation was extracted from the data provided by **Bojeşteanu**, **Manu** and **Leonte** (2011). At the same time, data on the output gap, both in CEE and the euro area, were extracted from the database of the European Commission (AMECO).

Preliminary empirical analysis shows that credit growth in CEE countries was one of the main determinants of economic advance over potential in the region (see Chart 1).

**Chart no. 1 – Correlation between Credit flow and Output GAP**
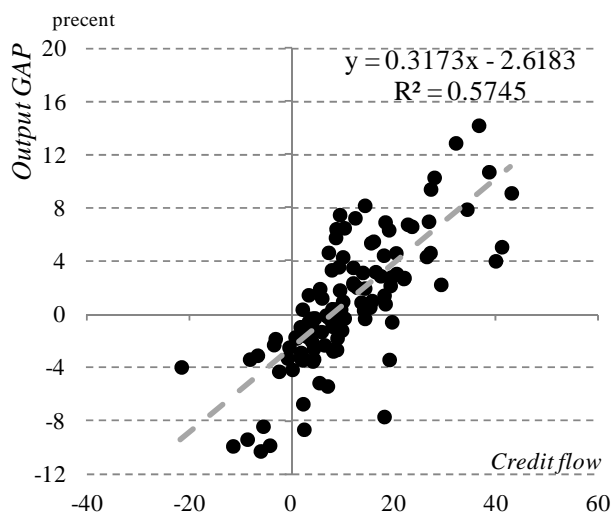
Data source: Eurostat, AMECO, authors'calculations

Univariate tests show a consistent elasticity (31 percent) of the output gap to changes in credit flow of the new EU member states area, given an explanatory power of the functional relationships of more than 50 percent.

At the same time, empirical evidence shows that CEE regional economic overheating emphasized inflationary pressures, with price increase being driven positively by Output GAP (see chart 2).

Chart no. 2 – Correlation between average Inflation Rate and Output GAP
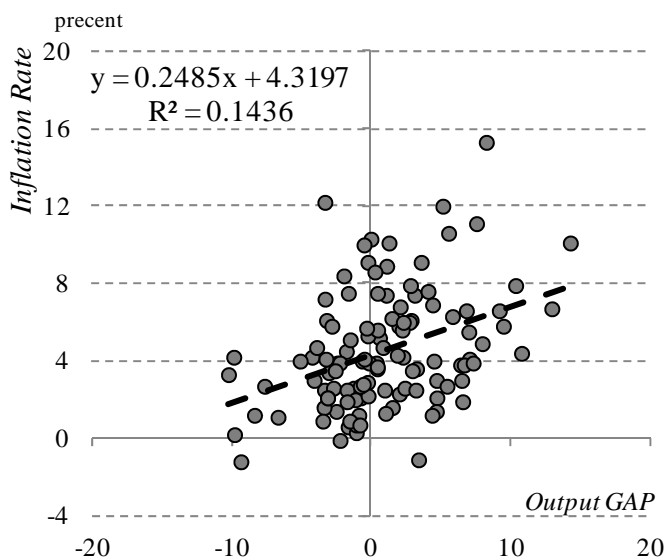
Data source: Eurostat, AMECO, authors' calculations

Univariate assessment of the average rate of inflation dependence to economic developments indicates a significant causal linear form, both in terms of elasticity levels (about 25 percent), as well as in the degree of determination (about 15 percent). Impact occurs instantaneously.

The candidate indicators for structuring the models 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
Equation 1: Output GAP		
1	Credit flow as percent of GDP	+
2	Employment (log transformation)	+
3	Foreign direct investment (log transformation)	+
4	Long term interest rate (Bond yields)	-
5	Output Gap euro zone	+
Equation 2: Inflation rate		
1	Expected inflation	+
2	Inflation registered one year ago	+
3	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 (see table 2).

Table 2 – Univariate analysis results for Output GAP model

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Adj - R^2	DW
Equation 1: Output GAP						
Credit flow	**0.351577**	**0.028221**	**12.45816**	**0**	**0.586012**	**1.34881**
Credit flow (-1)	0.264296	0.039767	6.646143	0	0.276665	1.226868
Credit flow (-2)	0.002375	0.059888	0.039665	0.9685	-0.097596	0.947851
Employment	**0.846715**	**0.113555**	**7.456444**	**0**	**0.329355**	**0.85025**
Employment (-1)	0.749146	0.125671	5.961157	0	0.243364	1.703493
Employment (-2)	0.337582	0.165094	2.044784	0.0446	-0.038895	1.108218
Foreign direct investment	0.108407	0.031475	3.44422	0.0009	0.102182	1.578448
Foreign direct investment (-1)	**0.166797**	**0.031369**	**5.317258**	**0**	**0.192614**	**1.28342**
Foreign direct investment (-2)	0.108583	0.03763	2.885578	0.0052	0.015395	1.22532
Long term interest rate	-1.412076	0.253048	-5.580268	0	0.217337	1.006546
Long term interest rate (-1)	**-1.576382**	**0.250236**	**-6.29958**	**0**	**0.285082**	**1.76229**
Long term interest rate (-2)	-1.046905	0.314068	-3.333376	0.0014	0.037709	1.346465
Output Gap euro zone	**1.178127**	**0.206228**	**5.712736**	**0**	**0.185447**	**0.51413**
Output Gap euro zone (-1)	0.765062	0.23664	3.233021	0.0017	0.024918	0.975025
Output Gap euro zone (-2)	-0.290836	0.289135	-1.005885	0.3175	-0.079081	0.862912
Equation 2: Inflation rate						
Expected inflation	**0.786989**	**0.05736**	**13.72013**	**0**	**0.762095**	**1.78372**
Expected inflation (-1)	0.584269	0.050397	11.59338	0	0.722016	1.930702
Expected inflation (-2)	0.274488	0.069351	3.95796	0.0002	0.356736	1.793194
Registered inflation (-1)	**0.58124**	**0.050388**	**11.53535**	**0**	**0.702981**	**2.31686**
Registered inflation (-2)	0.269937	0.05786	4.665357	0	0.414325	1.632486
Registered inflation (-3)	0.161149	0.058408	2.758994	0.0074	0.290837	1.44826

The lines highlighted in bold correspond to those lags with the largest explanatory power and, consequently, are short-listed for the multivariate analysis.

3. EMPIRICAL ANALYSIS

The operational objective of the empirical multivariate assessment was to substantiate the mechanism by which credit rate affects meeting the inflation rate criterion of the nominal convergence process in the countries of Central and Eastern Europe, taking into account macroeconomic factors short-listed in the previous section.

Analytical component consists of a set of simplified econometric models, built by panel estimates, using annual data.

The first equation of the financial satellite models the dynamics of **output gap**. Empirical results confirm that the dynamics of economic activity responds to the bank financing impulse, about 15 percent of the credit flow turning into output gap (see Table 3).

Table 3 – The estimated result of the output gap multivariate model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.846585	1.243641	3.093004	0.0027
Credit flow	0.149684	0.035522	4.213890	0.0001
Long term yields (-1)	-0.670829	0.156894	-4.275693	0.0001
Output GAP euro zone	1.215784	0.180672	6.729233	0.0000
Fixed Effects (Cross)				
_BG--C	-1.803072			
_CZ--C	-0.214519			
_EE--C	0.419297			
_LET--C	-0.141726			
_LIT--C	0.834303			
_HUN--C	0.061110			
_POL--C	0.026270			
_RO--C	2.660473			
_SK--C	-0.271509			
_SLO--C	-0.714372			

Adjusted R-squared	0.783031	S.D. dependent var		4.767707
Durbin-Watson stat	1.569262	Prob(F-statistic)		0.000000

Economic growth deviation from its potential level in CEE countries depends also on the output gap of the euro area, with elasticity slightly higher than one (1.21). At the same time, increase of long-term interest rates in the previous year by one percentage point leads to a compression of the output gap of around 0.7 percent. These three main drivers together explain about 80 percent of the variance of the output gap. Econometric estimates also suggest that there are some structural differences among countries in the sample in terms of the output gap, fixed effects being statistically significant. These structural differences are not, however, major, as re-estimation of the model without fixed effects leads to a similar result, while the fitting performance is only marginally reduced (to 0.75).

We perform additional checks to determine whether a) macroeconomic variables other than those included in our specification are important, and b) parameter estimates are stable within the sample of countries. Both foreign direct investment and employment were not statistically relevant whenever credit growth variable was present into functional form. Moreover, stability tests confirm that the estimated model represents a fairly robust specification, although the fitting performance went slightly below 75%.

The result of estimating the **average rate of inflation** equation shows that supplying economic growth above potential, through an impulse is instantly accompanied by generalized increase of prices in the economy, the Phillips curve model being relevant also in CEE economies. Slightly over 15 percent of the economic growth dynamics deviation from its potential level materializes in the actual average inflation rate (see Table 4).

Table 4 – The estimated result of the inflation rate multivariate model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.725957	0.314442	2.308715	0.0231
Expected inflation	0.416021	0.074399	5.591745	0.0000
Inflation registered one year ago	0.375217	0.059839	6.270428	0.0000
Output GAP	0.164511	0.048749	3.374635	0.0011
Fixed Effects (Cross)				
_BG--C	0.021088			
_CZ--C	0.102567			
_EE--C	-0.141943			
_LET--C	1.004068			
_LIT--C	-0.808419			
_HUN--C	0.196495			
_POL--C	-0.024209			
_RO--C	-0.284649			
_SK--C	-0.086447			
_SLO--C	0.021450			
Adjusted R-squared	0.804468	S.D. dependent var		4.533256
Durbin-Watson stat	2.526991	Prob(F-statistic)		0.000000

At the same time, inflation expectations for a time horizon of one year are also relevant, with a positive coefficient (0.41), statistically significant for a probability of one percent. The levels of statistic tests are indicative of the fact that the set of models observe the requirements of good econometric performance. Coefficients are statistically significant and their signs are in line with economic intuition. Estimated multifactorial functional form manages to capture about 80 percent of the variance of the average rate of inflation, by also taking into account, through fixed effects, slight structural differences existing in terms of price stability. The relatively low level of structural coefficients, together with the fact that the changes caused by testing the functional form in the absence of fixed effects are insignificant, conclude that there are only marginal structural differences between the new Member States, in terms of the Phillips curve's ability to shape price developments in the economies.

CONCLUSION

The innovative character of this study is to highlight the capacity of the private sector credit flow indicator, provided by the new procedure of the European Commission, related to macroeconomic imbalances, to explain a significant part of both the output gap, as well as the inflation rate recorded in the countries of Central and Eastern Europe, in the pre-and post-crisis.

The added value of this approach consists of two elements. First, the analysis provides a quantitative mechanism for assessing the fundamental dependence of the output gap on credit developments in the economy, with econometric results of this study showing that about 15 percent of the credit flow is reflected in the economic growth deviation from its potential level. Secondly, the study shows that macroprudential policy can contribute to meeting the objective of price stability, especially given that monetary policy instruments have limited effectiveness in countering excessive lending, amid full liberalization of the capital account. Excessive lending induces a process of overheating the economy, favoring a generalized increase in prices. The econometric results show that about 15 percent of the output gap turns into inflation. Not even the scenario where financing the economy enters a downward slope is without risks to price stability, given that the reduction in revenues due to a negative output gap is not accompanied by a similar adjustment in expenditures. In such a context, there is strong pressure on government deficit and inflation rate can record significant growth, fuelled by the inevitable increase of indirect taxes such as value added tax.

ACKNOWLEDGEMENTS

REFERENCES:

1. Bernanke, Ben S., Mark Gertler, and Simon Gilchrist. **The Financial Accelerator in a Quantitative Business Cycle Framework**, in handbook of *Macroeconomics*, Volume 1C, Handbooks in Economics, Volume 15, Amerstdam: Elsevier, 1999, pp. 1341–93 (earlier version: NBER Working Paper, 5455.).

2. Bernanke, B, **The Financial Accelerator and the Credit Channel**, 2007 http://www.federalreserve.gov/newsevents/speech/Bernanke20070615a.htm

3. Bojeşteanu E., Manu S. and Leonte A., **Aşteptările inflaţioniste ale consumatorilor – anticipative sau adaptive?**, *BNR*, 2011, retrieved from http://www.bnr.ro/Elemente-ale-cadrului-de-analiza-si-prognoza-al-politicii-monetare-6973.aspx

4. Borys Magdalena Morgese, Éva Katalin Polgár and Andrei Zlate, **Real convergence and the determinants of growth in eu candidate and potential candidate countries a panel data approach**, *ECB OCCASIONAL PAPER SERIES NO 86 / JUNE 2008*

5. Georgescu Florin, **Contribuţia politicii prudenţiale a BNR în cadrul mix-ului de politici economice, Banca Naţională a României**, 2010
   http://www.bnr.ro/PublicationDocuments.aspx?icid=6885

6. Égert Baláz, **Real convergence, price level convergence and inflation differentials in Europe**, CESIFO WORKING PAPER NO. 2127, 2007

7. Isărescu Mugur, **Rolul politicii monetare în cadrul mixului de politici economice**, Diserţie cu ocazia decernării titlului de Doctor Honoris Causa al Universităţii de Vest din Timişoara, 2007

8. Lein-Rupprecht Sarah M., Miguel A. León-Ledesma, and Carolin Nerlich, **How is real convergence driving nominal convergence in the new eu member states?**, *ECB WORKING PAPER SERIES NO 827 / NOVEMBER 2007*

9. Phillips, A. W. **"The Relationship between Unemployment and the Rate of Change of Money Wages in the United Kingdom 1861-1957"**. *Economica* 25 (100), 1958, 283–299.