EXPLORING THE RELATIONSHIP BETWEEN CREDIT AND NOMINAL GDP

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Abstract

The functions of money as medium of exchange and unit of account are closely related to the problems of relative prices formation and the value of money itself. Rejecting the classical dichotomy, we can assume some interaction between the real and the monetary sectors. Following the new trends in monetary theory we focus on the nominal macroeconomic parameters. In particular, econometric research is carried out in order to reveal the relationship between the nominal GDP growth and the total credit in the countries of Central and Eastern Europe. The objective is to measure the level of dependency and the nature of the relationship between these important macroeconomic variables.

INTRODUCTION

The experts often come to the conclusion that the rapid growth of credit is the cause of the current financial crisis. The latter began as uncontrolled growth of private debt. Later the US crisis spread to the other parts of the global financial system – banking sector, the real estate market, the informal (gray) financial sector, public finances. The principles of conventional banking suggest a very close relationship between the level of aggregate savings and lending. Financial liberalization and the boom in the real estate market, along with the increasing economic activity and ballooning property prices, were obviously boosted by the banking (financial system) lending.

Several areas of disagreement remain however. The first is about the role of the bank credit. If we accept the Keynesian view that investment determines saving (Keynes, 1936), then increased bank lending should really add to domestic demand, what is denied by some authors supporting the loanable funds theory (see Kakarot-Handtke, 2014). If the Keynesian approach is correct we should observe a positive connection between the bank lending and the nominal and the real GDP.

Additional questions raise the puzzle about the difference between money and credit. Some authors rightly emphasize that credit may expand without increasing the money supply as in the case of successful new bond issues (Woolsey, 2009). It is

clear however that in a monetary economy any issue of non-monetary debt instruments is intermediated by money and is finally a way of bridging the gap between economic agents with excess monetary savings and those who need additional purchasing power. Consequently money and credit are strongly correlated, non-bank credit being unilaterally dependent on bank created money. If we assume additionally that modern endogenous money is based on credit, then bank lending is a good proxy of total credit. So studying the interdependencies between the bank credit and nominal GDP we can draw conclusions about more general macroeconomic interdependencies.

Recently the attention of the monetary policy oriented macroeconomists is attracted by the idea of the nominal GDP (NGDP) targeting (see for example Rowe, 2011). The NGDP targeting is especially endorsed by the newly emerged internet based market monetarist school (see for details Hetzel, 2009 and Sumner, 2011). The market monetarists reject the real business cycles approach denying the impact of monetary (nominal) shocks on the real economy (see Kydland and Prescott, 1982). The new monetarists assume that if the monetary authorities guarantee that any increase in money demand is matched one to one by an increase in money supply then nominal GDP will remain unaltered. They, like the Keynesians, acknowledge that in the modern economies prices are sticky. Under these circumstances, if the monetary policy is excessively tight, the nominal GDP will tend to fall. The growth is also expected to be lower. In the case of private sector generated excess demand for money we will observe consequences on commodity, foreign exchange, bond, stock and other markets. This means that money is not neutral and monetary policy matters. If in addition we assume that money is credit based (what is not however the position of the new or quasi monetarists), then we should observe positive relationship between bank credit and NGDP. The impact of lending on the real GDP should be in the same direction.

Another approach to the problem is suggested by the theory of free banking. The proponents of free banking assert that the creation of inside money in terms banknotes and checkable deposits is automatically restricted to the needs of the real economy. Central role in this self-adjusting mechanism plays 'the rule of excess

reserve' and the more general 'principle of adverse clearings' (Selgin, 1988). The excess reserve tenet assumes that a private bank can increase its lending (the new loan is created via a new checkable deposit to the borrower) only if it disposes with excess reserves (in terms of central bank or commodity money). At the same time the bank clients use the borrowed money only to pay their suppliers and not to increase the demand for inside money balances. Since the suppliers are in general served by other banks, then any new loan generates a clearing drain equal to the amount of the new credit. The principle of adverse clearing simply generalizes the excess reserve rule to private bank note issue. It is assumed that this mechanism keeps the private banks money creation in line with real sector requirements and warrants monetary equilibrium. In practice however we can doubt that this type of self-adjustment can really take place. First of all, the borrowers need additional money not only to pay for purchases, but also to increase inside money balances in line with the increased activities. Secondly, if the excess reserves of a particular bank are exhausted as a result of supplying additional lending, the excess reserves do not disappear, but are merely transferred to other banks, so the process of increased lending will continue. In addition, if the banking system with clearing mechanism consists not only of small banks, but of universal banks with developed and diversified branch structure, the clearing drain will not be equal to the new lending, but will be substantially less. If we take into account also that free banking in its pure form should rely on commodity money as reserve asset, then it is clear that free banking cannot guarantee the stability of the price level and we should expect alternating inflation-deflation periods.

There is another flaw of the free banking system. It is related to the reaction of the money supply to the changes in the frequency of clearing payments (Selgin, 1988). When, for example, the frequency declines, then, *ceteris paribus* (with the same volume of payments), the demand for inside money increases. The supply however declines, because it is positively correlated with the frequency. This may happen in the case of reduced synchronization of payments in the real economy due to increased bunching costs. The problem may be resolved only by using the central

bank lender of last resort function to support interbank clearing mechanism as a part of the more general policy of securing money market equilibrium.

If we critically summarize the conclusions of different theories, we can expect strong connection between bank lending and the nominal GDP. So, one of the aims of the present research paper is to examine the dynamics of the supply of credit and nominal GDP growth in the emerging financial markets and in Central and Eastern Europe. The reason for this particular choice is the fact, that in the years before 2008, the region witnessed exceptionally rapid credit growth. Researchers from different countries draw the conclusion, that lending, in conjunction with the eastern expansion of the EU, accelerated economic growth. Consequently, the main intention of the present research is to reveal the relationship between lending and economic growth in nominal terms. The study consists of four parts: introductory, methodological, empirical and theoretical interpretation.

GENERAL APPROACH

The theoretical part of the thesis is based primarily on literature about the credit creation and its relation to the expansion of the other macroeconomic variables in the period before the credit crisis and after the financial turmoil. In spite of the fact, that there are many studies about the effects of the financial crisis on the financial systems of the countries of Central and Eastern Europe (many of them develop panels of indicators for early detection of critical events, see Babecky *et al.*, 2012), our research is based on the observation that the origins of the credit boom are not sufficiently explained. Therefore the main task of the first part of our paper is to answer the question whether the credit growth in Central and Eastern European countries (EEC) members of the European Union is correlated with the changes in the rate of economic growth through the GDP cycles.

The empirical study is based on panel time series of the banking system lending and the GDP in the Czech Republic, Estonia, Hungary, Poland, Slovakia, Slovenia, Bulgaria, Lithuania, Latvia, and Romania for the period 1990-2010.

The sources of the data used are the official statistics releases by the central banks, national statistical offices, the International Monetary Fund, the European Central Bank and Eurostat.

The analysis of the main factors generating the rapid credit growth is of crucial importance when trying to find out the causal explanation of particular credit episodes in selected countries. However, this approach is not able to identify completely all factors that directly boost both demand and supply of credit. The main reasons for stimulating the supply of credit and determining the levels of development of financial intermediation in the EEC are usually assumed to be the optimistic expectations about the prospects of EU membership, the speed of adjustment of eastern economies to the European common market and the penetration of European transnational banks into the economies of the postcommunist countries.

Factors determining the demand for bank landing are strongly associated with the process of transition to a decentralized market organization of the respective economic systems and the process of privatization of key national industries. The strong foreign banks penetration facilitated the transfer of up to date practices of risk management and thus reduced the spread between interest rates on deposits and loans, eased the access to financing from parent banks, broadened the bank product portfolios. The macroeconomic stabilization achieved in most parts of eastern European countries directly affected not only the demand for credit, but the supply of loanable funds to businesses and individuals. Usually the demand for credit is associated with some macroeconomic variables (GDP, wages, interest rates, input prices) or variables such as stock price indexes, tax payments and others (see for detailed literature review Gattin-Turkalj, Ljubaj, Martinis and Mrkalj, 2007).

In spite of scrutinizing these supply and demand factors, we focused on VAR analysis, including lending and GDP growth. This allows for detailed dynamic analysis of the interaction between bank lending and economic growth. While this approach is not able to give a positive picture of the causal factor structure laying behind the credit and GDP growth it makes possible the disclosure of causal interdependencies between the real and the monetary sectors.

Econometric Methodology

The study is based on the use of panel data and on evaluating a linear regression equation by means of the method of least squares (ordinary least squares regression).

$$y_{it} = \alpha + \beta x_{it} + u_{it} \quad (1.1)$$

Where:

y_{it} – Dependent variable – nominal GDP growth rate of the $\boldsymbol{i}$-th country at time period $\boldsymbol{t}$

x_{it}– Independent variable – bank lending growth rate of the $\boldsymbol{i}$-th country's at time period $\boldsymbol{t}$

An important condition for the accuracy of the results obtained by the method of least squares is not to omit some explanatory variable because they are not directly observed or are missing in the design equation. To avoid this possibility and to guarantee the objectivity of the results of the econometric calculations we expand the regression equation with an additional variable – $\boldsymbol{z_i}$. So we get the following extended equation:

$$y_{it} = \alpha_i + \beta x_{it} + u_{it} \quad (1.2)$$

Where: $\alpha_i = \alpha + yz_i$

EMPIRICAL RESULTS

Initially we calculate the regression equation without $\boldsymbol{z_i}$ presuming that the dynamics of the nominal gross domestic product (GDP) is mostly attributable to the dynamics of lending/borrowing (CRED) also in nominal terms. The results of the regression evaluation are presented in Tables 1 and 2.

The data does not indicate a strong correlation between the dynamics of GDP and CRED, i.e. we cannot consider CRED as the only variable, determining GDP. To confirm this finding we first consider the value of R^2 as indicator, stating how much of the variability of GDP is explained by the regression equation. The explanatory variable CRED, as evidenced, is able to account for 20.85% of the variations of GDP,

which means that the variable is a significant factor determining economic growth. The adjusted R-squared indicator, taking into account the other explanatory variables, also supports this conclusion.

If we compare the S.E. and the S.D. (these variables represent the standard error of regression and the standard deviation of the residuals $\boldsymbol{u_{it}}$) and the standard deviation of GDP, we can see that the values of both are relatively close – 9.206588 and 10.30828. This indicates that the standard deviation of GDP is explained to a relatively lesser extent by the explanatory variable – CRED, compared to the other, not included factors.

Finally, we can deduce that the dynamics of the independent variable CRED is not sufficient in itself to explain the dynamics of GDP and that the applied regression equation does not have sufficient explanatory power due to the lack of significant association between dependent and independent variables and/or failure to include additional important variables in the regression. This conclusion is confirmed by the reading of the Durbin-Watson test, which reveals the presence of significant autocorrelation dependencies included in the regression equation. In addition, we observe that the distribution of the residues $\boldsymbol{u_{it}}$ is characterizes by the existence of fat tails pointing out that there is considerable autocorrelation of dependent variable GDP and that these interconnections are not taken into account by the regression.

As a response to the above conclusions and in order to improve the explanatory power of the regression, we include additional elements in the equation - $\boldsymbol{z_i}$. The results from the application of econometric model (1.2) are presented in Table 3.

In a direct comparison of the models (1.1.) and (1.2) we come to the conclusion that the latter demonstrates better results from the application of regression evaluation of interdependencies between the studied variables. This statement is confirmed by the values of the test statistics associated with the Akaike and Schwartz criteria (Akaike info criterion and Schwarz criterion). As evidenced by the results of equation (1.2), the improvement in explanatory power of the regression model is substantial – 40.24% of the variability of GDP is explained by the regression model compared to 20.85% for the model (1.1). There is a decrease in the standard deviation

of the residuals $\boldsymbol{u_{it}}$ – 9.206588 in the equation (1.1) and 8.296439 in the model (1.2) – which is in line with the increased explanatory power of the model (1.2), compared to (1.1), but is still relatively close to the standard deviation of CRED of 10.30828.

These results lead to the conclusion that the model (1.2) presents a regression that fails to clarify to the necessary extent the dynamics of GDP. Moreover, there is an improvement in the explanatory power of the regression model due to the inclusion of more than one independent variable. This reflects the fact that the complex behavior of the dynamics of GDP cannot be explained by the movements of a single variable or, alternatively, this variable may not be CRED.

An additional confirmation of this conclusion are the values of the coefficients of the model (1.2) α_i = 7.995368 and β = 0.083425, which clearly demonstrate relatively higher weight of α and $\boldsymbol{z_i}$, given a constant rate and weight of the explanatory variable CRED. This result validates the assumption that the dynamics of GDP is explained largely not by other external independent variables but via the dynamics of its volatility in the past – an indication that is given to us by the values of tests and Durbin-Watson distributions with fatter tails of standardized residues $\mathbf{u_{it}}$, indicating the presence of significant autocorrelation dependencies associated with the volatility of GDP.

Analyzing data from the two models we cannot fail to note that the values of Std. Error, t-Statistic, Prob. (P-value), F-statistic, Prob. (F-statistic) the coefficients of the regression equations are statistically significant and different from zero. Thus, we can determine that the models (1.1) and (1.2), although not containing selfsufficient data about GDP, nevertheless, provide valuable insights about the relationship between the studied variables GDP and CRED, requiring in the same time analysis of underlying factors affecting regression equations (1.1) and (1.2).

Let's look at the values of the explanatory variables determined reflecting the values of CRED in the different countries involved in the study – Table 4. We can divide the countries into two groups according to their average positions vis-à-vis the variable CRED database. In the first group we can include countries showing greater than average pace of change of total average credit than CRED = 26.83231.

Countries showing higher than average rates of lending are: 1. Romania (63.65692), 2. Slovenia (32.42308), 3. Latvia (30.31538), 4. Bulgaria (28.37000), 5. Slovakia (27.30000).

At the opposite pole are countries with an average rate of lending less than the average of all countries: 1. Czech Republic (7.681538), 2. Hungary (14.75615), 3. Poland (15.30923), 4. Estonia (24.01077), 5. Lithuania (24.50000). These countries show lower lending rates and higher resistance to lending. In the second group standard deviations are in the range starting from 9.8233508 (Hungary) to 25.13616 (Estonia). The first group shows significantly greater variability: from 24.96350 (Latvia) to 72.95574 (Romania). *Ceteris paribus* the above data indicates that in the first group of countries, the importance of the explanatory variables CRED and GDP is higher than in the case of the second.

This statement, though true in terms of quantification, should not be regarded as evidence of a strong link between CRED and GDP. We should underline that the regression equation reflects relatively low weight of lending as explanatory variable of gross domestic product (β = 0.083425), but in some countries the relative importance of the banking sector may be significantly higher.

As already mentioned, in the structure of equation (1.2) the constant α has been transformed into a $\alpha_i = \alpha + yz_i$, in order to capture the impact of possibly omitted independent variables in the regression equation, expressed by the term z_i. In this respect we should analyze the values α_i as a measure of the relative impact of the missing from the equation (1.2) variables. This analysis is done in Table 5. From the latter we can divide the studied countries in two groups- those with relatively low levels $\alpha_i$of those with high levels.

In the group with low values (from zero to unity) we can include: Hungary, Latvia and Bulgaria. The group of high values (from 1 to 2) consists of Poland and Slovakia. And finally the group of very high values (more than 2) comprises Slovenia, Czech Republic, Lithuania and Romania. Excluding the extremes in this ordering (Hungary and Romania), we can say that high values to α_i indicate greater importance of missing in the regression equations variables.

Consequently, the explanatory variable CRED has the most significant impact on GDP in the countries with the lowest coefficient – α_i– Hungary, Latvia and

Bulgaria. It should be pointed out that Bulgaria and Latvia together with Romania, Slovenia and Slovakia fall within the group of countries showing a higher than average lending rates. We should also emphasize on the negative sign of the values α_i for all countries, except Romania.

This fact suggests that the impact of CRED on GDP is not as important as it seems, especially when a negative value of α_i combines with positive value β. So in countries with high absolute values of α_i, such as Poland, Slovakia, Slovenia, Czech Republic, Lithuania, the relative importance of the dependent variable CRED declines. This relationship does not contradict the data about the average value of the CRED in Table 4.

The presented findings reinforce the claim that in the above mentioned countries the impact of credit to GDP is relatively less pronounced compared to the others. The statistical significance of the coefficient α_i, presented in Table 6, also confirms the above conclusions. In this table, the p-value (Prob.) provides reasonable statistical support about the application α_i in the regression equation.

We apply also a VAR model with the following specification:

$$y_t = A_1 y_{t-1} + \cdots + A_p y_{y-p} + B x_t + \varepsilon_t \qquad (1.3)$$

Where:

y_t – vector of internal to the model variables

x_t – vector of external to the model variables

$A_1 \ldots A_p$ and B – matrix coefficients

ε_t – Vector of residuals.

The results of VAR analysis can be divided into two equations related to the variables GDP and CRED respectively. The VAR analysis is performed with lags of 2, 4 and 10 years. Trying to generalize the results, we can specify, that in the short run the impact of the variable GDP is relatively stronger than that of CRED. In the medium term perspective the importance of GDP is still stronger, but less categorically. In the long run the comparative weight of the two variables is indeterminate.

If we look at the VAR model with two years lag (Table 7) we can observe, that in terms of explaining GDP dynamics only the values of GDP(–1) and CRED(–1) are statistically significant. This means that from the point of view of a GDP dynamics explanation, only the latter variables matter and only in the short run (lag of one year). In addition, the impact of GDP is much stronger (the values of the coefficients speak for themselves- 0.654653 for GDP (–1) against 0.047526 for CRED (–1)). Concerning the VAR model for CRED we come to the conclusion, that in the short run the level of lending is determined to a higher extent by the level of GDP than by the own trends of CRED. We observe only two statistically significant lag variables – GDP (–1) and CRED (-2). The particular values of the coefficients support the hypothesis that the impact of GDP is much stronger than that of CRED. The estimates are –2.018369 for GDP (–1) against –0.284788 for CRED (-2) respectively.

The evaluation of VAR models of GDP and CRED with lags of four years (Table 8) reveals strong impact of GDP on GDP and CRED dynamics, but this effect is limited to the first two delays and is decreasing afterward. In the case of the VAR model of GDP we can observe statistically significant impact of only its own lagged values for the first two years with decreasing values of the coefficients. This particularity together with the lack of statistically significant effect of CRED determines in the middle term perspective the much stronger influence of GDP on its own dynamics, but without long term effects.

Concerning the VAR estimation of CRED, we can point out to a middle term impact of GDP, but this dependence is relatively short-lived and with declining strength. The latter assertion can be supported by the fact, that a statistically significant impact is observed only in the case of the coefficient before GDP (–1). The value of the coefficient associated with GDP (–1) with four lags horizon is 1.837594 which is significantly less than the value of the same coefficient with two years lag horizon of estimation – 2.018369.

The results of VAR estimation with ten years of lag interval (Table 9) demonstrate lack of definite long term mutual determinacy on the part of both variables. The VAR estimation of GDP reveals a statistically significant impact in the case of variables GDP (–2), CRED (–4) and CRED (–7). We must emphasize, on the

one hand, that the absolute value of the coefficient of GDP (–2) is higher than the values of CRED (–4) and CRED (–7), but if we, on the other hand, take into account the lags of the variables, reflecting the influence of lending, namely 4 and 7 years, we could reasonably suppose that the long term impact of lending, while still limited, has its formative effect on the current levels of GDP.

The evaluation of the 10 year lags VAR model of CRED does not disclose any statistically significant impact of both variables in the case of any lag.

The analysis of the VAR interdependencies between the studied variables can be broadened with the information from the Figure 2, reflecting the reaction of GDP and CRED to the impulse impact of the equations' residues. The examination of the impulse response graphs confirms the conclusions of VAR breakdown. The impulse effect of GDP on its own lagged values displays stronger reaction in short and medium term up to 5 lags with decreasing strength along the lag horizon. The effect of CRED on GDP exhibits short term peak of lag 2 and gradual decline up to lag 4. These impulse reactions coincide with VAR results revealing stronger impact of GDP, compared to CRED in short and medium term. Scrutinizing the impulse impact of GDP over CRED we observe strong reaction in the short term up to 3 lags and subsequent downward trend converging to zero at the 10th lag. As a result we can draw the conclusion that the effect of GDP on CRED is relatively strong in short run but does not determine the CRED dynamics in a long term perspective.

We can test the interdependencies between GDP and CRED also by implementation of Granger causality analysis. The latter is applied with lags of 2, 4 and 10 years (Table 10). The results of testing the respective hypothesis with 2 lags confirmed the existence of Granger causality from GDP to CRED. In the case of 4 years lag the causality is reversed and is taking place from CRED to GDP. In the case of less than 10 years lag horizon no statistically significant causality was revealed. Trying to generalize the econometric results we can conclude that the Granger causality tests substantiate the VAR analysis, namely that in short run GDP determines CRED but in middle term perspective the roles interchange. In the long run no stable statistically significant interdependence is revealed.

CONCLUSIONS

The econometric research carried out in the present paper relates the dynamics of the nominal GDP to that of nominal lending in the new countries-members of the EU. The choice of nominal values has both advantages and limitations. First of all we should observe that virtually all that matters from the point of view of the economic agents' survival is in nominal terms – the financial obligations, payments, revenue, accounts and so on, everything that determines the financial endurance of the firms, households and individuals, is expressed in nominal values. Even the central banks' targets may be fixed in terms of nominal GDP (McCallum, 2011).

The decomposition of nominal GDP in terms of real growth and inflation is an artificial operation in order to avoid money illusion. In fact both nominal and real parameters matter. In addition, if we assume that at least in the long run, the money illusion does not affect the economic agents and the central bank, then the analysis in nominal and real terms should give the same results. So our paper is based on the idea that the interdependence between nominal GDP and nominal credit dynamics reveal important and lasting regularities.

Another key topic affecting the interpretation of our results is the well-known paradox of thrift. If we, according to Keynes, presume that individual and collective savings differ, then we should come to the conclusion that investment determines saving and not vice-versa – *"It is, of course, just as impossible for the community as a whole to save less than the amount of current investment, since the attempt to do so will necessarily raise incomes to a level at which the sums which individuals choose to save add up to a figure exactly equal to the amount of investment"* (Keynes, 1936, Chapter 7, p.84). In view of the fact that investment is the most vulnerable part of the GDP, than in the short run, the nominal GDP dynamics will affect saving, respectively lending, and not the other way around. Here one should keep in mind that Keynes assumed a closed economy.

In the middle term perspective, however, the past changes of the volume of lending inevitably influence the dynamics of nominal GDP. We should also take into account debt deflation type of effects. According to Irving Fisher (1933), the rate of inflation interacts with the current level of accumulated credit and leads to increase

(in the case of deflation) and decrease (in the case of inflation) of the real debt. The real credit fluctuations shape the cyclical behavior of the economy. If the inflation rate depends on the dynamics of money and credit supply, then past changes of nominal lending will affect the real debt level and consequently the real and nominal GDP growth.

In the long run the hypothesis to be tested is that of the neutrality and superneutrality of money. If money neutrality holds, we can expect that the changes of money and credit will affect only the price level and not the real macro economic variables, especially in the long run (Bordo and Schwartz, 2006). If the changes of money and credit affect the price level in the short run, then money neutrality implies that there is no connection between the nominal GDP growth and credit in the long run. In its turn, the superneutrality means that money is not only neutral, but that prices react also to permanent changes in growth rates of the nominal money supply. The latter hypothesis is not tested in the present paper.

What we can observe from our research is that in the short run we can detect impact from nominal GDP to lending and not vice-versa. This seems to confirm the Keynesian hypothesis of investment determining saving and lending. Shortterm money neutrality is not corroborated since it implies strong influence from nominal lending to nominal GDP.

As it concerns middle term regularities (lag of four years), we detect statistically significant effect only on the part of lagged values of the nominal GDP on GDP and CRED.

The long term interactions also reveal interesting results. We observe statistically significant impact of CRED over the GDP with lags of 4 and 7 years. The signs of the coefficients are positive. This seems to confirm the credit deflation hypothesis. High credit growth in the past is positively correlated with the inflation rate. The latter relieves the real credit burden and has positive impact on real and nominal GDP. This conclusion is confirmed additionally by Granger causality analysis.

The lack of substantial interdependence between the nominal GDP and CRED dynamics may be viewed as confirmation of the long term neutrality of money.

The observed interdependencies allow for some conclusions concerning macroeconomic policy. The absence of short term impact of CRED on GDP and the relatively strong reverse connection reveals that in principle fiscal policy may be considered as a more efficient tool for short term stabilization, compared to monetary instruments. In the middle term perspective however the monetary policy is important in order to avoid credit deflation. This paper confirms to some extent the suggestion about nominal GDP targeting.

We should emphasize also that these conclusions are confirmed with different strength in the different EEC countries. The impact of CRED on GDP is stronger in Hungary, Latvia and Bulgaria. The latter partially coincides with the conclusion, that Bulgaria, Hungary and Latvia can be characterized by a close to equilibrium credit-to-GDP ratio (see Égert et al., 2006). In Poland, Slovakia, Slovenia, Czech Republic and Lithuania the relative importance of CRED declines. Since these two groups include countries with different monetary regimes, different fiscal and monetary policies, we need additional research to reveal the origin of the observed discrepancies.

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STATISTICAL APPENDIX

Table 1: Regression Results Using only one Independent Variable - CRED

Dependent Variable: GDP
Method: Panel Least Squares
Sample: 1998 2010
Periods included: 13
Cross-sections included: 10
Total panel (balanced) observations: 130

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.941269	0.986666	7.035074	0.0000
CRED	0.122709	0.021132	5.806913	0.0000
R-squared	0.208510	Mean dependent var		10.23385
Adjusted R-squared	0.202326	S.D. dependent var		10.30828
S.E. of regression	9.206588	Akaike info criterion		7.292981
Sum squared resid	10849.44	Schwarz criterion		7.337097
Log likelihood	-472.0437	Hannan-Quinn criter.		7.310906
F-statistic	33.72024	Durbin-Watson stat		1.110511
Prob(F-statistic)	0.000000			

Table 2: Statistical Results of the Regression Equation (1.1) as an Explanatory Variable Including CRED

Dependent Variable: GDP
Method: Panel Least Squares
Sample: 1998 2010
Periods included: 13
Cross-sections included: 10
Total panel (balanced) observations: 130
GDP=C(1)+C(2)*CRED

	Coefficient	Std. Error	t-Statistic	Prob.
C(l)	7.995368	0.912934	8.757885	0.0000
C(2)	0.083425	0.020548	4.060044	0.0001
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.402458	Mean dependent var		10.23385
Adjusted R-squared	0.352244	S.D. dependent var		10.30828
S.E. of regression	8.296439	Akaike info criterion		7.150350
Sum squared resid	8190.877	Schwarz criterion		7.392987
Log likelihood	-453.7727	Hannan-Quinn criter.		7.248941
F-statistic	8.014908	Durbin-Watson stat		1.174425
Prob(F-statistic)	0.000000			

Table 3: Statistical Results of the Regression Equation (1.2) as an Explanatory Variable Including CRED and additional elements - z_i

Estimation Command: LS(CX=F) GDP=C(1)+C(2)*CRED Estimation Equation:
GDP=C(1)+C(2)*CRED Forecasting Equation: GDP=C(1)+C(2)*CRED + [CX=F]
Substituted Coefficients:
GDP=7.99536818278+0.0834247280081*CRED + [CX=F]

Table 4: Descriptive statistics of the explanatory variables in the PB model (1.2)

Descriptive Statistics for CRED Categorized by values of ISOCODE Sample: 1998 2010 Included observations: 130

ISOCODE	Mean	Std. Dev.	Obs.
BUL	28.37000	34.35826	13
cz	7.681538	18.49416	13
EST	24.01077	25.13616	13
HUG	14.75615	9.823508	13
LAT	30.31538	24.96350	13
LIT	24.50000	21.91012	13
POL	15.30923	12.59863	13
ROM	63.65692	72.95574	13
SLOVA	27.30000	61.39473	13
SLOVE	32.42308	31.31760	13
All	26.83231	38.35935	130

Table 5: Values of Coefficient α_i in Model (1.2)

ISOCODE	Effect
BUL	-0.431358
CZ	-2.951583
EST	-0.959999
HUG	-0.041781
LAT	-0.109036
LIT	-3.416197
POL	-1.180229
ROM	13.86330
SLOVA	-1.857479
SLOVE	-2.915639

Table 6: Statistical Significance Test of the Coefficient α_i in the Model (1.2)

Redundant Fixed Effects Tests

Equation: Untitled

Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	4.291619	(9,119)	0.0001
Cross-section Chi-square	36.542034	9	0.0000

Table 7: Statistics from VAR analysis with 2 year lags

Vector Autoregression Estimates

Sample (adjusted): 2000 2010

Included observations: 110 after adjustments

Standard errors in ( ) & t-statistics in [ ]

	GDP	CRED
GDP(-1)	0.654653	2.018369
	(0.09685)	(0.49405)
	[6.75912]	[4.08538]
GDP(-2)	-0.050785	0.843110
	(0.10901)	(0.55606)
	[-0.46587]	[1.51623]
CRED(-1)	0.047526	-0.035887
	(0.01892)	(0.09649)
	[2.51252]	[-0.37194]
CRED(-2)	-0.011994	-0.284788
	(0.02222)	(0.11333)
	[-0.53986]	[-2.51291]
C	2.260839	4.790013
	(1.11114)	(5.66781)
	[2.03471]	[0.84513]
R-squared	0.536525	0.294949
Adj. R-squared	0.518869	0.268090
Sum sq. resids	4748.038	123540.4
S.E. equation	6.724538	34.30124
F-statistic	30.38738	10.98137
Log likelihood	-363.1586	-542.3946
Akaike AIC	6.693793	9.952629
Schwarz SC	6.816542	10.07538
Mean dependent	9.505455	26.73991
S.D. dependent	9.694620	40.09416

Determinant resid covariance (dof adj.)	50172.10
Determinant resid covariance	45714.66
Log likelihood	-902.3261
Akaike information criterion	16.58775
Schwarz criterion	16.83324

Table 8: Statistics from VAR analysis with 4 year lags

Vector Autoregression Estimates

Sample (adjusted): 2002 2010

Included observations: 90 after adjustments

Standard errors in ( ) & t-statistics in [ ]

	GDP	CRED
GDP(-1)	0.717883	1.837594
	(0.11424)	(0.52008)
	[6.28374]	[3.53330]
GDP(-2)	-0.651907	-1.107150
	(0.21512)	(0.97929)
	[-3.03046]	[-1.13056]
GDP(-3)	0.176451	0.793440
	(0.21858)	(0.99505)
	[0.80726]	[0.79739]
GDP(-4)	0.226909	0.271703
	(0.16214)	(0.73812)
	[1.39946]	[0.36810]
CRED(-1)	0.046479	0.012399
	(0.02417)	(0.11002)
	[1.92320]	[0.11270]
CRED(-2)	0.012069	-0.101465
	(0.02718)	(0.12372)
	[0.44408]	[-0.82009]
CRED(-3)	0.010149	0.065034
	(0.02614)	(0.11900)
	[0.38823]	[0.54649]
CRED(-4)	-0.012459	-0.186998
	(0.02549)	(0.11605)
	[-0.48875]	[-1.61139]
C	2.655343	12.57648
	(1.42365)	(6.48091)
	[1.86517]	[1.94054]
R-squared	0.465462	0.193030
Adj. R-squared	0.412668	0.113329
Sum sq. resids	3798.117	78710.97
S.E. equation	6.847652	31.17275
F-statistic	8.816593	2.421934
Log likelihood	-296.1148	-432.5222
Akaike AIC	6.780328	9.811605
Schwarz SC	7.030309	10.06159
Mean dependent	8.510000	24.22178
S.D. dependent	8.935110	33.10502
Determinant resid covariance (dof adj.)		44878.54

Determinant resid covariance	36351.62
Log likelihood	-727.9537
Akaike information criterion	16.57675
Schwarz criterion	17.07671

Table 9: Statistics from VAR analysis with 10 year lags

Vector Autoregression Estimates

Date: 04/22/12 Time: 23:05

Sample (adjusted): 2008 2010

Included observations: 30 after adjustments

Standard errors in ( ) & t-statistics in [ ]

	GDP	CRED
GNP(-1)	0.284609	0.443461
	(0.21897)	(1.90987)
	[1.29973]	[0.23219]
GNP(-2)	-0.868987	3.227957
	(0.38777)	(3.38207)
	[-2.24100]	[0.95443]
GNP(-3)	-1.126138	-1.666798
	(0.87417)	(7.62442)
	[-1.28823]	[-0.21861]
GNP(-4)	0.886696	-4.617375
	(0.77846)	(6.78964)
	[1.13904]	[-0.68006]
GNP(-5)	0.918986	1.835502
	(0.77634)	(6.77117)
	[1.18374]	[0.27108]
GNP(-6)	-0.602822	6.095568
	(0.73925)	(6.44767)
	[-0.81545]	[0.94539]
GNP(-7)	0.933217	-8.052226
	(0.99140)	(8.64686)
	[0.94131]	[-0.93123]
GNP(-8)	-0.845540	1.259165
	(0.75592)	(6.59305)
	[-1.11856]	[0.19098]
GNP(-9)	-0.359757	-0.671750
	(0.46488)	(4.05463)
	[-0.77387]	[-0.16567]
GNP(-10)	0.455084	0.423160
	(0.29517)	(2.57445)
	[1.54176]	[0.16437]
CRED(-1)	0.061684	0.196727
	(0.04842)	(0.42229)
	[1.27402]	[0.46586]
CRED(-2)	0.082416	-0.923863

	(0.07317)	(0.63815)
	[1.12642]	[-1.44773]
CRED(-3)	0.056276	0.173153
	(0.07617)	(0.66437)
	[0.73879]	[0.26063]
CRED(-4)	-0.161894	-0.136252
	(0.06871)	(0.59931)
	[-2.35609]	[-0.22735]
CRED(-5)	0.054437	0.896333
	(0.10727)	(0.93560)
	[0.50748]	[0.95803]
CRED(-6)	-0.019558	-1.038203
	(0.07741)	(0.67517)
	[-0.25265]	[-1.53769]
CRED(-7)	0.195674	-0.160635
	(0.09661)	(0.84261)
	[2.02542]	[-0.19064]
CRED(-8)	-0.035769	0.786075
	(0.05805)	(0.50627)
	[-0.61621]	[1.55267]
CRED(-9)	0.003980	-0.067651
	(0.05089)	(0.44388)
	[0.07821]	[-0.15241]
CRED(-10)	0.037968	0.153455
	(0.04629)	(0.40372)
	[0.82026]	[0.38011]
C	2.039835	34.45105
	(5.04296)	(43.9841)
	[0.40449]	[0.78326]
R-squared	0.869119	0.581900
Adj. R-squared	0.578272	-0.347211
Sum sq. resids	286.8046	21817.58
S.E. equation	5.645102	49.23592
F-statistic	2.988238	0.626297
Log likelihood	-76.43221	-141.4073
Akaike AIC	6.495481	10.82715
Schwarz SC	7.476319	11.80799
Mean dependent	1.026667	12.95700
S.D. dependent	8.692721	42.41937

Determinant resid covariance (dof adj.)	62342.71
Determinant resid covariance	5610.844
Log likelihood	-214.6232
Akaike information criterion	17.10821
Schwarz criterion	19.06989

Table 10: Statistics from Granger Causality Test

Pairwise Granger Causality Tests

Sample: 1998 2010

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
CRED does not Granger Cause GDP	110	3.34459	0.0391
GDP does not Granger Cause CRED		17.9507	2.E-07

Lags: 4

Null Hypothesis:	Obs	F-Statistic	Prob.
CRED does not Granger Cause GDP	90	1.05328	0.3851
GDP does not Granger Cause CRED		3.53652	0.0104

Lags: 10

Null Hypothesis:	Obs	F-Statistic	Prob.
CRED does not Granger Cause GDP	30	1.36348	0.3260
GDP does not Granger Cause CRED		0.49790	0.8538

Figure 1: Residuals distribution

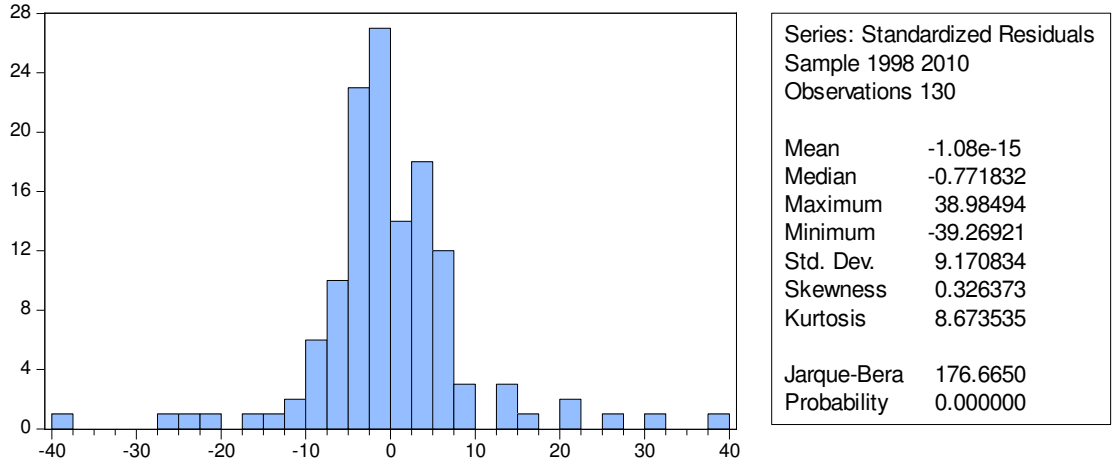

Figure 2: Impulse Response Effects