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Bank Loans and the Business Cycle: The Case of the Czech Republic

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***Abstract*—**This article aims to evaluate the impact of loans provided within the Czech banking sector on the growth of the Czech economy. The article is based on research of current scientific findings in respect to bank loans and economic development. The paper is based on data taken from the Czech Statistical Office on the development of the gross domestic product and data from the Czech National Bank on the development of loans from the period 2004-2015. Links between selected variables are tested using Granger causality tests. The results calculated confirm the hypothesis of the impact of the loans on economic growth, with a six-month delay. The results thus correspond to the standard economic findings and results of most previous studies.

***Keywords*—**Bank, business cycle, economic growth, loans.

I. Introduction

IN the current form of market and mixed economies, a significant role is played by the banks. Banks act as a fundamental financial intermediary between surplus entities and deficit entities. Every healthy economy needs a sound banking system, as only this will generate a critical mass of money in that economy. In other words, a necessary precondition of a functioning market (mixed) economy is a functioning banking system.

In this article, we discuss the relationship of bank loans and economic development. Development of the economy is measured using the standard indicator of gross domestic product (GDP) and relate that to the progress of total loans measured according to the statistics of the Czech National Bank [6]. We will assess the relationship of these indicators under conditions in the Czech Republic in the years 2004 - 2015. This is a highly relevant economic topic, especially but not only in the context of the recent financial crisis and its aftermath. Banks at that time were more cautious in providing loans, affecting, among other things, economic development itself.

This article aims to evaluate the impact of lending in the Czech banking sector on the growth of the Czech economy.

Currently, there is a connection between the banking sector and economic performance, much narrower due to the size of the local financial markets and the impact of globalisation. One proof is the banking crisis in the USA, which spilled out into public finance crises and economic downturns in many countries of the world, including most European countries. Current studies basically copy the views of the economists mentioned above from positive influence through passive, to the negative influence of banks on economic development. The largest is a group of economists who believe in the positive impact of bank loans on economic development. Various relationships between the development of bank loans and economic growth have emerged from economic research on this subject right from the start. Schumpeter [17], for example, mentioned a strictly positive influence, whereas Lucas [14], for example, indicated a strictly negative one. On the other hand, Robinson demonstrated that bank loans show insignificant influence on economic development [16].

The basic results of studies on these issues have been summarized by Černohorský [9] or Černohorská and Kula [8] as an initial aspect of further research into this subject. Boyd and Prescott [4], for example, have provided more extensive and supplementary information on this thesis. They concluded that financial intermediaries (banking institutions) are able to achieve better resource allocation due to lower costs for accumulating and processing information and thus support economic growth. Furthermore, King and Levine [13] state that banking sector growth is also able to provide better opportunities for starting successful businesses and thus to achieve faster economic growth or technological development for the given country. Cetorelli and Gambera [5] demonstrate that the banking sector allows new, innovative companies easier access to loans and, in this way, supports the tempo of economic growth, because new companies' investments are more likely to be invested in innovative technology. Bencivenga and Smith [3] outline a positive relationship between bank loans and economic growth in that the banking sector can reduce excessive limiting of loans due to decreased monitoring costs and can thereby ensure accelerated economic growth for the country. Gurley and Shaw [12] conclude their study with the statement that financial intermediaries are able to secure mechanisms necessary for commerce, clustering and risk diversification. This fact can make it easier for a company to attain access to projects with higher expected yields, i.e., with positive impact on the given country's economic growth.

On the basis of these facts, it can be said that currently the most significant group of economists are those demonstrating bank loans' positive impact on economic development. However, we must still give consideration to studies that, for various reasons, either do not find any relationship between the growth of bank loans and economic development or even those asserting a negative relationship.

II. Data and Methods

This study uses data obtained from the database of the Czech National Bank [6]. This is quarterly data, which are

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seasonally adjusted and are for the time period of 2004 - 2015. In this study, we have used the value of overall loans granted within the Czech economy – the stock value for each quarter – as an indicator of the growth of granted loans. We selected the standard ratio of GDP to be the indicator of economic development, i.e., quarterly data for real GDP for the years under consideration from the Czech Statistical Office [7].

Considering the fact that the goal of this paper, which is a part of a more extensive study, is to assess the importance of bank loans in conjunction with economic growth, we decided to use the methods of cointegration analysis and Granger causality for the next step, determining the relationship between the selected variables. These are econometric methods used to describe relationships between economic and financial time series. The basic reason for selecting these methods is to try to avoid so-called spurious regression. If nonstationary data are used, this can occur when classic regression analysis is conducted. However, most economic and financial time series are nonstationary. Namely, this could cause statistically significant estimates for the regression function parameters; however, this would lead to incorrect conclusions concerning the relationship of the economic variables.

The point of using cointegration analysis is primarily its ability to distinguish long-term and short-term relationships between economic time series. For short-term relationships, the relationship being analyzed exists only over the short term and disappears over the long term. In terms of economics, this means that the given variables do not correlate with each other over the long term in any way. On the other hand, both variables converge towards equilibrium in long-term relationships. At the same time, it is true that time series are exposed to shocks over the short term (caused by other economic and non-economic factors), and therefore they tend not to be in equilibrium over the short term.

Using Granger causality makes it possible to express conclusions on whether one variable has a causal effect on a second variable. Specifically, when one variable affects a second variable, the performance of the first variable should then improve prediction of how the second variable develops over time.

Before starting Engle-Granger test, the model's prerequisites need to be met: the optimal lag length needs to be determined and the data being used needs to be stationary. The optimal lag length is determined using the Akaike information criterion (AIC). We look for the lowest value for the information criterion; this is then used in the following steps. For more details see Černohorský [9]. The time series' stationarity is determined using the ADF test. If the null hypothesis is not rejected, the time series are nonstationary. In the next step, we modify the time series using differencing and repeat the ADF test. If the difference of a time series modified this way is stationary, we proceed to conducting the actual Engle-Granger test. We use Granger causality to observe the mutual relationships between the monitored variables. If the time series are not cointegrated, we test for Granger causality to determine if the causal ties between the variables show two-way causality. We have used the procedure presented in Černohorská and Kula [8] for the analyses mentioned.

First, the time series that have been presented here are always tested for optimal lag length. The lag length is determined according to where the lowest information criterion value is located. Lag lengths determined in this way are subsequently used in further testing. The appropriate criterion depends on the number of observations. We used Akaike information criterion (AIC). Central banks and the government are forced to make decisions, given the time lag, not only on the basis of available information but also on developmental estimates (at least at a horizon in which a change occurs due to the estimated time lag between 12 and 18 months in monetary or fiscal policies) as is mentioned in Mankiw [15].

There are several statistical tests to determine the order of integration, known as unit root tests. Here we have employed the probably most widely used of them, which is known by the name of its creators, the Dickey-Fuller test (hereinafter referred to as the ADF test). This test then is used to analyse whether the time series is of type I (0) - stationary or I (1) - non-stationary.

The analysis was conducted in the Gretl 1.9.4 program for econometric analysis; this program makes it possible to conduct an augmented Dickey-Fuller test (ADF test) for this case.

Three versions of the ADF test are commonly used for verifying hypotheses – one with a constant, one without a constant, and one with both a constant and a trend. When testing, we used the assumption that the process listed below (1), where we test that Ø=0 (the variable contains a unit root), takes the following form from Arlt and Arltová [1]:

$$\Delta X_t = (\varphi_1 - 1)X_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta X_{t-i} + e_t \qquad (1)$$

where Xt expresses the dependent variable, p lag, and et the residual term. Deciding on the stationarity – or the non-stationary – of a time series will be conducted by evaluating the p values (the level of significance is in this paper always set at 0.05), which thus establishes whether the null hypothesis is rejected or accepted with 95% probability. For this test, this is formulated as follows:

- H_0: the tested series are non-stationary (a unit root exists)
- H_1: the tested series are stationary (a unit root does not exist)

Since non-stationarity can be assumed for the series analysed, and the said apparent regression cannot arise when using a stationary time series (the type I (0) series), the option is offered here to remove it by differencing (stationing) individual analysed series. However, research carried out by authors such as Banerjee et al. [2] have demonstrated that this path cannot proceed, because it will result in the loss of important information on long-term relationships between the properties of time series. Engle and Granger [10] used for the analysis of unsteady relationships between series, the EG test, which is able to analyse cointegration of non-stationary time series according to the following hypotheses:

- H_0: Test series are not cointegrated
- H_1: Test series are cointegrated

Decisions on the relationship between time series are based on p values defined by the EG test. If the null hypothesis (p> 0.05) is not rejected, the time series will be identified as non-cointegrated – thus, for series between which there is no long-term relationship, or for series which contain no common element and examining them as a system is irrelevant since they have developed over the long term independently. Otherwise (in cases where p <0.05) the time series will be identified as cointegrated; i.e., for series between which a long-term relationship can be demonstrated at a level of significance.

Very often VAR models are used to test mutual relationships between variables. The concept of causality, which was introduced by Engle and Granger [10] and Sims [18], is used in econometric analysis. Whether the investigated variables are endogenous can be tracked in the simplified two-equation model. The reason for testing causal relationships (i.e., causality) according to the definition of Engle and Granger is to determine whether certain variables' changes come before the changes of other variables. Which variable is the cause and which is the result is not determined. Granger [11], [10] proposed simple testing procedures for verifying the validity of the two conditions listed above, which are derived from the VAR models. When testing the hypotheses, the following applies:

- H_0: the variable Xt does not Granger-cause the variable Yt.
- H_1: the variable Xt does Granger-cause the variable Yt.

III. Results

Based on the model selected, we can proceed to analyse the development of GDP, depending on the evolution of the volume of loans.

In Table I, we have listed the basic results of methodical procedure – specifically, the value of the Akaike information criteria. This helps in selecting an optimal lag time. The optimal lag time is the one for which the AIC value is the lowest – in our case, this is a lag time of two quarters.

TABLE I
Results of Optimum of Delays

Order of Delays	AIC for *Y*
1	21.3357
2	20.9078
3	20.9423
4	20.9795

Source: Authors' own work based on [6], [7]

Next, we test the time series' stationarity using (1). The results are listed in Table II.

The initial data are nonstationary. We obtain stationary data after modifying the data using the first difference. The next step is to conduct the Engle-Granger test. The p-value is 0.3455 (i.e., greater than 0.05), so we can therefore accept H0, that the given time series are not cointegrated.

TABLE II
Results of ADF Stationarity Test for Total Loans and GDP

Order of Delays	AIC for *Y*	AIC for ΔY
Model	P-value	Evaluated result of ADF test
	Test with constant	
Y	0.1632	Time sequence is non-stationary
Uc	0.3928	Time sequence is non-stationary
	Test with constant	
1st difference Y	0.0249	Time sequence is stationary
1st difference Uc	0.0033	Time sequence is stationary

Source: Authors' own work based on [6], [7]

In accordance with the EG test, the presence of a unit root is then tested using the ADF test. Based on the calculated *p*-value of 0.3455, we cannot reject the null hypothesis of the existence of a unit root at the selected significance level of 0.05. In this case, no evidence of any co-integrated time sequence has been shown.

Because the time series are not cointegrated, we are able to proceed to the next test within the analysis – testing for the Granger causality.

TABLE III
Results of Granger Causality in Absolute Values

Null hypothesis	Delay	P-value	H0
Uc does not causally act on *Y*	1	0.8998	Not rejected
Uc does not causally act on *Y*	2	0.0214	Rejected
Uc does not causally act on *Y*	3	0.2293	Not rejected
Uc does not causally act on *Y*	4	0.2248	Not rejected
Uc does not causally act on *Y*	5	0.8497	Not rejected
Uc does not causally act on *Y*	6	0.4032	Not rejected
Uc does not causally act on *Y*	7	0.7114	Not rejected
Uc does not causally act on *Y*	8	0.6766	Not rejected

Source: Authors` own work based on [6], [7]

Table III shows the values obtained from the Granger test of time causality. Based on the *p*-values, we will decide whether there is any dependence between the development of bank loans and GDP growth in terms of Granger causality. The outputs of the tests reject the null hypothesis that the variables of the total loans affect GDP growth with a mid-year delay, where the *p*-value is lower than 0.05. This is only in the case of a lag time of two quarters. From the economic perspective, we can state that using the time series of total loans allows us to better predict how the GDP time series develops at a 0.05 level of significance.

IV. Discussion of Results

The model tested here – where the economy's output volume, measured using GDP, is correlated with the growth of granted loans – has been confirmed to a limited degree.

We say "to a limited degree," because long-term relationships were not revealed between the variables being studied, i.e., cointegration. On the other hand, the significance of the short-term relationships was proved (calculated using Granger causality), because employing bank loan development can provide better predictions of economic growth as measured by GDP.

As statistically significant thus seems the time delay two

quarters, while rejecting the null hypothesis. We can state that causality has been statistically proven.

Our findings thus agree with the majority opinion introduced in the studies mentioned previously. Furthermore, there is clearly no complete dependence of the development of GDP on the development of bank loans. This is due to the fact that economic realities are affected by many other factors which influence the development of the economy. As the most important, we must mention the influence of the monetary policy of the central bank. It both indirectly affects the supply of loans by setting interest rates and also uses other instruments. In the Czech Republic in the period under review, we must point out foreign exchange intervention to weaken the Czech crown (koruna), which led to economic growth. Furthermore, a significant effect of fiscal policy is apparent, which in the first response to the crisis after 2008, was too restrictive and thus undermined economic growth. On the contrary, in recent years, according to many economists, there has been a much too expansive view on how the Czech economy is thriving. Another factor is definitely the confidence (or optimism or pessimism) of consumers and companies in future economic development. Furthermore, we should draw attention to the risks arising from any excessive credit expansion that in the Czech Republic has already led to an increase in unpaid loans and thereby threatens the banking sector and the economy. At the present time, however, banks operating in the Czech Republic operate according to good-quality and credible credit models and, at least in the near future, this credit overhang is not a threat.

V. Conclusion

The aim of this article was to evaluate the effects of lending in the Czech banking sector on the growth of the Czech economy. Based on our research, we have concluded that there is a positive relationship of lending on economic development, which is now accepted as a standard economic conclusion. In our investigation, we drew on data from the Czech National Bank and the Czech Statistical Office on the development of bank loans and economic development between 2004 and 2015. Our research is established on the basis of examining the relationship of the two aforementioned variables using Granger causality. To implement this, it was first necessary to test delays of the dependent variable GDP, as well as stationarity and co-integration. In our calculations, we concluded that the development of bank loans causally affects the development of GDP. Thus, the hypothesis was confirmed that the growth rate of loans is linked to the growth of economic performance. However, even in our data, discrepancies with this conclusion can be seen in certain years, which can be explained in that, in reality, a number of other variables operate within the development of the economy. Among the most important in the Czech Republic, we may include the effects of monetary and fiscal policy and the confidence of companies and consumers. Our study can be thus seen as a contribution to economic thinking on the relationship between the development of bank lending and economic development. It also serves as a cornerstone for further exploration of the fundamental economic factors on economic development.

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