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# *An Empirical Analysis of the Relationship between Economic Growth and Credit Volumes in Hungary*

**SUMMARY:** Our research focuses on the impact of the private sector's credit volume on economic growth. The main purpose of our study is to present the theoretical background between lending activity and economic growth, which is empirically tested for Hungary in 2000-2017. We have used the Vector Autoregression model, where the dependent variable is a linear function of past lags of itself and past lags of the other involved variables. We have identified a significant relationship between private sector credit and general government debt and the pace of economic growth. Based on our empirical research, the base effect, Germany's economic growth and recession were significant variables.

**KEY WORDS:** economic growth, lending, Hungary

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*'Development and crisis  
have the same roots.'*

The quote from *László Méri* (2018) provides a framework and a starting point for our paper: this common root of development and crisis that we 'found' is lending. The thesis that there is a strong, positive relationship between the lending activity and the economic growth of a country was an unquestionable axiom in economics literature for a long time (Méri, 2002). This thesis is substantiated by empirical data on the development of a number of

economies, the most relevant example being the US, the most important player in the world economy. The US increases lending, which is a means of escaping forward, to increase propensity for consumption and, as a result, to increase the GDP.

## THE MAIN QUESTION OF THE PAPER

The direct relationship is clear with the restriction that you examine how borrowing in the private and public sectors increase demand and economic growth. However, indirect effects are not that obvious. With the series of economic crises, the question arises whether

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the negative effects of overlending become dominant. So much so that some authors, e.g. *King and Levine* (1993), European Systematic Risk Board (2014), say that lending activity is a good predictor of economic crises.

We mostly focus on what factors determine the pace of economic growth, and where lending is among these factors. Theoretical and empirical research into economic growth is a key area of economics. As *Marer* nicely put it: *'Economic growth matters not just because it leads to rising prosperity. People living in countries with growing economies tend to be happier and more optimistic. Material improvement leads to general satisfaction; stagnation or decline leads to misery and pessimism. Economic growth matters because its absence causes long-term unemployment and falling living standards for many'* (Marer, 2013, p. 242).

The main purpose of our study is to present the theoretical background between lending activity and economic growth, which is also tested empirically for Hungary between 2000 and 2017 Q2. The paper seeks to answer the following questions.

▶ Why the private sector credit-to-GDP ratio is an adequate indicator of the level of financial development?

▶ What is the relationship between loan growth and economic growth in Hungary? To what extent is lending a factor that stimulates economic growth and to what extent is it the cause of crises?

▶ Through what channels does the increase in the private sector credit-to-GDP ratio affect the real economy in Hungary?

## GROWTH REGRESSION ANALYSIS OF ECONOMIC GROWTH

Economists mostly consider GDP, more specifically real GDP per capita, as the best economic indicator of development level and

standard of living. From the vast economic literature, we reviewed some basic research from our focus area (Németh, 2016; Mankiw, 1992; Young, 1995; Barro, 1991; Beck et al., 2000). In our analysis, a theoretical exploration of the economic growth factors of different growth theories is followed (in the second part of the article) by the presentation of our empirical model based on that.

In our paper we used the tools of growth regression analysis. This is a practical methodology, with an empirical approach to economic growth: it uses the tools of econometrics and different models (OLS, VAR, VECM, SVAR) to analyse output growth. The result variable is usually real GDP per capita growth, while explanatory variables include various economic and social indicators that have appropriate theoretical explanatory power regarding economic growth. A relationship established by econometrics is not necessarily a real economic relationship, its must be substantiated theoretically. It is extremely important to select the appropriate combination of explanatory variables.

In his research, *Barro* (1991) conducted growth regression analysis to explore economic growth in 98 countries between 1960 and 1985. In his paper he tested 30+ variables to explore the causes of economic growth. The following economic variables were found significant in the study:

- school enrollment rate,
- initial (1st year of the examined period) per capita real GDP,
- government expenditures,
- accumulation of physical capital,
- political stability variable.

In the same field of research, *Beck* and his colleagues examined the effects of financial development level on economic growth. In addition to the indicators found significant by Barro, they examined inflation, the degree of openness of the economies, black market

premium, and credits to the private sector as a share of GDP (Beck et al., 2000). In the empirical part of our paper we used growth regression analysis, where we used the variables from the studies mentioned and some of our own ideas. The exact definition of the variables of the regression testing and the description of the methodology and the model are included in the last sections of the paper.

Economic growth is determined by the interaction of several factors (economic cycle, country-specific features). *Robert E. Lucas* says that understanding the causes of economic growth is one of the key areas of economics. *‘The consequences for human welfare involved in questions like these are simply staggering: Once one starts to think about them, it is hard to think*

*about anything else’* (Lucas, 1988, p. 5). *Figure 1* shows the GDP growth of the two countries included in our empirical research.

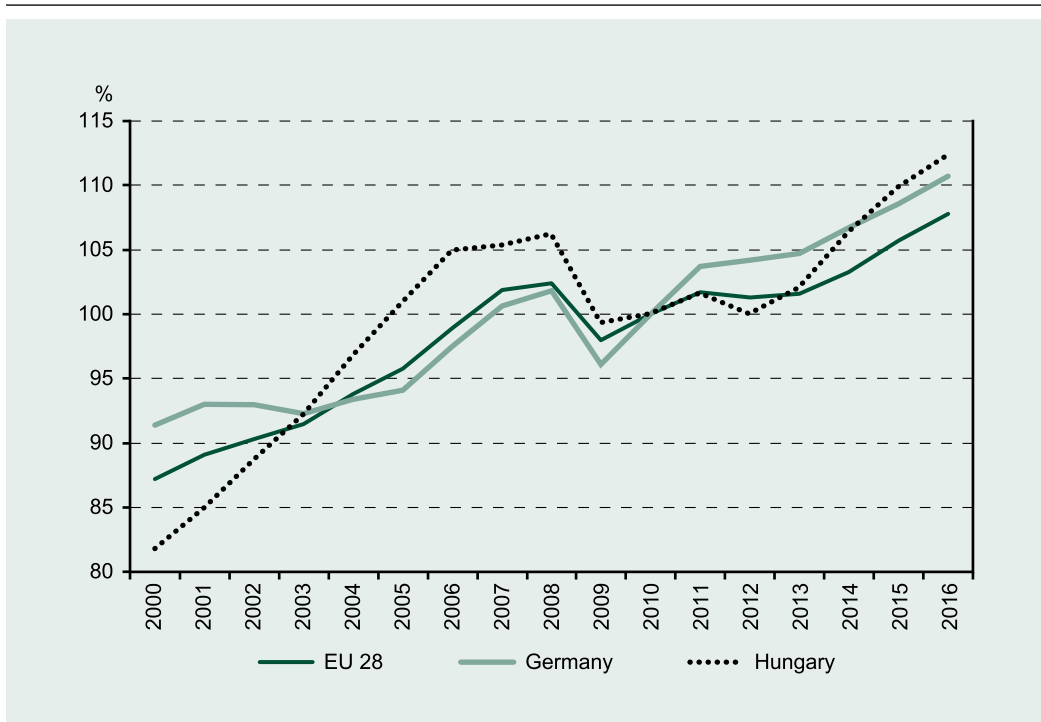
### THE THEORETICAL RELATIONSHIP BETWEEN ECONOMIC GROWTH AND CREDIT VOLUMES

The theoretical background of the relationship between growth and lending

In this section, we analyse the effect of the financial intermediary system on economic growth. First, we establish why the private sector credit-to-GDP ratio is an adequate

Figure 1

#### CHANGE IN THE VOLUME OF GDP IN GERMANY, HUNGARY AND THE EU-28 (2010=100%)



Source: compiled by the authors

indicator for expressing the depth of financial intermediation (Hypothesis 1). A review of the literature on this topic reveals two distinctively different theories regarding the relationship between the financial intermediary system and economic growth. Classical growth theories do not include the financial system in their analysis, as it is deemed there is no causal relationship between the financial system and economic growth (Solow model, real business-cycle theory). Other economists, however, believe there is a close relationship between economic growth and the depth of the financial intermediary system. The major authors of this school are *Thorsten Beck, Robert King, Ross Levine and Norman Loayza*. A detailed analysis of the debate between the two schools is beyond the scope of this paper. For our research, we consider the second theory as definitive.

We analyse lending activity in the whole private (retail and corporate) and public sector. Even though general government debt is determined by completely different economic factors (MNB 2017a), debt in this sector is also an important factor of economic growth. In our model

$$D = D_p + D_G \quad (1)$$

where  $D_p$  denotes private sector credit and  $D_G$  denotes general government debt.

The key category of the article is the change in private sector credit as percentage of the GDP:

$$d_p = D_p / GDP \quad (2)$$

where  $d_p$  is private sector credit expressed as percentage of the GDP.

In the definition of private sector credit, we use the following statistical demarcations.

① It is intersectoral debt that is examined, meaning intrasectoral debt has been consolidated

(the debt of a company/private individual to another company/private individual is a claim for one and a liability for the other, so the consolidated value is zero).

② Debt is defined as debt towards the banking system. The definition in (1) automatically excludes so-called commercial loans (loans to the private sector not provided by a credit institution). Debts other than debts towards credit institutions (e.g. tax debt) are not analysed here. Even though such debts are part of the liabilities of the private sector, they are not part of lending activities.

③ The analysis covers only the lending activity of credit institutions, loans provided by others (e.g. leasing and factoring companies) are not included.

According to *Schumpeter*, whose Theory of Economic Development is a key piece of literature on this subject, there is a direct positive relationship between the financial intermediary system and economic growth. Schumpeter says the active participation of the financial system is essential for economic growth (Schumpeter, 1982). There is no consensus among economists on this subject. According to ‘mainstream’ growth theories, there is no relationship between economic growth and the depth of the financial intermediary system. Others believe the debate is not about the existence of such relationship, but about its causality (*see Table 1*).

A key focus of our paper is the relationship between economic growth and the level of financial development. In this case a developed (deep) financial system means that direct capital flows are mostly unhindered, savers and borrowers find one another efficiently, and money changes hands with the lowest possible transaction costs (Mankiw, 2018). Due to the characteristics of the two-tiered banking system, the depth of the financial system is best described by the extent of the activities of financial intermediaries (commercial banks).

Table 1

THE RELATIONSHIP BETWEEN LENDING AND ECONOMIC GROWTH		
	No relationship	Close relationship
Argument	<ul style="list-style-type: none"> <li>• Classical dichotomy: the thesis that the real economy and the financial system are completely separable</li> </ul>	<ul style="list-style-type: none"> <li>• The improvement of capital allocation leads to real economic growth</li> <li>• The procyclicality of the banking system has an impact on real economic growth</li> </ul>
Example	<ul style="list-style-type: none"> <li>• Classical growth theories: Solow-model</li> <li>• Real business-cycle theory</li> </ul>	<ul style="list-style-type: none"> <li>• Joseph Schumpeter</li> <li>• John Hicks</li> <li>• Robert King és Ross Levine</li> </ul>

Source: own compilation

Based on King and Levine (1993), and Beck et al. (2000), in our paper we consider the private sector’s credit-to-GDP ratio the best indicator for describing the financial intermediary system.

Capital market intermediation also has an impact on the depth of the financial system. In Hungary, we have a German-type financial system, where capital-market instruments are less important. According to *Parragh and Végh* (2018), in Hungary the stock market capitalisation to GDP ratio is 20.6%, which is quite low. The social responsibility approach of banks has also had a significant impact on lending in recent years (Lentner et al., 2015), but this area is not described here for reasons of space.

### The effect of lending on economic growth

In this section we explore to what extent lending as an economic growth factor contributes to GDP growth according to literature. *Hicks* is often quoted about this issue, as he says that the economic growth of the industrial revolution was not due to technological

development but due to the emergence of appropriate financing opportunities. *Hicks* says that the technology had been available years before, and development was generated by the emergence of liquid money and capital markets (*Hicks*, 1969).

Informational asymmetry is a great problem in lending, as the lender cannot assess the borrower’s ability to repay the loan, and borrowers can’t differentiate themselves from other, ‘worse’ borrowers (MNB 2017b; *Zsámboki*, 2002). By improving capital allocation, commercial banks increase the extent and efficiency of investments, which results in economic growth (*Cecchetti and Kharroubi*, 2012). In his study, *Levine* defined 5 functions of the financial system that can help the efficient allocation of capital (*Levine*, 2005, p. 5):

- ① Produce information ex ante about possible investments and allocate capital.
  - ② Monitor investments and exert corporate governance after providing finance.
  - ③ Facilitate the trading, diversification, and management of risk.
  - ④ Mobilize and pool savings.
  - ⑤ Ease the exchange of goods and services.
- In addition to the channel of capital

allocation, Beck identified further channels through which lending may have an impact on economic growth (Beck, 2014). Lending facilitates exports, as producing for export is riskier and requires more capital. Pre-financing may be necessary for export transactions.

Targeted programmes by the central bank that had an effect on lending should also be mentioned among factors influencing lending. Such major factors are the social responsibility approach of banks, the Funding for Growth Scheme and the Market-based Lending Scheme. We cannot explore this area in the present publication, but it is described in detail in an article by *Kolozsi-Parragh-Pulai* in the 2017/4 issue of *Public Finance Quarterly* (Kolozsi et al., 2017).

With lending, economic actors make intertemporal decisions to increase their current income against their future income. As a result, they can smooth their consumption and investments over time. Disposable income increases as a result of borrowing, which increases aggregate demand; supply immediately adapts and output increases. As income increases, economic actors can bring forward expenditures that would have required long-term savings (Mérő, 2002).

After the EU accession, the Hungarian credit market soared. The correction of this process was in 2009-2010, with a considerable withdrawal of funds: foreign-owned banks withdrew significant funds from the Hungarian banking system. The situation was serious, which was also shown by the fact that the IMF intervened. After that the radical withdrawal of funds from the Hungarian banking system slowed with the so-called Vienna Initiative and Vienna Initiative 2.0. It is a special feature Hungary and the Baltic states share that the loan-to-deposit ratio and public debt are high (Giday, 2013), and the economy has a dual structure. The latter is important because it is difficult

for small companies to access credit, so in this sector lending has mostly an indirect effect, for example through the change in demand that is due to the loans of medium-sized and large companies and to the change in the disposable income of the public.

In summary, we can cite a comprehensive study by the IMF on the effects of lending on economic growth: the quality of the financial system fundamentally determines the efficiency of economic policy (IMF, 2012). In our empirical model, this positive relationship is our hypothesis. But first, the research into reverse correlation is reviewed in the next section, as it is presented in economic literature.

### The effect of economic growth on lending

There is consensus in literature that economic cycles exist, but how they develop is still debated. In *Lőrincz's* definition, an economic cycle is the short-term fluctuation around the long-term trend of output (Lőrincz, 2000). In the upturn phase of the economic cycle, output values are higher than the long-term output trend, and in the downturn phase they are lower. According to *Irving Fisher*, the turning-point of the economic cycle is the financial crisis, which is indicated by lending booms, the increase in asset prices and the increase in the credit risk of banks (Fisher, 1933; Lentner, 2013). Lending can increase the amplitude of economic cycles, this is why lending boom is considered a good crisis indicator (King and Levine, 1993; Lentner, 2015). As opposed to this, *Gourinchas* and his colleagues analysed the relationship between lending booms and bank crises, and their conclusion is that bank crises cannot be unambiguously attributed to excessive lending booms (Gourinchas et al., 2001).

Several economists examined the relationship between the financial intermediary system and economic growth. For our study, the most relevant papers are those by King and Levine (1993) and by Beck, Levin and Loayza (Beck et al., 2000). The conclusion of the authors is that there is a close, positive correlation between the financial intermediary system and economic growth. King and Levine used data from 80 countries over the 1960-1989 period. Beck, Levin and Loayza used conventional cross-sectional analysis and dynamic panel model (GMM) on data from 74 countries over the 1965-1990 period. Their main conclusion is that it is not through increasing investment, but through more efficient capital allocation and the resulting productivity growth that the financial system exerts its effects.

*Rousseau and Wachtel* used econometric methods to examine this relationship regarding economic performance in the United States, the United Kingdom, Canada, Norway, and Sweden over the 1870-1929 period. (Rousseau and Wachtel, 1998). *Rousseau and Sylla* extended their research to the 1850-1997 period as they examined the effects of the financial intermediary system on real economy in 16 countries. They found that these effects were stronger before the Great Depression than they were after (Rousseau and Sylla, 2001). In their empirical research, *Arcand* and his colleagues found a non-linear relationship between lending and economic growth. This is an inverse U-shaped relationship, too little and too much credit do not lead to economic development (Arcand et al., 2012). *Law and Singh* (2014) came to the conclusion that when private sector credit-to-GDP ratio exceeds 90-100%, there is a turning point and the relationship turns negative. They suggest that there is a threshold level for the credit/GDP ratio where economic growth has the highest possible value.

*Bodnár* and her colleagues identified 4

key causes that explain the inverse U-shaped relationship between the change of credit and economic growth (Bodnár et al., 2014, p. 60).

① The financial sector draws away resources from sectors of the real economy, and if this exceeds a certain level, the efficiency of production may decline.

② Countries with more developed financial systems are closer to the full utilisation of their efficiency limits, where additional credit units do not have such a benefit as they do in a country with a less developed financial system.

③ Economic growth is more tightly related to investment loans. In a country with larger credit volumes (a more developed financial system), the share of consumer credit is higher, which doesn't contribute to growth so much.

④ In a country with larger credit volumes, financial crises are more likely to develop, after which it takes a long time for lending to recover due to negative experiences.

The monetary approach to the effect of economic growth on lending is based on the idea that money supply is created through lending and foreign exchange purchases. This is expressed in the basic formula of money creation, where  $\Delta M$  is the change of the money supply,  $\Delta NDC$  is the change of net domestic credit and  $\Delta NFA$  is the change of the net position of the banking system vis-à-vis the rest of the world

$$\Delta M = \Delta NDC + \Delta NFA \quad (3)$$

The NDC channel of money creation is also debt creation, so there is strong, positive correlation between the change in the money stock in the economy and the change in credit volumes (Gilányi, 2014).

If the money stock is constant, and real output increases because of capital, labour, human capital and technology, it might result in a deflationary environment, and as a result economic entities may prefer the store of value function of money as opposed to its functions

as a medium of exchange and payment. In such an environment, economic operators postpone their consumption knowing that the next day they can purchase more products for the same amount. Demand decreases, so the initial growth is followed by a decrease in output. This means the money stock must increase at least at the pace of economic growth.

There is the other school, the bank-focused approach, where *Keeton* (1999) defined 3 basic causes for loan growth: a supply, a demand and a productivity factor.

On the supply side, banks have different attitudes towards risk during upturn and downturn, and they ease non-price lending standards. Commercial banks control the credit supply, and decision-makers of monetary policy have an indirect effect on this through the credit channel (MNB, 2012). The price of funds is determined by the central bank through the base rate. In his study, *Dalio* (2015) empirically observed that in the upturn phase of the cycle, base rate is either low, around 0%, or positive but decreasing.

The interest revenue of commercial banks decreases when interest rates are low, which is then compensated by increased lending. Another important aspect is that banks also increase lending to maintain their market share. It can be empirically observed that the banks' willingness to take risks is different during the upturn and the downturn phase of the cycle (*Mérő*, 2002). In the upturn phase, non-price lending standards, e.g. lending processes and collateral requirements are loosened. In such periods banks have positive expectations about economic development, and they are willing to take more risks.

The demand side is the situation when companies increase their credit demand. In the upturn phase of economic cycles, the revenues and profits of companies may increase, which encourages entrepreneurship and has a positive effect on business prospects in the

short term. In this phase, companies deem the risks of borrowing lower, which contributes to the increase in credit demand. Such examples include when external funding is increased for tax optimization purposes, and the increase in the relative price of capital market financing.

The third and most important factor is productivity. Technological development leads to an increase in the productivity of companies, and their credit demand also increases to facilitate further expansion. At the same time lending standards may be loosened as well, but this doesn't lead to excessive risk-taking, as increasing productivity also increases the ability of economic entities to repay their loans.

The effects that you see during the downturn phase of the cycle are the exact opposite. Here output decreases, unemployment increases, and increasingly serious social tensions arise. During a downturn, the incomes of economic actors decrease, which makes it uncertain whether they can pay their debt service, and as a result the income of banks decreases. The income of banks is further decreased by loan loss and provisioning to cover potential losses. 'Bad loans' provided during the upturn are restructured, which is a deleveraging process for the banks. At such times, the bank sector is overly cautious, which is also significantly visible in lending activities. In the downturn phase, sometimes even creditworthy companies that could be funded without any problems can't get loans: this is the *credit crunch*, where the bank sector cuts back its lending activity too much and deepens the crisis (*Balog et al.*, 2014), acting procyclically.

Positive expectations lead to excessive lending in many cases. The system works well as long as the real economy can keep up with credit expansion. To maintain stability, it is important that commercial banks only provide loans to suitable economic actors that can deliver. With stable operation,



investments that increase real production are financed from the increasing credit volume, and these investments can generate money for debt service (amount of loans, interests and other costs).

One of Mérő's (2002) key findings is that in countries with a low level of financial intermediation, the increase in credit may exceed productivity growth without incurring excessive risk. In this case this means that because of the low level of financial intermediation, even clients who can be financed without any problem have not been provided loans. Another conclusion is that credit standards may be loosened in such countries as long as credit expansion stays within the limits of reasonable lending practice.

## METHODOLOGY AND DATABASE

In our paper we used parallel times series testing, more specifically the vector autoregression model (VAR). The VAR model is a distributed lag model, where the dependent variable is a function of not only the current explanatory variables, but also of their past values (Ramanathan 2002). The main reason for choosing the methodology is that the effects of factors affecting economic growth are not immediate, but delayed. We describe the methodology based on the influential econometrics course book by *Hamilton* (Hamilton, 1994).

$$y_t = \alpha + \Phi_1 \times y_{t-1} + \Phi_2 \times y_{t-2} + \Phi_p \times y_{t-p} + \varepsilon_t \quad (4)$$

$y_t$  = ( $n \times 1$ ) vector containing model variables

$\alpha$  = ( $n \times 1$ ) vector containing constants

$\Phi$  = ( $n \times n$ ) matrix containing autoregressive coefficients, where  $j = 1, 2, 3, \dots, p$

$\varepsilon$  = ( $n \times 1$ ) vector with a Gaussian white noise process with discrete representation,

where  $E(\varepsilon_t) = 0$  and  $E(\varepsilon_t \varepsilon_t') = \Omega$ , if  $\Omega = (n \times n)$  symmetrical positive semidefinite matrix and  $t = \tau$ , and otherwise 0.

In case of variables, we used seasonally adjusted quarterly data, so there is a relatively large number of items in the time series and the VAR model can be used. The area examined is Hungary, for the 2000-2017 Q2 period. In our analysis we wish to explain real GDP growth ( $y$ ), which is the result variable in the model. In the selection of explanatory variables, we relied on the studies mentioned in section 2, and we used variables considered significant in these papers and other variables we thought would be relevant. *Table 2* contains the variables included in the model, and the result variable is highlighted in grey.

At the trade openness indicator ( $x1$ ), we added exports and imports (current prices) and divided this by the GDP (current prices) (Eurostat, 2017). This variable shows the dependence of the country on foreign trade. Private sector credit ( $x2$ ) contains the loans and the value of debt securities provided by the Hungarian bank sector to the private sector (corporate, retail, non-profit) as % of the GDP. General government debt ( $x3$ ) contains the loans and the value of debt securities provided by the bank sector, the private sector and by RoW as % of GDP.<sup>1</sup> The increase in private sector credit ( $x4$ ) and the increase in general government debt ( $x5$ ) indicate the growth of seasonally adjusted debt. Long-term interest rate ( $x6$ ) is the average of the daily changes in the price of 10-year treasury bonds, not the interest rate at issue. Another variable included is German economic growth ( $x7$ ) as an explanatory variable. One of our considerations was that the main foreign trade partner of the Hungarian economy is Germany, so the growth rate is closely linked to German economic performance.

The first step of creating the model was to examine every variable if it is stationary,

Table 2

**VARIABLES INCLUDED IN THE MODEL**

Variable	Name	Unit of measurement	Database
y	Real GDP growth	%	OECD
x1	Trade openness	% of GDP	Eurostat
x2	Private sector credit	% of GDP	BIS
x3	General government debt	% of GDP	BIS
x4	Increase in private sector credit	%	BIS
x5	Increase in general government debt	%	BIS
x6	Long-term interest rate	%	OECD
x7	German economic growth	%	OECD
x8	Recession	dummy	OECD

Source: own compilation

as it is a condition for using VAR. We tested stationarity with an ADF test. According to the null hypothesis of the test, a unit root is present in the given process, the p-value was high for every variable during testing, so the time series used are unit root processes. To handle this, we took the first difference of the processes. We ran the ADF test again on the first differences, and the p-value was close to zero for all of them, which means these are already stationary. This also means that every time series examined is first-order integrated.

We ran the VAR model with differenced variables. In case of the results in *Table 3*, the result variable is the value of economic growth measured quarterly ( $\dot{y}$ ). This is explained with the lagged values of the variables. The recession variable ( $x8$ ) is included in the regression as a dummy; in case of a financial or sovereign crisis, it takes 1 as its value to handle the volatility caused by the crisis. We defined recession as a period where the total GDP growth of the OECD countries was negative. Based on the information criteria (FPE, AIC, HQIC, SBIC), we decided to use a model with

4 lags, which is appropriate for quarterly data. The results of the tests are shown in *Table 3*.

The model is technically suitable, according to the null hypothesis of the Lagrange-Multiplier (LM)-test there is no residual autocorrelation in the model. The p-value of the test is 0.36, there is no reason to reject the null hypothesis. In addition, the inverse roots lie within the unit circle in the models, which also confirms that the variables used are stationary.

## EMPIRICAL RESULTS

*Table 4* shows the results of our estimates for real GDP growth rate difference. As we have already mentioned, for conclusions to be drawn, the sign and significance of the coefficients are the most important, as it is difficult to interpret the interaction of differences quantitatively. As there is no quantitative interpretation of the results, the interpretation of the results regarding differenced variables is the same as that of the original variables. Grey fields indicate the significant coefficients, asterisks

Table 3

**SELECTING THE NUMBER OF LAGS IN THE VAR MODEL**

Lag	FPE	AIC	HQIC	SBIC
0	2.5e-28	-40.845	-40.6338	-40.3098*
1	2.1e-28	-41.0241	-39.9682	-38.3479
2	3.2e-28	-40.7117	-38.811	-35.8946
3	3.6e-28	-40.8712	-38.1258	-33.9132
4	1.2e-30*	47.0985*	43.5084*	-37.9996

Note: \* lowest value

Source: edited by the authors

indicate the probability of rejection (*p*-value) at 1%, 5% and 10%.

Trade openness and long-term interest rates were not significant for any period, which means these variables have no significant effect on real GDP growth in Hungary.

Our first conclusion is that real GDP growth is positively affected by the real GDP growth rate in the previous quarter, but the real GDP growth rate 4 quarters before decreases current real GDP growth. This is explained by the saturation effect, because with continuous real economic growth it is increasingly difficult to maintain the growth rate, with the same input effort, the output curve flattens. The positive effect is in accordance with the theory of economic cycles, and you can also see in the results that the effects of sovereign and financial effects are eliminated.

Trade openness has no effect on real GDP growth. In our opinion it is due to the fact that Hungary’s openness is extremely high, and further opening would not influence economic growth significantly. According to 2017 data, Hungary was the 10th most open economy globally, the openness value was more than twice the EU-28 average (Worldbank, 2017).

Based on the model, real economic growth is positively and significantly influenced by the private sector (retail, corporate and non-profit)

credit-to-GDP value lagged by 4 quarters. The result proves that growth is significantly fuelled by the increase of private sector credit-to-GDP ratio, which is also confirmed in literature (Levine, 2005). When we examine general government debt-to-GDP ratio, we also find a positive and significant relationship at the 1st and the 4th lags. Like the private sector, public finances can also induce economic growth.

We also examined the seasonally adjusted change in the gross value of debts, not only the debt-to-GDP ratio. In the private sector in can be established that the increase in gross credit volume (2-quarter lag) contributes to the growth of the real economy, so the effect is visible even if the credit volume increases at a lower rate than the real GDP. In case of public finances, gross credit growth (4-quarter lag) decreases real GDP, and the increase in gross public debt has a negative effect on real GDP. This is a well-known effect in literature called *crowding out*, where public borrowing drives private borrowing from the credit market.

The recession dummy variable and the German economic growth variable developed as expected. Real GDP growth was positively affected by the German economic growth rate 4 quarters before, and the relationship between the Hungarian and German economies was confirmed.

Table 4

**RESULTS REGARDING THE SIGN AND THE SIGNIFICANCE OF THE RELATIONSHIP**

Variables	Coefficient	Standard deviation	<i>z</i>	<i>p-value</i>
Real GDP growth <i>t-1</i>	0.239	0.143	1.670	0.096*
Real GDP growth <i>t-2</i>	-0.073	0.141	-0.510	0.608
Real GDP growth <i>t-3</i>	-0.060	0.162	-0.370	0.711
Real GDP growth <i>t-4</i>	-0.659	0.159	-4.150	0.000***
Trade openness <i>t-1</i>	-0.028	0.032	-0.860	0.388
Trade openness <i>t-2</i>	-0.056	0.035	-1.630	0.103
Trade openness <i>t-3</i>	-0.044	0.030	-1.440	0.149
Trade openness <i>t-4</i>	-0.049	0.032	-1.530	0.127
Private sector credit <i>t-1</i>	-0.085	0.102	-0.840	0.403
Private sector credit <i>t-2</i>	-0.140	0.102	-1.380	0.169
Private sector credit <i>t-3</i>	-0.076	0.104	-0.730	0.467
Private sector credit <i>t-4</i>	0.228	0.098	2.330	0.020**
General government debt <i>t-1</i>	0.150	0.074	2.300	0.043**
General government debt <i>t-2</i>	0.079	0.069	1.140	0.255
General government debt <i>t-3</i>	0.097	0.071	1.370	0.170
General government debt <i>t-4</i>	0.152	0.072	2.330	0.034**
Increase in private sector credit <i>t-1</i>	0.045	0.038	1.180	0.239
Increase in private sector credit <i>t-2</i>	0.066	0.037	1.810	0.070*
Increase in private sector credit <i>t-3</i>	0.048	0.036	1.330	0.183
Increase in private sector credit <i>t-4</i>	-0.040	0.034	-1.180	0.237
Increase in general government debt <i>t-1</i>	-0.030	0.043	-0.700	0.485
Increase in general government debt <i>t-2</i>	-0.060	0.052	-1.150	0.250
Increase in general government debt <i>t-3</i>	0.010	0.055	0.180	0.855
Increase in general government debt <i>t-4</i>	-0.120	0.050	-2.400	0.016**
Long-term interest rate <i>t-1</i>	-0.187	0.326	-0.580	0.565
Long-term interest rate <i>t-2</i>	0.079	0.334	0.240	0.812
Long-term interest rate <i>t-3</i>	-0.323	0.297	-1.080	0.278
Long-term interest rate <i>t-4</i>	-0.051	0.288	-0.180	0.860
German economic growth <i>t-1</i>	-0.048	0.173	-0.280	0.783
German economic growth <i>t-2</i>	0.013	0.167	0.080	0.936
German economic growth <i>t-3</i>	0.060	0.168	0.360	0.722
German economic growth <i>t-4</i>	0.268	0.143	1.870	0.061*
Recession (exogen)	-0.009	0.005	-1.840	0.065*

Note: \*\*\* significant at 1%, \*\* significant at 5% \* significant at 10%

The coefficients of private sector credit variables were mostly positive. A positive relationship means that if corporate and retail credit volumes have increased in previous years, the rate of economic growth increases *ceteris paribus*. The result is in accordance with the conclusions of *Cecchetti and Kharroubi* (2012) and *Levine* (2005), that by improving capital allocation through lending, commercial banks increase the extent and efficiency of investments, which may result in economic growth. This process was substantially shaped by the Funding for Growth Scheme of the Hungarian Central Bank and by EU funds. The expectation described in the theoretical section was confirmed.

After the 2008 financial crisis, the decisions of economic operators were influenced by ‘bad memories of lending’ for several years. Economic growth started with low lending activity, so creditless recovery occurred in Hungary. Recovery was mostly led by the rebound effect, export expansion and one-off, country-specific effects (*Bodnár et al.*, 2014). Due to the former significant downturn, there was considerable unutilised capacity

in the economy, and thus it was possible to increase production without investments. In Hungary, EU funds also greatly contributed to the creditless economic growth. Constraints appeared both in credit supply and credit demand, which postponed the expansion of credit while there was already real economic growth in the economy (*Bodnár et al.*, 2014).

In Hungary, sources of growth that have been important so far (potential growth with low investment, through EU funds and due to the significant under-utilisation of capacities) are expected to be much less significant in the future. We believe that for further growth, (further) credit expansion in the corporate sector is essential. In addition to the expansion of credit, the capital market must also be developed in the Hungarian economy; the diversification of corporate capital structure would decrease risk and it has further growth potential. Positive examples include the Bond Funding for Growth Scheme of the Hungarian Central Bank, and programmes that facilitate the listing of companies on the stock exchange (e.g. the Mentoring programme of the Budapest Stock Exchange).

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#### NOTE

<sup>1</sup> In addition to gross debt, net debt is also an important factor, which could be explored in future research.

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