DOES A RELATIONSHIP EXIST BETWEEN THE DEVELOPMENT OF THE BANKING SECTOR AND THE ECONOMIC GROWTH OF EUROZONE?

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ABSTRACT

The goal of this paper is to discover the relationship between select banking sector indicators and the economic growth of the Eurozone. Loans provided by banks to the private non-financial sector and the M3 banking aggregate were chosen from among select banking sector indicators. Both absolute values and year-to-year changes are tested for these values. The Eurozone's economic growth was evaluated using the development of GDP. The aforementioned relationship between these values is analyzed using the Engle-Granger cointegration test. These tests are conducted on select statistical data from the years 2000 to 2013. The input data are quarterly in nature and have been seasonally adjusted. Before using the Engle-Granger cointegration test, it is necessary to test the time series for the optimal magnitude of delay, where the dependent variable is considered the value of GDP, i.e., ΔGDP. In order to be able to proceed to testing the cointegration of the time series using the Engle-Granger test, it was necessary to eliminate the series that do not meet the basic prerequisites – consequently, the existence of a unit root, i.e. the non-stationarity of the original time series. In light of the results of the Dickey-Fulller test, it was necessary to eliminate the time series of year-to year changes in GDP, because the time series of the Eurozone's year-to-year GDP changes indicate stationarity at a level of significance of 0.05. For determining the cointegration relationship, it is possible to proceed with the Engle-Granger test, which is meant to determine the long-term relationship between the values – between the amount of bank loans provided to the private non-financial sector and GDP and between the M3 aggregate and GDP. On the basis of these tests, it was found that there is no cointegration relationship between any time series at a level of significance of 0.05; this means that no long-term relationship was found between the amount of bank loans provided to the private non-financial sector and GDP or between M3 and GDP. It is necessary to realize that the impact of the global financial crisis was being experienced during the period analyzed, i.e., between 2000 and 2013. It is possible that this is the reason why is not possible to statistically confirm the long-term positive influence of the banking sector on the economic growth of the Eurozone.

Keywords: *banking sector, cointegration test, economic growth, Eurozone, GDP*

1. INTRODUCTION

The banking system has become an essential component of every country's national economy. The same as other sectors, banking has features and specifics that typify it; these have adapted to the internal and external influences of the economic sector. Banks are financial institutions that act as intermediaries for payments, provide loans, and accept deposits from clients. Bank development is closely related to the way money develops. Most often, central banks' primary

macroeconomic goals are to maintain price stability, support full employment, and support economic growth. Their objectives are achieved by using monetary policy instruments – by setting interest rates, open market operations, interventions on the currency market, or monetary reserve adjustments in the economy via a transmission mechanism with various transmission channels. The banking system in the European Union is unique in that there is a European Central Bank plus national central banks and commercial banks in individual countries. The Eurozone is composed of the 19 European Union countries that have introduced the euro, beginning in 1999. (Cernohorska, 2015)

Essentially, being a financial intermediary consists of the process of using the resources of economic entities to finance loans for entities in the real economy. This results in allocating loans from entities showing a surplus to entities showing a deficit. According to macroeconomic theory, this activity is necessary for an economy to operate effectively. Goldsmith made the first attempts at finding a relationship between the development of the banking sector and a given country's economic state. Goldsmith (1969) conducted the first empirically founded research on data of 35 countries from 1860 and 1963.

The size of loans provided appears to be a significant indicator of the economic growth of individual countries (the development of GDP) from the banking sector. According to research by the authors Levine (1999) and Beck et al. (2000), it is possible to explain economic growth better using loans provided only to the private sector than by using the indicator of loans provided overall. The goal of this paper is to discover the relationship between the selected banking sector indicators and the economic development of the countries in the Eurozone. Loans provided by banks to the private non-financial sector and the M3 banking aggregate were chosen from among select banking sector indicators. The relationship of these values was analyzed by the Engle-Granger cointegration test, as previously mentioned. These tests were conducted for select statistical data from the years 2000–2003. The input data were quarterly in nature and have been seasonally adjusted. On the basis of these tests, it was determined whether the banking sector had a positive, neutral, or negative influence on the economic development of the Eurozone countries. This paper is composed of the following sections: in Section 2, the authors list a review of the literature relating to economic growth and the influence of the banking sector on economic growth. Section 3 presents the theoretical foundation for conducting the Engle-Granger cointegration test. In Section 4, analysis of the banking sector indicators is conducted for economic growth in the Eurozone using the Engle-Granger cointegration test. In Section 5, the authors present their conclusions and state closing remarks.

2. THEORETICAL BACKGROUND

Many economists consider finance to be one of the most important factors in economic development. Robinson (1952) states that financial development is followed by economic growth. Levine and Zervos (1996) demonstrated that financial markets positively influence countries' economic development, because they discovered a very strong positive correlation between stock market liquidity (measured by the relationship of trading value to the size of the given economy) and the level of economic growth in data from 49 countries from 1976–1993. On the basis of this research, stock market liquidity was also demonstrated to be a strong predictor of the future development of GDP per capita.

Likewise, Atje and Jovanovic (1993) found a significant correlation between stock markets and economic growth in their study analyzing data from 40 countries from the years 1980–1988.

On the basis of research by Arestis et al (2001), it is nonetheless possible to assume the fact that the development of the financial markets does indeed lead to economic growth, but that the impact of banking sector development on individual countries' economic growth is fundamentally greater.

Many authors have devoted themselves to understanding how the banking sector (banks) can affect the economic growth of individual countries in their international research work. Thanks to lower costs for collecting and processing information, financial intermediaries (banking institutions) are able to achieve better resource allocation (Boyd & Prescott, 1996). The development of the banking sector can achieve better prospects for initiating successful business activities – and therefore faster economic growth or technological development for the given country (King & Levine, 1993). The results of another study (Cetorelli & Gamera, 2001) show that the banking sector makes it easier for "young" companies to receive loans and thus supports the tempo of economic growth, because the investments of new companies are more likely to be invested in innovative technology. Bencivenga and Smith (1993) come to the conclusion that, thanks to reduced monitoring costs, the banking sector can lower even above-average credit rationing and thereby ensure the acceleration of a country's economic growth. In their study, Gurley and Shaw (1995) state that financial intermediaries are able to ensure the mechanism necessary for trading, pooling, and diversifying risk. This fact can facilitate a company's access to projects with higher expected profits, i.e., with positive impact on a given country's economic growth. Levine (2005) used empirical research to prove the interconnection between the operation of the financial system and economic growth. In light of these facts and on the basis of research in academic literature, the relationship between the value of M3 (the so-called primary indicator of the volume of money in an economy) and GDP appeared to be the most suitable relationship. This relationship has also been analyzed by the authors' King and Levine (1993a, 1993b), for example. They confirmed that it is possible to explain the economic growth of more than 80 countries using this indicator.

3. METHODS AND DATA

In light of the paper's objective, the concept of cointegration – dealt with primarily by the authors Granger and Engle (1987) – is used to investigate the how the indicators of loans provided by banks to the private non-financial sector and M3 affect GDP in the Eurozone countries.

In an attempt to achieve up-to-date output, individual tests are conducted on quarterly data from the years 2000-2013 that have been seasonally adjusted. The data are derived from the Research Division of the Federal Reserve Bank of St. Louis (FRED) – data on gross domestic product at constant prices and the M3 monetary aggregate – and from the Bank for International Settlements (BIS) – data on the amount of bank loans provided to the private non-financial sector.

First, the time series that have been presented here are always tested for optimal lag length. This is done using the Akaike information criterion (AIC), when the best lag (used later in the subsequent tests) is always taken to be the lowest AIC value.

$$(M) = ln\sigma a\, 2 + 2M/T \qquad (1)$$

The tests are conducted on the basis of the relationship of the values in (1), where M expresses the number of parameters, $ln\sigma a2$ denotes residual variance, and T is the number of observations (Arlt & Arltová, 2007). The next step in the analysis is verifying the existence of a unit root (invariance of the random variable over time), thus determining whether it is a stationary or non-stationary time series. 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. For more details, see Dickey and Fuller (1979). 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 (2), where we test that Ø=0 (the variable contains a unit root), takes the following form (Arlt & Arltová, 2007):

$$\Delta Xt = (\emptyset 1 - 1)Xt - 1 + \sum_{i=1}^{p} \alpha i\, Xt - 1 + et \quad (2)$$

X_t 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)

If the time series are non-stationary in nature, the process continues with cointegration analysis, which is conducted here using the Engle-Granger cointegration test (Engle & Granger, 1987) according to the hypotheses listed below.

- H_0: the tested series are not cointegrated
- H_1: the tested series are cointegrated

The decision on the time series' relationship is based on the p value as defined by the Engle-Granger cointegration test. If the null hypothesis is not rejected ($p > 0.05$), the time series will be considered non-cointegrated – thus, as series without the existence of a long-term relationship between them. In the opposite case ($p < 0.05$), the time series will be considered cointegrated, i.e., series between which it is possible to show a long-term relationship at the level of significance.

4. THE INFLUENCE OF SELECT BANKING SECTOR INDICATORS ON ECONOMIC GROWTH IN THE EUROZONE COUNTRIES

The Engle-Granger cointegration test is used to test the causal relationship between the overall amount of loans provided by banks to the private non-financial sector and GDP and between the M3 monetary aggregate and GDP. Both the absolute values and year-to-year changes are tested for these values.

The time series used are listed for the period of all four quarters of the year 2000 up to all four quarters of the year 2013. The absolute values of GDP, seasonally adjusted, are listed in constant prices either for the year 2009 or 2010. Table 1 shows a description of the variables used.

Table 1: A Description of the Variables Used for Bank Loans (Author's own work)

Variable Abbreviation	Variable Description
GDPEUR	The time series of the gross domestic product of the Eurozone, with seasonal adjustment
ΔGDPEUR	Year-to-year change of the time series of the Eurozone's gross domestic product, seasonally adjusted
BCEUR	The time series of the overall bank loans provided to the private non-financial sector of the Eurozone
ΔBCEUR	Year-to-year change of the time series of overall banking loans provided to the private non-financial sector of the Eurozone
MEUR	The time series of the M3 aggregate for the Eurozone
ΔMEUR	Year-to-year change of the M3 aggregate for the Eurozone

4.1. Test for Optimal Lag Length Using the Akaike Criterion

Before using the Granger causality test, it is necessary to test the time series for optimal lag, where the dependent variable is the value of GDP, i.e., ΔHDP. Tables 2 and 3 list the values of the AIC criterion for 4 lag lengths (the lowest value is always shown in bold type).

The optimal lag results determined that, according to the Akaike criterion's lowest values, a lag length of 2 always appears to be optimal for the absolute values of the dependent variable of GDP. The lag length is also 2 for the year-to-year changes of the listed values.

Furthermore, it is possible to state that the lowest AIC was achieved for absolute values in the Eurozone countries while including the constant. In the case of year-to-year changes, the lowest AIC value was likewise achieved when including the constant. Nonetheless, the length of the optimal lag is always the same in each test, even when the constants or trends of various AIC values are included.

Table 2: Results of the Optimal Lag for Bank Loans in the Eurozone (Author's own work using results of the program Gretl 1.9.4.)

Lag Length	AIC for GDPEUR	AIC for ΔGDPEUR
-	Test with the constant	Test with the constant
1	49.984407	2.822197
2	**49.688352**	**2.057152**
3	49.723992	2.086916
4	49.731454	2.114469

Table 3: Results of the Optimal Lag for M3 in the Eurozone (Author's own work using data processed by the program Gretl 1.9.4.)

Lag Length	AIC for GDPEUR	AIC for ΔGDPEUR
-	Test with the constant	Test with the constant
1	49.862320	2.721023
2	**49.329968**	**2.132477**
3	49.369137	2.168949
4	49.403809	2.203680

4.2. Verifying the Stationarity of the Time Series

Possible non-stationarity of data can lead to apparent regression; the difficulty with this lies mainly in the fact that using the least squares method would make it possible to obtain statistically significant parameter estimates of the regression function – even though the time series analyzed do not relate to each other. For this reason, it is necessary to test the time series used here with the help of an augmented Dickey-Fuller test.

The results of the ADF test for a unit root, in this case in the model with the constant, are shown in Table 4.

Table 4: Results of the ADF Test for Total Loans Provided by Banks (Author's own work using the results of the program Gretl 1.9.4.)

Variable Abbr.	Value of the P Parameter	Evaluation of the Results of the ADF Test	H_0:
GDPEUR	0.451	non-stationary time series	not rejected
BCEUR	0.333	non-stationary time series	not rejected
ΔGDPEUR	**0.002**	**stationary time series**	**rejected**
ΔBCEUR	0.799	non-stationary time series	not rejected

Table 5: Results of the ADF Test for M3 (Author's own work using the results of the program Gretl 1.9.4.)

Variable Abbr.	Value of the P Parameter	Evaluation of the Results of the ADF Test	H_0:
GDPEUR	0.451	non-stationary time series	not rejected
MEUR	0.364	non-stationary time series	not rejected
ΔGDPJAP	0.168	non-stationary time series	not rejected
ΔGDPEUR	0.002	**stationary time series**	**rejected**
ΔMEUR	0.734	non-stationary time series	not rejected

As can be seen for the time series with absolute values, the time series were determined to be non-stationary at a level of significance of 0.05 (Tables 4 and 5). The time series of year-to-year changes in GDP for the Eurozone indicate stationarity at the level of significance.

4.3. Cointegration Analysis

In order to be able to proceed to testing the cointegration of the time series using the Engle-Granger test, it is necessary to eliminate the series that do not meet the basic prerequisites, i.e., the existence of a root unit – non-stationarity of the original time series. In light of the previous results of the Dickey-Fuller test, the ΔGDPEUR time series have been eliminated.

The results of the cointegration analysis for the remaining time series are listed in Table 6. The values of the coefficient indicate to us how much the dependent variable (GDP) changes when the exogenous variable (bank loans) increases by 1. The value of the *p* parameter indicated that the time series were non-cointegrated.

Table 6: The Results of the Engle-Granger Cointegration Test and the ADF Test for Bank Loans and M3(Author's own work using data processed by the program Gretl 1.9.4.)

Variable Abbr.	P Value	Lag Length	H_0:	Conclusion
GDPEUR-BCEUR	0.274	2	not rejected	not cointegrated
ΔGDPEUR-ΔBCEUR	the test was not conducted – it does not meet the basic requirements for conducting cointegration			
GDPEUR-MEUR	0.382	2	not rejected	not cointegrated
ΔGDPEUR-ΔMEUR	the test was not conducted – it does not meet the basic requirements for conducting cointegration			

The results of this test are relatively surprising. Nonetheless, despite this, it was possible to take them into account. As has been mentioned above, the time series used depict the period from 2000–2013. The culmination of the global financial crisis happened during this period, and non-conventional monetary and fiscal policy instruments were implemented in the eurozone countries and beyond. Even though a positive relationship has been previously demonstrated between the loans provided by banks to the private non-financial sector and GDP, mutual interconnection of these values was not demonstrated over the long term.

5. CONCLUSION

The indicators chosen for discovering the relationship between select banking sector indicators and economic growth in the Eurozone were the relationship between the size of bank loans provided to the private non-financial sector and GDP and between the M3 aggregate and GDP. First, optimal lag length was specified for all the time series analyzed using Akaike's criterion. Next, the presence of a unit root was analyzed using the Dickey-Fuller test. When the prerequisites were met, the next step was the Engle-Granger test for determining cointegration relationships, which was meant to determine the long-term relationship between the selected values. On the basis of these tests, it was determined that there is no cointegration relationship between any time series at a level of significance of 0.05. It may be quite surprising that no long-term relationships were discovered between the amount of bank loans provided to the private non-financial sector and GDP and between the M3 aggregate and GDP. Nonetheless, it is necessary to emphasize that the global financial crisis covered one third of the period under observation, i.e., the period of 2000–2013. It is possible that this is the reason why it was not possible to confirm the long-term positive influence of the banking sector on the economic development of the Eurozone countries.

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LITERATURE:

1. Atje, R., Jovanovic, B. (1993). Stock Markets and Development. *European Economic Review*, (p. 632-640). Elsevier B.V.
2. Arestit, P., Demetriades, P., Luintel, K. B. (2001). Financial Development and Economic Growth: the Tole of Stock Markets. *Journal of Money, Credit and Banking*, (p. 16-41). Ohio: The Ohio State University.
3. Arlt, J. a Arltová, M. (2007). *Ekonomické časové řady: [vlastnosti, metody modelování, příklady a aplikace]*. Praha: Grada.
4. Beck, T., Levine, R., Loayaza, N. (2000). Finance and the Sources of Growth. *Journal of Financial Economics*, **(**p. 261-300). Elsevier B.V.
5. Bencivenga,V., Smith, B. (1993). Some Consequences of Credit Rationing in an Endogenous Growth Model. *Journal of Economic Dynamics and Control*, (p. 97–122). Elsevier B.V.
6. Boyd, J., Prescott, E. (1986). Financial Intermediary-Coalitions. *Journal of Economic Theory*, (p. 211-232). Elsevier B.V.

7. Cetorelli, N., Gambera, M. (2001). Banking Market Structure, Financial Dependence and Growth: International Evidence from Industry. *The Journal of Finance*, (p. 617-648). American Finance Association.
8. *Consolidate banking statistic*. (2016). Retrieved 05.05.2016 from https://www.bis.org/statistics/consstats.htm
9. Černohorská, L. (2015). Impact of Financial Crisis on the Stability Banking Sectors in the Czech Republic and Great Britain. *Procedia Economics and Finance*, (p. 234-241). Elsevier B.V.
10. Dickey, D. A., Fuller W. A., 1979. Distribution of the Estimators for Autoregressive Time Series with a Unit Root. *Journal of the American Statistical Association*, (p. 427-431). American Statistical Association.
11. Engle, R. F., Granger, C. W. J. (1987). Co-Integration and Error Correction: Representation, Estimation, and Testing. *Econometrica*, (p. 251-276). The Econometric Society
12. Goldsmith, R. W. (1969). *Financial Structure and Development*. New Haven: Yale University Press.
13. *Gross Domestic Product*. (2016). Retrieved 20.02.2016 from https://fred.stlouisfed.org/series/GDP.
14. Gurley, J. G., Shaw, E. S. (1955). Financial Aspects of Economic Development. *The American Economic Review*, **(**p. 515-538). American Economic Association.
15. King, R. G., Levine, R. (1993). Finance and Growth: Schumpeter Might Be Right. *The Quarterly Journal of Economics*, (p. 717-737). Oxford: Oxford University Press.
16. King, R. G., Levine, R., 1993. Finance, Entrepreneurship, and Growth: Theory and Evidence. *Journal of Monetary Economics*, **(**p. 513-542). Elsevier B.V.
17. Levine, R. (1999). Law, Finance, and Economic Growth. *Journal of Financial Intermediation*, (p. 8-35). Elsevier B.V.
18. Levine, R. (2005). Finance and Growth: Theory and Evidence. *Handbook of Economic Growth*, (p. 865-934). Elsevier B.V.
19. Levine, R., Loayza, N., Beck, T. (2000). Financial Intermediation and Growth: Causality and Causes. *Journal of Monetary Economics*, (p. 31-77). Elsevier B.V.
20. Levine, R., Zevros, S. (1998). Stock Markets, Banks, and Economic Growth. *The American Economic Review*, (p. 537-558). American Economic Association.
21. Robinson, J. (1952). *The Generalization of the General Theory*. *The Rate of Interest and Other Essays*. London: MacMillan.