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ECONOMIC ACTIVITY AND BANK EFFICIENCY IN EU COUNTRIES

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Abstract. The performance of the financial sector is of paramount importance in the development of an economy. The financial sector serves as the primary conduit between those who save and those who invest. By virtue of the information available regarding both groups of economic agents, this conduit facilitates the reduction of information asymmetries and enables more expedient investment targeting in specific sectors deemed crucial for economic growth. For decades, research has been conducted on the relationship between the financial sector and economic growth in individual countries or groups of countries with the aim of providing governments with recommendations on specific measures that will improve the welfare of economic agents and achieve higher economic growth. It also examines whether there is a link between economic growth and financial sector development, or vice versa, from economic growth to financial sector development. In light of the pivotal role of financial intermediaries in the economic advancement of nations, this study seeks to examine and evaluate the extent to which the financial sector in EU countries fosters economic growth, or vice versa. Furthermore, the study examines and assesses the extent to which the financial sector contributes to economic growth, in addition to the direction of the relationship between the two. The data set encompasses the period between 2010 and 2022. In order to achieve the objectives of the study, a panel model is applied to the EU countries. Two indicators are employed to capture financial sector activity: namely, banking efficiency and market capitalisation. The non-parametric DEA method is employed for the purpose of more fully capturing and characterising the EU banking sector, with the objective of measuring banking efficiency. This study eschews the use of traditional indicators in favour of a more complex indicator, namely technical efficiency, which is measured by DEA. This approach allows for the conversion of inputs and outputs into a single measure of bank efficiency. In order to account for the growing role of capital markets in the decades following the global financial crisis of 2008, the estimated models include market capitalisation as an additional factor. The results of the balanced panel model estimation confirm that the EU countries are characterised by the "supply-side hypothesis", i.e., financial intermediaries are important for economic development, and the estimated relationships are positive. However, the models highlight the pivotal role of the banking sector in driving economic growth in the older EU countries, as market capitalisation has been demonstrated to have a limited impact on economic growth in these countries. This suggests that those responsible for economic policy should prioritise the improvement of the banking sector and encourage banks to play a more active role in intermediation, with the aim of achieving economic growth.

Keywords: bank efficiency, market capitalisation, EU countries, economic growth.

JEL Classification: G10, G21, C50

1. Introduction

Financial intermediaries play a pivotal role in economic development, as they possess comprehensive data on the needs of investors seeking resources and the preferences of savers who wish to deploy their surplus funds. Financial intermediaries play a pivotal role in reducing information asymmetries and facilitating the flow of financial resources between sectors.

The crucial role played by financial intermediaries gives rise to the necessity to examine whether, in the present context of a series of crises and economic transformations, the relationship between economic development and the performance of the financial sector is being sustained. The objective of this study is to ascertain whether such a link exists and, if it does, to determine how it is evaluated. Furthermore, the study investigates whether financial intermediaries contribute to the improved macroeconomic development of countries or whether the relationship is inverse.

There are a number of studies of this interaction in the economic literature that cover different time

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periods, different stages of country development, or different ranges of countries – for one country or a group of countries with similar development. In this study, a relatively long period of analysis was chosen – from 2010 to 2022 – to cover the period saturated with crisis processes caused by the global financial crisis, the European debt crisis, and the pandemic crisis. Although these crises are not homogeneous in nature and occurrence, they have a similar impact on the economic development of countries, particularly in relation to the banking sector.

Countries of the European Union (EU): Romania, Bulgaria, Lithuania, Estonia, Latvia, Hungary, Poland, Czech Republic, Slovakia, Slovenia, Austria, Sweden, Belgium, Cyprus, Spain, Germany, France, Greece, Finland, Croatia, Italy, Luxembourg, Ireland, Portugal, the Netherlands, Malta[1]. The selection of these countries is predicated on the fact that they are EU member states and espouse analogous perspectives on the implementation of policies that are common to the EU. It should be noted that some of the countries in question are already part of the euro area, while others are not. In terms of income levels, the countries in question are catching up at a faster rate with the old euro area members. However, there is room for improvement in terms of income and price levels in most of them, especially when compared to these indicators of the countries in the core of the EU.

In the EU countries studied, the banking sector remains the main intermediary unit, with financial intermediation measured at around 100% of GDP for the new EU candidate countries since 2004, with few exceptions, while this figure is higher for the core EU countries. In 2020, it reaches 312% in Sweden, 319% in the Netherlands, and 454% in France. At the same time, capital markets are less developed, accounting for about 30% of market capitalisation of GDP in the new EU countries and about 60% on average in the old EU countries.

The research makes a significant contribution to the field by encompassing a diverse range of countries, including those within the European Union, and by examining a substantial timespan. The study considers a range of indicators that characterise not only the banking sector, but also the performance of the capital market, which is becoming an increasingly viable alternative to bank financing. In addition, the bank's activities are taken into account through its efficiency, which is measured using the non-parametric method of Data Envelopment Analysis (DEA). The purpose of using this alternative measure is to capture the multitude of inputs that the banking sector uses in its operations to produce the relevant products provided to customers.

The study is structured in five sections. The introductory section sets out the rationale for the study and justifies the need for this research. The second part presents a review of the existing literature on the relationship between economic growth and financial development. The third and fourth sections are dedicated to the methodology and results of the estimated panel model for the relationship under investigation. The final section presents the principal conclusions reached during the course of the study.

2. Review of the Literature

In the field of financial development and economic activity, research has been conducted at the level of individual countries (Mihaylova-Borisova, 2015; Awdeh, 2012) and at the level of groups of countries (Dudian, Popa, 2013; Caporale et al., 2014; Mihaylova-Borisova, 2023).

Mihaylova-Borisova G. (2015) examines the relationship between banking efficiency and economic growth in Bulgaria over the period 2007-2013. Awdeh A. (2012) analyses the importance of the banking sector for economic growth in Lebanon over the period 1992-2011.

Dudian M., Popa R. (2013) presents an analysis of eight CEE countries for the period 1996 to 2011, employing five indicators to characterise the state of the banking system. These are: domestic credit as a percentage of GDP; the rate of change of domestic credit as a percentage of GDP; the rate of change of monetary aggregates; the interest rate spread; and non-performing loans as a percentage of the total loan portfolio. The estimated model is unable to demonstrate a positive correlation between domestic credit and economic growth, due to the influence of financial crises that occurred during the study period for the countries included in the scope.

Caporale M. et al. (2014) constructed a dynamic panel model for ten EU member states, simulating the period 1994-2007. Given the acknowledged diversity among these countries, the authors elected to categorise them into more homogenous subgroups. The results of the model indicate that economic growth is only to a limited extent influenced by developments in the financial sector. This can be attributed to significant discrepancies in the prevalence of non-performing loans. Furthermore, the limited impact of the financial sector can be attributed to the prevalence of significant crises in the countries under examination.

The relationship between economic activity and the performance of financial intermediaries can also be classified according to the type of indicators

[1] The study did not include Denmark due to the unavailability of data in the sources used for many of the indicators required to calculate bank efficiency and to construct the panel model

employed to assess the financial system. Some studies concentrate on a single indicator, whereas others employ a combination of indicators to characterise the financial system, with a particular focus on the banking system. The majority of studies focus on the application of indicators such as non-financial sector claims as a share of GDP (Mihaylova-Borisova, 2023; Guru, Yadov, 2019), monetary aggregates (Kovachevich, 2023; Guru, Yadov, 2019), banking efficiency (Mihaylova-Borisova, 2015; Mihaylova-Borisova, 2024) or market capitalisation as a percentage of GDP (Neimke, 2003).

Mihaylova-Borisova G. (2023) demonstrates a positive correlation between financial development and economic growth in CEE countries using the private sector bank credit indicator. Kovachevich M. (2023) employs the Autoregressive Distributed Lag (ARDL) model to investigate the short-term and long-term relationships between economic growth and the broad money-to-GDP ratio in CEE countries, namely Bulgaria, the Czech Republic, Hungary, Poland and Romania, over the period 2007-2021. The author corroborates the existence of a relationship between the examined indicators over the long term for all countries.

Another important issue raised in research is the determination of causality. Paudel R. and Acharya Ch. (2019) argue that the financial sector matters for economic growth, i.e., they support the 'supply-side hypothesis' known in the literature. The reverse relationship, known as the "demand-side hypothesis" and related to the importance of economic growth for financial development, is proved in Awdeh A. (2012). Yildirim S. et al. (2013) confirm the bi-directional relationship between economic and financial indicators. The direction of the relationship may change under the influence of external factors, in particular, crisis phenomena.

A more comprehensive examination of the literature on the impact of the two indicators – economic performance and financial sector activity, with a particular focus on the banking sector – is presented by Mihaylova-Borisova G. et al. (2024).

3. Data and Methodology

3.1. Hypothesis

The study tests two hypotheses:

1. The financial sector is particularly important for economic growth in the EU, contributing to increased economic activity.

2. Indicators that characterise the financial development of EU countries, such as banking efficiency and market capitalisation, have a positive impact on economic activity.

3.2. Variables and Data Sources

To test these two hypotheses, official data on the activity of the EU banking sector published by the ECB for the period 2010-2022 are used (Table 1). Economic data for EU countries are taken from the World Bank database and market capitalisation data are taken from CEIC[2].

Table 1 presents the sources of these data:

Table 1
Variables and data sources

Variables	Sources
GDP – GDP growth rate, real terms, y/y, %	World bank
EFF – technical efficiency, measured by DEA	Own estimation, primary source for technical efficiency's calculation is the ECB
MCAP – market capitalisation, % of GDP	CEIC
INFL – inflation, measured by using CPI index, %	World bank

The only variable that should be calculated before being used in the model is technical efficiency. This is an indicator calculated using the non-parametric DEA method. This is one of a number of methods that are based on the production frontier and assume that banks are production units with inputs that produce the required outputs. Production frontier methods compare the performance of banks with that of the population as a whole. The objective is to determine how efficiently banks are able to use available inputs to produce a given level of outputs. The method can be applied to small aggregates of banks as well as large ones, which is its advantage. The type of production frontier does not need to be defined, as required by another method – the stochastic frontier approach. There are detailed descriptions of individual methods for determining the production frontier, their advantages and disadvantages, and practical application in Mikhailova-Borisova G. et al. (2024; 2015).

The technical efficiency indicator is calculated through the application of DEA and mathematical programming, with values ranging from 0 to 1. Banks that achieve technical efficiency, as indicated by a technical efficiency ratio of 1, form the production frontier, demonstrating the effective utilisation of inputs to attain the specified level of outputs. The DEAP 2.1 program is employed to solve the mathematical model and obtain the efficiency ratios.

Prior to the solution of the mathematical model, it is necessary to ascertain the inputs and outputs. A number of approaches to the determination of inputs and outputs are known in the literature. However, the

[2] The latest available data for all countries and all indicators are as of 2022.

most frequently used is the intermediation approach, which is particularly relevant in the context of banks, given their intermediation activity, consisting of the transformation of deposits into loans (Othman et al., 2016; Borisov, 2020; Mihaylova-Borisova, 2015; Mihaylova-Boriosova, 2024; Nenovsky et al., 2008). In this approach, deposits, fixed assets and borrowings in the sector are considered inputs, while loans and securities are regarded as outputs, representing the main income-generating assets.

The results obtained for the bank's efficiency as a result of applying the DEA method are presented in Figure 1 and Table 2.

The data presented in Figure 1 illustrate a decline in the efficiency of the banking sector in EU countries in the period immediately following a crisis, or approximately one year later[3]. Furthermore, in the aftermath of the global financial crisis of 2008, the efficiency of the EU banking sector witnessed a decline, reaching one of its lowest points in 2010. During this period, the number of the most efficient banking systems, namely those forming the production frontier, stood at a mere 12. Such relations are also observed in 2021, in the aftermath of the pandemic year 2020, when there is a further decline in the number of banking sectors exhibiting maximum efficiency.

Having elucidated the methodology employed in the derivation of the technical efficiency indicator, the ensuing data descriptive statistics are presented for the purpose of substantiating the research hypotheses (Table 3).

Prior to estimating the pertinent model, it is essential to ascertain the direction of causality, that is, whether economic growth exerts an influence on the enhanced performance of the financial system, or vice versa. The initial hypothesis must be tested. To this end, the Granger causality test will be implemented in the econometric software Eviews 10.

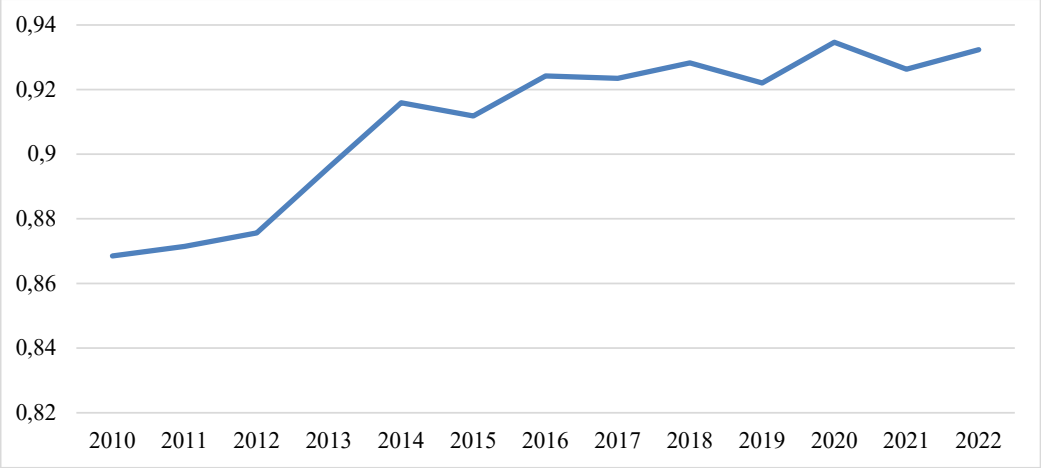

Figure 1. EU banking sector efficiency
Source: author's own calculations

Table 2
EU banking system's technical efficiency

	2010	2011	2012	2013	2014	2015	2016
Average value	0.869	0.871	0.876	0.896	0.916	0.912	0.924
Minimum value	0.529	0.541	0.466	0.475	0.472	0.557	0.608
Standard deviation	0.156	0.160	0.166	0.151	0.139	0.135	0.117
Number of bank sectors with maximum of technical efficiency of 1	12	14	14	14	14	13	14
	2017	2018	2019	2020	2021	2022	
Average value	0.923	0.928	0.922	0.935	0.926	0.932	
Minimum value	0.561	0.565	0.515	0.619	0.675	0.645	
Standard deviation	0.119	0.115	0.123	0.105	0.101	0.106	
Number of bank sectors with maximum of technical efficiency of 1	15	15	13	15	13	14	

Source: author's own calculations and presentation

[3] For a more detailed analysis of the technical efficiency of the banking sector in EU and CEE countries, the work of Mikhailova-Borisova et al. (2024) should be referred to.

Table 3
Descriptive statistics of variables

	GDP	INFL	EFF	MCAP
Total				
Average	2.205	2.246	0.910	45.33
Minimum	-11.325	-2.097	0.466	1.56
Maximum	24.370	19.705	1.000	393.04
Median	2.262	1.642	1.000	30.96
Standard deviation	3.700	3.055	0.129	49.66

Source: author's own calculations

The test is applied to both indicators of financial development, namely the relationship between technical efficiency and economic growth, and the relationship between market capitalisation and economic growth.

The results of the Granger causality test for the initial relationship indicate that the null hypothesis, which states that "EFF does not Granger cause GDP", is rejected at a probability of 1.21%, which is below the critical value of 5%. This implies that the causality is unidirectional, from technical efficiency to economic growth. In other words, an alteration in the level of efficiency within the EU banking sector affects the economic growth of these countries. In testing the second link between market capitalisation and economic growth, neither of the null hypotheses, namely that "GDP does not Granger cause MCAP" and "MCAP does not Granger cause GDP", can be rejected, as the probability is well above the critical level of 5%, 39.2% and 74.1% respectively. The results suggest that the relationship between economic growth and market capitalisation may be bidirectional. In light of the findings pertaining to the initial correlation between economic growth and technical efficiency, an econometric model will be constructed to elucidate the direction of influence, with a particular focus on the potential for financial development to drive economic growth.

For this purpose, the following panel model is estimated for EU countries:

$$GDP = f(EFF, MCAP, INFL) \quad (1)$$

where:

GDP – GDP growth rate, %;

EFF – technical efficiency;

MCAP – market capitalisation, % of GDP;

INFL – inflation as measured by the consumer price index, y/y, %.

The figure represents the gross domestic product (GDP) growth rate of EU countries in real terms. Figure 2 illustrates the evolution of real GDP in EU countries over the course of the study period. It is noteworthy that during periods of economic crisis, particularly in 2020 amidst the health crisis, there has been a notable decline in GDP in real terms.

EFF – the technical efficiency, measured by the DEA approach, which takes a value between 0 and 1. The indicator's impact on economic growth should be positive, as banks, thanks to their intermediation function, convert the deposits they

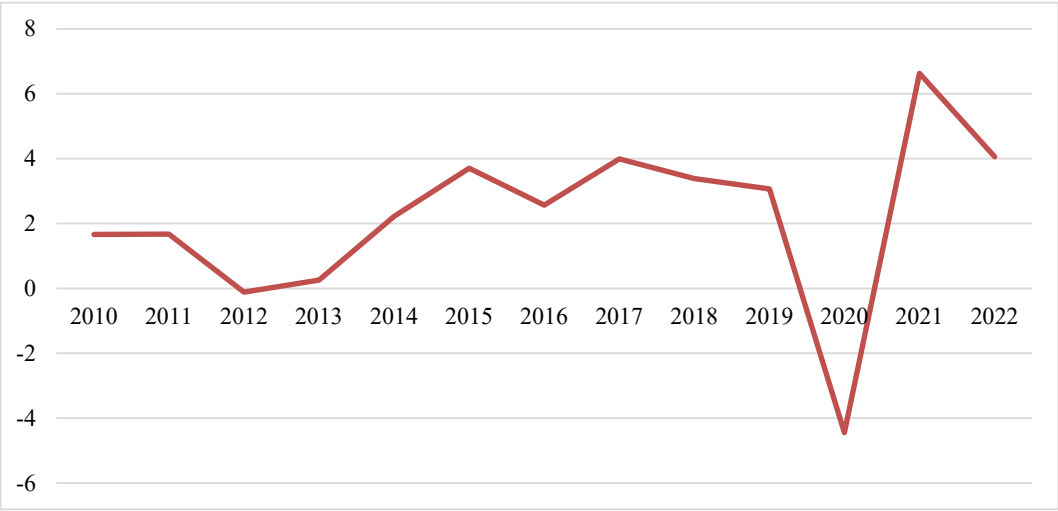

Figure 2. Real GDP growth in the EU, %

Source: World Bank, author's own calculations

receive into loans, and loans contribute to higher investment and higher and more stable economic growth.

MCAP – market capitalisation, % of GDP. Market capitalisation is expected to have a positive impact on economic activity, as increasing capitalisation indicates an increased demand for securities traded on capital markets, which means that economic agents have greater access to financing for their investments, which are useful for economic development.

INFL – inflation, %. A positive impact of inflation is expected as the economic literature proves that low and predictable inflation leads to economic growth (Iqbal, Nawaz, 2009). Fisher (1993) also proves that at low inflation rates positive economic growth is observed, but at high inflation rates the pre-inflation coefficient reverses from positive to negative. Figure 3 shows the inflation rate for the EU countries included in the study.

4. Results

The stationarity of the variables should be tested before estimating the model. Several unit root tests are used for this purpose, namely Levin, Lin and Chu t, PP-Fisher chi-square test and ADF-Fisher chi-square test. For each test, statistics and probability are presented to determine the integrated order of the variables, both dependent and independent.

Tables 4, 5 and 6 show that the GDP variable is stationary and integrated at I (0). At the same time, EFF is integrated at I (1) of the first order and MCAP and INFL are integrated at I (2) of the second order.

Two models are estimated: Model 1, which includes only technical efficiency as an explanatory variable for economic activity, and Model 2, which includes both financial variables.

The two models estimated are balanced panel models and cross-sectional fixed effects are included in their estimation. The results of the estimated models are presented in Table 7.

In Model 1, all coefficients on the independent variables are statistically significant at the 10% level or above. In Model 2, the coefficient on the pre-market capitalisation is not statistically significant at the 10% level, indicating that it is not a relevant factor in the economic development of EU countries during the period under study. Accordingly, the results of Model 1 are the focus of the subsequent analysis.

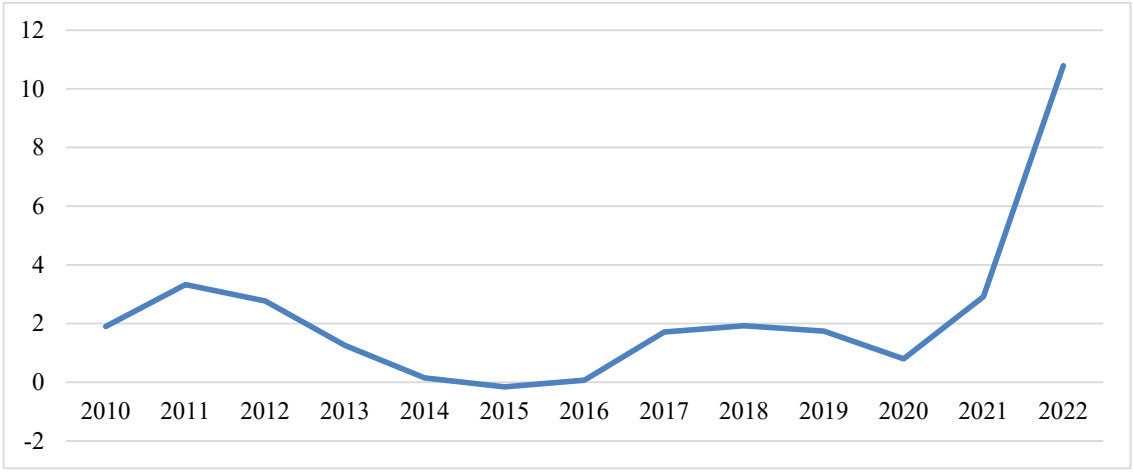

Figure 3. Inflation in the EU, %
Source: World Bank, author's own calculations

Table 4
Stationarity test results, variables' levels

Tests results		GDP	EFF	MCAP	INFL
		Null: Unit root			
Levin, Lin, and Chu t	*Statistic*	-7.618	0.638	0.704	0.446
	Probability	0.000	0.738	0.759	0.672
		Null: Unit root			
ADF-Fisher chi-square test	Statistic	128.063	13.983	39.823	23.079
	Probability	0.000	0.999	0.892	1.000
PP-Fisher chi-square test	*Statistic*	285.749	11.482	100.047	12.553
	Probability	0.000	1.000	0.000	1.000

Source: E-views, author's presentation

Table 5

Stationarity test results, variables' first difference

Test		EFF	MCAP	INFL
		Null: Unit root process		
Levin, Lin, and Chu t	*Statistic*	-5.689	-1.711	-5.423
	Probability	0.000	0.044	0.000
		Null: Unit root process		
ADF-Fisher chi-square test	*Statistic*	114.077	130.664	71.640
	Probability	0.000	0.000	0.037
PP-Fisher chi-square test	*Statistic*	193.935	383.658	51.145
	Probability	0.000	0.000	0.508

Source: E-views, author's presentation

Table 6

Stationarity test results, variables' second difference

Test		MCAP	INFL
		Null: Unit root process	
Levin, Lin, and Chu t	*Statistic*	-9.134	-6.372
	Probability	0.000	0.000
		Null: Unit root process	
ADF-Fisher chi-square test	*Statistic*	169.853	82.655
	Probability	0.000	0.004
PP-Fisher chi-square test	*Statistic*	451.164	134.779
	Probability	0.000	0.000

Source: E-views, author's presentation

Table 7

Regression equations result

	Model 1	Model 2
Constant	3.943433***	3.954359***
	12.78472	12.82155
D(TE(-5))	8.980351**	9.493896**
	2.350286	2.467544
D(D(CPI(-4)))	0.202252*	0.203081*
	1.931398	1.940502
GDP_GR(-1)	-0.262752***	-0.265647***
	-3.724778	-3.765548
GDP_GR(-2)	-0.250204***	-0.251166***
	-3.38627	-3.401224
D(D(MCAP(-1)))		0.008277
		-1.993236
R-squared	0.830	0.831
Adjusted R-squared	0.789	0.789
Prob(F-statistic)	0.000	0.000
Durbin-Watson stat	1.982	1.996
Cross-sections included	26	26
Total panel (balanced) observations	182	182
Sample adjusted period	/2016-2022/	/2016-2022/

* Significant, 10 percent level

** Significant, 5 percent level

*** Significant, 1 percent level

Source: E-views, author's own calculations

The regression model demonstrates a positive correlation between the technical efficiency of EU banks and the realised GDP growth. The coefficient on technical efficiency is the largest among the coefficients on the independent variables. The coefficient has a value of 8.98, indicating that a 0.1 increase in the technical efficiency gap over two consecutive years will result in a 0.9 percentage point increase in growth. The variable is included with a lag of five, and the coefficient preceding the variable is statistically significant at the 5% level. The inclusion of the lag variable is necessary because the process of improved banking sector efficiency taking hold and subsequently leading to increased investment and growth is a time-consuming one. The positive correlation between banking efficiency and economic growth across countries provides evidence in support of the supply-leading hypothesis, a conclusion that is also supported by the findings of Paudel R. and Acharya Ch. (2019).

The evidence presented by Fisher (1993) suggests that inflation, as measured by the consumer price index, has a positive impact on economic growth. The positive correlation between inflation and economic growth is substantiated by the relatively low and predictable inflation rate observed over the entire period, with an average of 2.25%. In the year 2022, a more substantial increase in prices was observed, due to a number of factors, including external factors such as the rise in energy commodity prices, the sustained expansionary monetary policy of central banks (Borisov, 2022a; Borisov, 2022b) and the outbreak of war between Russia and Ukraine. The dependent variable is included in the model with lags 1 and 2, which is indicative of the presence of cyclicality in economic systems.

5. Conclusions

The objective of the study is to ascertain whether there is a causal relationship between financial development and economic activity in EU countries. In recent decades, numerous studies have been conducted with the aim of assessing this relationship, covering different periods and countries. The present study tested this relationship by initially testing causality to determine whether the "supply-leading hypothesis" or the "demand-following hypothesis" is the more accurate representation of the data. To test the hypotheses under consideration, EU countries were included in the estimated panel model. To capture financial development, two variables were used: bank efficiency in EU countries and market capitalisation as a share of GDP to also capture financial intermediation in capital markets.

The findings of the estimated balanced panel model corroborate the hypothesis that financial intermediaries play a pivotal role in economic development within the European Union. The estimated relationship between banks' technical efficiency and economic growth is positive, thereby supporting the "supply-leading hypothesis". Nevertheless, the models highlight the pivotal role of the banking sector in driving economic growth in EU countries, as market capitalisation is found to have a limited impact on these countries' economic expansion. This suggests that those responsible for economic policy should prioritise the improvement of the banking sector and encourage banks to assume a more active role in intermediation, with the aim of achieving higher and more sustainable economic growth.

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