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THE IMPACT OF MONETARY AND FISCAL POLICY VARIABLES ON THE EU ECONOMIC GROWTH. PANEL DATA ANALYSIS*

Joanna Stawska ¹, Katarzyna Miszczyńska ²

¹University of Lodz, Faculty of Economics and Sociology, Department of Central Banking and Financial Intermediation, 39 Rewolucji 1905 r. street, 90-214 Lodz, Poland

²University of Lodz, Faculty of Economics and Sociology, Department of Public Finances, 39 Rewolucji 1905 r. street, 90-214 Lodz, Poland

E-mails:¹ joanna.stawska@uni.lodz.pl; ² katarzyna.miszczynska@uni.lodz.pl

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Abstract. The financial crisis of 2008-2009 has changed an approach to conducting monetary and fiscal policy. Changing economic conditions forced the economic authorities to make decisions that influenced an interaction between the central bank and the government (policy mix) in the European Union countries. The article aims to identify the impact of variables in the area of monetary and fiscal policy on the economy in the EU countries in existing economic conditions. The article verifies the hypothesis that variables from the monetary and fiscal policy have a statistically significant impact on the GDP per capita growth rate in the EU countries. To achieve the goal and verify the hypothesis, the following research methods were used: presentation of statistical data as well as statistical and econometric research methods (panel model). The rationale for the adoption of this topic was to examine the impact of central bank policy and government in the EU countries on their economies. The contribution of this article is to present the role of monetary and fiscal policy in the economic growth of the EU countries in 2000-2019. The results of the study indicate that the GDP per capita growth rate in 28 European Union countries in the period of 2000-2019 was statistically significantly affected by such variables as: interest rate (from the monetary policy area), GG deficit/surplus (the variable from the area of fiscal policy). This is important information in the context of conducting monetary policy and fiscal policy by relevant decision-makers, i.e., monetary authorities and fiscal authorities in the EU countries.

Keywords: economy; European Union; fiscal policy; monetary policy; policy mix; sustainable policy

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1. Introduction

In the period of 2000-2019 that is examined in this article, economic conditions in the European Union countries changed, affecting the decisions of their economic authorities. In 2004, 10 countries joined the European Union, then in 2008-2009, the financial crisis began, which turned into a crisis of public finances. The monetary and fiscal authorities of the surveyed countries tried to counteract the effects of the crisis, which most often contributed to an increase in public debt and budget deficit. As a result of the increase in budget deficits, the so-called Excessive Deficit Procedure was imposed on the EU countries whose GG deficit exceeded 3% of GDP, which resulted in a need for subsequent decisions of economic authorities relevant to the economies of these countries.

The main motivation to take up this topic is the fact that variables in the field of monetary and fiscal policy affect the economic activity of many countries. In this case, we wanted to check whether over the 20 years (2000-2019) these variables are important for economic growth in the EU countries in the conditions of many structural changes and economic shocks (such as the financial crisis or the debt crisis). Sen & Kaya (2015) emphasize that macroeconomic policy plays an important role in achieving economic, rapid and sustainable growth without worsening inflation (which, according to economic theory, is related to the level of interest rates), and the leading tools of macroeconomic policy are monetary policy and fiscal policy. Voda et al. (2022) emphasize that it is precisely ensuring fiscal stability in the EU Member States that has become an important task in the current economic situation. Appropriate economic policy can contribute to fiscal consolidation and to contain the fiscal shock that has consequences for national budgets. Suescun (2020) notes that fiscal policy should be viewed in terms of long-term fiscal plans and not in terms of single-term shocks, because fiscal policy is the process of initiating and implementing socio-economic measures by the government to prevent fiscal stochastic shocks that may have the effect of destroying the economic balance and limiting fiscal - budgetary sustainable development. Chugunov et al. (2021) contest that the policy mix should focus on increasing public welfare and maintaining long-term macroeconomic stability by achieving moderate inflation, sustained economic growth, debt sustainability and sustainable public finances. The priority of fiscal policy should be creating favorable conditions for economic growth by regulating revenues, expenses and budget deficit. In turn, the priority of monetary policy should be maintaining price stability. Hence, the main purpose of policymakers using monetary and fiscal policy tools is to respond to economic fluctuations. Although the main goal of monetary policy is to respond to a change in inflation and fiscal policy is focused on public finances, both policies can be used to respond to economic activity.

In this study, particular attention was paid to variables that come from the area of monetary policy and fiscal policy. The impact of changes in these variables on GDP per capita was observed in the EU countries. The article aims to identify the impact of variables in the area of the monetary and fiscal policy in existing economic conditions on the economy in the EU countries. The article verifies the hypothesis that the variables from the monetary and fiscal policy have a statistically significant impact on the annual GDP per capita growth rate in the EU countries. Annual statistical data for 28 countries of the European Union in the years 2000 - 2019 was used in the study. Based on this data, the fixed effects panel model was created. The explained variable was the annual economic growth rate per capita (presented in PPS) in the EU countries. On the other hand, explanatory variables included GDP per capita (presented in PPS) – the initial level (GDP per capita lagged by one period), investments as % of GDP, General Government (GG) deficit/surplus, short-term interest rate, R&D expenditure per capita and zero-one EMU variable - denoting membership in the euro area.

A novelty in this study compared to previously conducted studies is focusing specifically on monetary and fiscal policy variables. The research period is also interesting because it covers a period of 2000-2019, which includes the accession of 10 countries to the EU in 2004, the financial crisis of 2008-2009, the crisis of public finance and the excessive deficit procedure.

The structure of the paper is as follows. Section 1 is the introduction. Section 2 presents the findings of a review of studies on the determinants of economic growth in the field of monetary policy and fiscal policy. In Section 3, a panel model was presented for the European Union countries in 2000-2019. This section also explains the model's assumptions. Section 4 presents research results, their interpretations and discussion. The last section contains the conclusions.

2. Theoretical background

Economic growth depends on many factors, including social, economic, political, environmental and cultural ones. Probably not all of them significantly affect the rate of economic growth in all countries or regions to the same extent. Some of these variables most frequently recurring in numerous empirical studies are presented in the following publications: e.g. Harrod (1939; 1942); Kaldor (1960); Phelps (1961, 1966); Romer (1986); Lucas (1988), Solow (1988, p. 307); Romer (1990); Barro, (1991, pp. 407-444); Mankiw, Romer & Weil (1992); Nonneman & Vanhoudt (1996); Sala-i-Martin, (1997a,b, pp. 178-183); Fernandez, Ley & Steel (2001a, pp. 563-576); Fernandez, Ley & Steel (2001b, pp. 381- 427); Sala-i-Martin, Doppelhofer & Miller (2004, pp. 813-835); Moral-Benito, (2010; 2012); León-Gonzalez & Montolio, (2012); Tadesse & Melaku (2019, pp. 87-115). These are theories of economic growth that arose on the basis of Keynesian macroeconomics, as well as neoclassical models, alternative models of economic growth, or modern optimization models, models of endogenous growth, short-term and long-term models.

Most research on economic growth is based on the search for an explanation of why some countries experience sustained growth in per capita income and others do not (Lucas, 1988). Hence, many varieties of theoretical growth models have emerged in the literature, all of which point to different components of macroeconomic factors that affect per capita income growth. Considering exogenous growth models, pioneered by Solow (1956), it is believed that productivity growth can be explained by direct investment, population growth and technological progress. Solow believed that direct investment and population growth only affect the level of output and do not affect the long-term growth rate. Instead, technological progress is considered to be the only factor influencing the long-run growth rate of economies and is responsible for productivity differences between countries. According to Solow (1956), an increase in the return on capital is associated with innovation. In turn, following the definition of endogenous growth models, the focus was on the assumption that international productivity differences can be explained by factors that affect the efficiency of capital and cause its flight. These factors include: government spending, inflation, real exchange rates and real interest rates. Within endogenous growth models, capital used for innovation purposes is also mentioned, which can induce economies of scale and contribute to international productivity differences. Among the most important factors in this approach are knowledge, human capital, research and development. Capital investment is an important element of endogenous growth when used for innovation purposes, such as investment in innovative and intellectual capital (Frankel, 1962; Grossman & Helpman, 1991) and knowledge and skills (Lucas, 1988). In an extended version of endogenous models, factors affecting capital efficiency growth are, real interest rate (Gelb, 1989), fiscal policy (Barro, 1990; Barro & Sala-i-Martin, 1992), inflation (Bruno & Easterly, 1998) and real exchange rates (Rodrik, 2008).

This paper introduces to the study, among other things, the concept of convergence in economic growth theory. Convergence findings were initially related to the first endogenous economic growth models (Romer, 1990),

which were later enriched with new elements such as technology diffusion, capital flows or labour migration, factors more characteristic of exogenous economic growth models. It is worth adding that there are many concepts of convergence, which makes it difficult to classify them unambiguously. There are no unambiguous results concerning the convergence hypothesis understood as an equalization of GDP per capita levels of different economies. Among the factors that influence the convergence process are capital accumulation and/or technology. In the case of the decisive role of capital in the convergence process - the differences in the levels of GDP per capita of economies at different levels of development should disappear over time. However, if technology is the main determinant of the convergence process, then the convergence of GDP per capita levels will occur among countries with a similar level of development. Thus, convergence in the sense of an economy converging to its state of uniform growth is grounded in both neoclassical economic growth models (exogenous growth models) and endogenous growth models. Economic growth models point to various factors that influence the rate of convergence (Nowak, 2006).

Boldeanu & Constantinescu (2015) emphasized that the determinants of economic growth are related factors influencing the pace of economic growth and they indicated the division of these determinants into six groups (four of which were classified as supply determinants and the other two were productivity and demand). Supply factors are natural resources, capital goods, human resources and technology. The factors determining economic growth vary widely. These factors include public expenditure, capital accumulation, private or public investment, employment rates and exchange rates. It is worth adding that the impact of these determinants on economic growth also depends on whether a given economy is developed or not. Another division of determinants influencing economic growth consists in dividing these factors into direct and indirect ones. The direct ones include: human resources (including an increase in the number of the active population and investments in human capital), natural resources (i.e., land and underground resources), an increase in the capital employed or technological progress. Indirect factors include: institutions (such as financial institutions or state administration), the size of aggregate demand, savings rates, investment rates, the effectiveness of the financial system, budget and fiscal policies, labor migration, capital, and government efficiency.

As a consequence of the financial crisis that started in 2008, the debate on the effectiveness of monetary and fiscal policy in the field of economic activity was resumed. Guerguil et al. (2017) and Özer & Karagöl (2018, pp. 391-409) noticed that as a result of the crisis, monetary policy has a limited impact on economic activity when interest rates are entangled in a zero lower bound. Then, there is a tendency to agree on the strength of fiscal policy as an anti-cyclical macroeconomic policy tool. Pečarić et al. (2018, pp. 81-97) note that with the onset and passing of the 2008 economic crisis, the impact of fiscal policy on economic growth has regained its importance in the scientific and research community. This was due to the fact that with the advent of the crisis, many countries tried to alleviate its harmful effects through automatic stabilizers (social spending, unemployment benefits, etc.). Then, these countries tried to stimulate the economy financially, e.g. by an increase in public expenditure, tax policy reforms, which aimed at encouraging aggregation of demand and, consequently, the GDP growth. It should also be emphasized that along with the expansive fiscal policy, the public deficit and debt often increase. In turn, high indebtedness as indicated by Cecchetti et al. (2011) can significantly increase the risk premium affecting future financial activities. Also Kumar & Woo (2010) stated that the negative impact of high public debt on economic growth may be associated with a decrease in labor productivity caused by a decrease in investment activity. To sum up, fiscal policy as well as other economic policies have a key impact on both short and long-term economic activity.

Talos et al. (2013, pp. 605-617) whose research focused on analyzing the impact of fiscal and monetary policy on economic growth in the European Union (EU) countries noted a strong impact of interest rates on GDP evolution. Talos et al. (2013) noted that in the years 2000-2011, the increase in public debt had a negative impact on GDP growth, the interest rate had a strong negative impact, while the inflation rate and private consumption had a positive effect on GDP changes. Vinayagathasam (2013) emphasizes that usually with restrictive monetary policy

- prices, production, and demand for money are expected to decline, with interest rates rising and exchange rate appreciation. On the other hand, based on empirical research conducted for a sample of 32 Asian countries, it was pointed out that the factors conditioning and motivating economic growth are trade openness and the investment rate. In turn, inflation hampers economic growth when it exceeds 5.43%. As a result, monetary policy affects economic growth. Monetary policy instruments affecting economic growth that are most frequently mentioned in the literature include interest rate (Bernanke & Blinder, 1992, pp. 901-921), unsecured reserves (Strongin, 1995, pp. 463 - 497) and exchange rates (Fung, 2002).

Barro (1990, pp.103-125) or Barro & Sala-i-Martin (1992, pp. 645-661; 2003) indicate that endogenous growth models include channels through which fiscal policy can affect long-term growth. Easterly & Rebello (1993, pp. 417- 458) noticed that many fiscal policy variables are highly correlated with the initial level of income and fiscal variables are potentially endogenous (which is important in the context of endogenous theory of economic growth where state policy has a significant impact not only on the level of production, but it also determines the long-term growth rate). In the Cashin (1995, pp. 237-269) study, a positive relationship between government transfers, public investment and economic growth was estimated based on panel data for 23 developed countries in 1971-1988. However, a negative relationship was noted between distorting taxes and economic growth. Devarajan et al. (1996, pp. 313-344) showed that in 1970-1990, in 43 developing countries, current public spending had a positive impact on economic growth while government spending had a negative impact. As a result, Benos (2009) concludes that both expenditure and income (both sides of the general government budget) are important for sustainable growth in line with endogenous growth models. In the literature on the subject, it is estimated that private investment has a positive impact on economic growth. This is consistent with growth theory (McGrattan, 1998, pp.13-27) as well as empirical research (Levine & Renelt (1992, pp. 942-963); Cooley & Ohanian (1997, pp. 439-472); Dinopoulos & Thomson (2000, pp. 335-362); Bond et al. (2004). Economic openness is also positively affected by the openness of the economy affected by the dissemination of international knowledge spillovers of R&D driven by trade (Coe & Helpman, 1995, pp. 859-887; Lichtenberg & Van Pottelsberghe de la Potterie, 1998, pp. 1483-1491; Coe et al., 1997, pp. 134-149).

Research on the impact of monetary and fiscal policy factors on economic growth was conducted not only in European countries but also in various countries around the world. Interesting research was also conducted by Monamodi (2019), and it concerned the impact of fiscal and monetary policy on economic growth in the South African economies of members of the customs union (SACU) in the years 1980-2017. Public expenditure and revenues were used as variables representing fiscal policy, while real interest rate, inflation and M2 money supply were used as variables in the field of monetary policy. The results indicated that fiscal and monetary policy significantly affected long-term economic growth in all SACU member economies. Inflation and supply of M2 had a positive impact on economic growth in the studied countries. The real interest rate and official exchange rate negatively affected the economic growth in SACU member economies. Fiscal policy has a significant positive impact on economic growth if public expenditure is treated as a functional instrument of fiscal policy, not the state income. Additionally, using the Granger causality test, the direction of long-term relationships between variables was determined and it was noted that the direction emerges from public expenditure, real interest rate, inflation and the official exchange rate to economic growth.

Another example of similar research is the study of the relationship between fiscal variables and economic growth in Asian countries in 1985-2001 conducted by using dynamic analysis of panel data. It was examined whether components and aggregated public expenditure affect real GDP per capita and whether components and other aggregated fiscal variables affect real GDP per capita. A long-term relationship between fiscal policy and economic growth was noted. A positive and statistically significant impact of expenditure on health, education, aggregation of public expenditure and aggregation of other fiscal variables on real GDP per capita was observed (Abdullah et al., 2009).

3. Research objective and methodology

The implementation of the research objectives assumed in the study, together with the verification of the research hypothesis was based on the fixed effects regression model in the years between 2000-2019. The use of such modeling was dictated by the solutions used in the literature (Pečarić et al., 2018, pp. 81-97; León-González & Montolio, 2012). Based on the literature review and analysis of available data, potential variables were extracted. Table 1 presents the definitions of all variables in question.

Table 1. Description of variables used in the study

Variable	Abbreviation	Description
Growth rate of the real GDP per capita	GDP_GRTH	Growth of real GDP per capita in PPS. The GDP growth was calculated as follows: $\left(\frac{GDP_t}{GDP_{t-1}} - 1\right) \cdot 100\%$ Source: Eurostat
The real GDP per capita lagged by one year	GDP ₋₁	Chain linked volumes (constant prices from 2010), euro per capita in PPS Source: Eurostat
Research and Development (R&D) expenditure per capita	RD	Intramural R&D expenditure (GERD) by sectors of performance and source of funds. Expressed in Purchasing Power Standard (PPS) per inhabitant at constant 2005 prices
Total investment as a share of GDP (%)	INV	Investment share of GDP by institutional sectors Source: Eurostat Gross fixed capital formation as % of GDP for government, business and households sectors
Short term interest rates	IR	Three months interbank interest rates
General Government deficit/surplus as % of GDP	GG_DEF	IR Government deficit/surplus, Percentage of gross domestic product (GDP) Net lending (+) /net borrowing (-)
Membership to the euro area	EMU	Countries which joined the euro area: - in 1999.- Belgium, Germany, Ireland, Greece, Spain, France, Italy, Luxembourg, Netherlands, Portugal and Finland - in 2007: Slovenia - in 2008: Cyprus and Malta - in 2009: Slovakia - in 2011: Estonia - in 2014:Latvia - in 2015: Lithuania

Source: own elaboration

The creation of economic growth depends on many factors. In the study, the authors make an attempt to answer a question if the monetary and fiscal policy shape the economic growth of the country. In the years 2000-2019, the gross domestic product increased on average by 3.77% in the European Union countries. Detailed statistics are presented in Table 2.

Table 2. Summary statistics of variables in the European Union countries (N=28) between years 2000-2019

Variable	Mean	St. Dev.	Min	Max
GDP_GRTH	3.7751	4.4661	-15.232	35.422
GDP ₋₁	24045	11222	4900	79000
RD	8524.3	15321	16,678	1.0121e+005
INV	22.124	4.1147	10.140	45.600
IR	-0.068116	2.5036	-39.000	21.000
GG_DEF	-2.3650	3.5082	-32.100	6.9000

Source: own elaboration

On the basis of the panel sample consisting of 28 countries and 20 observations over time (data for the years from 2000 to 2019), a preliminary pooled panel type estimation of a model was conducted (Hsiao, 1986; Baltagi, 2008; Brañas-Garza et al. (2011, pp. 3-11). The preliminary research was carried out while maintaining stationary variables (Barbieri, 2005, pp. 117-158). The stationarity of the variables was checked with Levin, Lin & Chu test (LLC) (Levin et al., 2002, pp. 1-24; Kleiber & Lupi, 2010). The stationarity results are presented in Table 3. As a result the variables GDP, RD that turned out not to be stationary, were transformed by the first differences or logarithms.

Table 3. Levin-Lin-Chu unit-root test for the variables.

Variable	p-value	H0: Panels contain unit roots H1: Panels are stationary
GDP_GRTH	0,000***	H1
GDP ₋₁	0,4833	H0
INV	0,0145**	H1
RD	1,000	H0
GG_DEF	0,0001***	H1
IR	0,000***	H1

The LLC test is conducted only for the non-binary variables; significance levels: $\alpha = 0.10^*$, 0.05^{**} , 0.01^{***}

Source: own elaboration in Gretl.

Moving forward, the appropriate estimation procedure was determined, after a prior analysis of panel tests. The final catalogue of variables determining the gross domestic product growth was chosen with the help of the Variance Inflation Factor, partial correlation coefficients and t-Student significance tests. The study was conducted in two variants. In Variant II, in addition to the same variables used in Variant I, a zero-one variable was added - EMU, related to the membership of a given country in the euro area. Membership in the euro area determines the monetary policy of a given country, i.e. interest rates, or the same currency in the EMU countries. The authors wanted to check the importance of membership in the euro area for the dynamics of economic growth.

Table 4 contains the results of tests confirming the selected estimation method.

Table 4. Diagnostic tests for panel data model verification in both variants

Hypotheses	Variant I - Tests	Variant II - tests
H ₀ : is the OLS model H ₁ : is the FE model	F (27, 499) = 3,38541 with p – value =4,51695e-008	F (27, 497) = 3.336 with p – value = 6.87975e-008
H ₀ : is the OLS model H ₁ : is the RE model	Breusch-Pagan test LM=23.2213 with p-value = 1,44389e-006	Breusch-Pagan test LM=20.1872 with p-value = 7.02221e-006
H ₀ : is the RE mode H ₁ : is the FE model	Hausman test H = 27,8591 with p value p = 3,87813e-005	Hausman test H = 28.2248 with p value p = 8.52319e-005

Note: OLS – ordinary least squares. RE-random effects model. FE-fixed effects model

Source: own elaboration in Gretl.

After verifying all tests (see Table 4), it was decided that a fixed effects regression model will be used to estimate the annual gross domestic product growth. Thus, in the further part of the article, the modeling of economic growth will be presented using fixed-effects model, whose formal notation, including the initial catalog of desired variables, is presented as follows:

$$GDP_GRTH_{it} = \alpha_i + \beta_1 GDP_{it-1} + \beta_2 INV_{it} + \beta_3 IR_{it} + \beta_4 GG_DEF_{it} + \beta_5 RD_{it} + \varepsilon_{it}$$

where: α_i - the fixed effect for the i-th country, β_1, \dots, β_5 - structural parameters of the model; ε_{it} - composite error term.

3. Results and Discussion

Modeling was carried out in two variants. Variant I had no EMU variable determining euro area membership. Variant II included the EMU variable.

Tables 5 and 6 present the results of the estimation of the model's parameters in both variants. All of the characters standing in front of the estimated parameters are in line with economic expectations. All variables that were included in individual models were classified into the following groups: (Kaldor, 1957), (Moral-Benito, 2012, pp. 566-579), (Sala-i-Martin et al., 2004, pp. 813-835), (Boldeanu & Constantinescu, 2015):

- 1) Human capital: research and development expenditures per capita (Coe & Helpman, 1995, pp. 859-887);
- 2) Fiscal policy: GG deficit/surplus, GDP₋₁ (Monamodi, 2019; Benos, 2009; Easterly & Rebelo, 1993, pp. 417-458);
- 3) Monetary policy: IR, Investments (Monamodi, 2019; Vinayagathasam, 2013);
- 4) Membership in the euro area: EMU (in Variant II)

Investments were in the group related to monetary policy because they are indirectly significantly related to the interest rates of central banks, which affects the level of interest rates on loans and thus the lending of banks affects the size of investment in the economy. This is confirmed by Keynes (1936), who indicates that a low interest rate means less entropy of the economic system and has a stimulating effect on investment and GDP growth.

Table 5. Estimation of the economic growth in the European Union countries (Variant I)

	<i>Coefficient</i>	<i>St. Dev.</i>	<i>t-Student</i>	<i>P-value</i>	
Fixed effects model, using 532 observations					
28 cross-sectional data units included					
Time series length = 19					
Dependent variable (Y): GDP_GRTH					
Robust standard errors (robust HAC)					
const	39.3334	6.27408	6.269	1.04e-06	***
l_GDP _{t-1}	-6.04342	0.452846	-13.35	2.10e-013	***
d_GGdef	0.480564	0.120535	3.987	0.0005	***
d_RD	0.00150427	0.000500501	3.006	0.0057	***
l_inv	7.88825	1.26225	6.249	1.10e-06	***
d_IR	-0.0730406	0.0263938	2.767	0.0101	**
VIF<10.0					
R ² = 41,89					
Note: Significance levels: $\alpha = 0.10^*$, 0.05^{**} , 0.01^{***} .					

Source: own elaboration in Gretl

Table 6. Estimation of the economic growth in the European Union countries (Variant II)

	<i>Coefficient</i>	<i>St. Dev.</i>	<i>t-Student</i>	<i>P-value</i>	
Fixed effects model, using 531 observations					
28 cross-sectional data units included					
Time series length = minimum 18, maximum 19					
Dependent variable (Y): GDP_GRTH					
Robust standard errors (robust HAC)					
const	40.9241	6.17693	6.625	4.15e-07	***
l_GDP _{t-1}	-6.28345	0.620819	-10.12	1. 10e-010	***
d_GGdef	0.484136	0.122898	3.939	0.0005	***
d_RD	0.00151314	0.000503533	3.005	0.0057	***
l_inv	8.05742	1.43472	5.616	1.10e-06	***
d_IR	-0.0724248	0.0262173	2.762	0.0102	**
EMU	0.507628	0.913225	0.5559	0.5829	
VIF<10.0					
R ² = 41,94					
Note: Significance levels: $\alpha = 0.10^*$, 0.05^{**} , 0.01^{***} .					

Source: own elaboration in Gretl

Thus, the interpretation of the model results was also carried out based on such division of variables. What is more, the VIF test confirmed a correct selection of variables for the model (they are available on request). It should be noted that due to the moderate strength of the correlation coefficient, results between both IR and INV variables were included in the model.

In the years 2000-2019, among the economic variables affecting the formation of economic growth were variables referring to: fiscal policy, monetary policy, and human capital. Those results also partially correspond with the

research conducted by Barro & Sala-i-Martin (1992, pp. 645-661; 2003), Bernanke & Blinder (1992, pp. 901-921), Cashin (1995, pp. 237-269), Abdullah et al. (2009), Talos et al. (2013, pp. 605 - 617), Pečarić et al. (2018, pp. 81-97), Monamodi, 2019).

It is worth interpreting the variable GDP per capita (l_GDP_{t-1}). This variable is associated with the convergence hypothesis denoting the dynamics of the economy towards a stationary state of equilibrium that appeared in the literature on economic growth in the 1950s as an implication of the assumptions of the neoclassical Solow-Swan growth model. However, the greatest development of empirical research on economic convergence occurred in the 1990s, which is directly related to the discussion on growth theory. The reference point for the modern perception of convergence, understood as the convergence of a group of economies to a common or similar state of equilibrium (characterized by a similar level of wealth and a similar rate of economic growth) is the publication of Baumol (1986, pp. 1072-1085). Thus, the process of economic convergence means that relatively poorer countries experience a higher rate of economic growth than rich countries, which is also confirmed by the minus sign with the GDP_{-1} variable in our study. Barro (1991), based on panel regressions in 98 countries over the period 1960-1985, finds a negative association between the growth rate of real GDP per capita and the initial (1960) level of real GDP per capita.

In the years 2000-2019, an increase in economic growth was most affected by investments (INV). An increase of one percentage point in the share of total investment determined a rise of 7.89 (in Variant I) and 8.05 (in Variant II) in GDP growth, *ceteris paribus*. An increase of one percentage point of interest rate determined, between the years 2000-2019, a fall of 0.07 unit in GDP growth, *ceteris paribus*. Barro (2003) confirms the positive relationship between GDP growth per capita and investment based on panel studies.

R&D expenditure also had a positive impact on the economic growth rate in EU countries over the period considered. R&D is an important contributor to economic growth by positively affecting innovation and total factor productivity (Romer 1990). In economic theory, there is a noticeable emphasis on the accumulation of R&D and human capital in the context of economic growth. It is often measured by how much production will increase when the level of expenditure on R&D increases. This is measured by estimating the production flexibility in relation to capital stock and exactly this is equal to the rate of return to R&D multiplied by the share of the R&D stock in output (Aghion & Howitt, 1992). Blanco et al. (2016) They even recommend that, in view of the existing evidence of synergies between human capital and their own R&D and R&D from other countries, the continual need for countries to strive to improve achievement in education, science, technology and engineering and mathematics, which are key to research and development and thus economic growth.

In turn, the variable - GG deficit or surplus also had an impact on economic growth in line with previous research results. Thus, the decline in GG deficit had a positive impact on the GDP growth rate. In the literature, it was mainly Keynes (1936) who emphasized that in the process of stimulating demand and employment (especially in periods of lower demand than supply of goods and services), the budget and government spending play an important role. It is government spending that can be used to stimulate the economy by inducing investment precisely through government investment (fiscal policy) and lowering real interest rates (monetary policy). Keynes also noted that there are situations when the economy is unable to respond to the price mechanism and return to equilibrium. Hence, counter-cyclical fiscal policies are suggested to reduce the amplitude of the business cycle during the depression and to influence economic growth in the short-run (as market forces influence economic growth in the long run).

Additionally, the authors attempted to check whether the country's presence in the euro area influences economic growth. However, on the basis of the proceedings, this supposition was not confirmed. The EMU variable was not statistically significant. Thus, the statement was made that the country's presence in the eurozone does not have a significant impact on economic growth in the European Union countries.

Conclusions

On the basis of the conducted research, determinants shaping the creation of the economic growth in the European Union countries were distinguished. The constructed econometric model included variables reflecting the fiscal and monetary policy and human capital. The variables which occurred to be the determinants of gross domestic product growth were also confirmed in the literature review. According to the main goal, which was the identification of the impact of variables in the area of the monetary and fiscal policy in existing economic conditions on the economy in the EU countries, it must be underlined that the impact of chosen variables corresponding with those policies was significant.

The added value of this study is the original approach, which includes the variable monetary and fiscal policy area; GDP variable denoting the wealth of the economy, allowing observation of the convergence phenomenon; R&D relevant to the rate of economic growth. In addition, the panel study allowed to indicate that in the period of 2000-2019 (covering many variables significantly affecting the economic situation in the EU countries), variables in the area of monetary and fiscal policy had an impact on the GDP growth rate. It is worth emphasizing that variables in the area of monetary and fiscal policy are important for sustainable economic growth, hence it is necessary to emphasize their importance in the economy.

Even though the conducted research presents a contribution to the state of research, some limitations should be considered when interpreting the results. Firstly, the time range of the analysis should be extended and, if possible, presented quarterly. In addition, it also seems reasonable to extend the analysis to other non-European Union countries. In this way, the analyzed phenomenon could be captured more completely. This would allow checking the applicability of these findings to other European countries. Therefore, future research should include conducting inference in a broader group of countries to ascertain if the present findings are specific to the selected group of countries or are applicable to other countries as well.

References

Abdullah, H. Habibullah, M.S., & Baharumshah, A.Z. (2009). The effect of fiscal variables on economic growth in Asian economies: a dynamic panel data analysis. *International Journal of Business and Management*, 4(1) <https://doi.org/10.5539/ijbm.v4n1p56>

Aghion, P., & Howitt, P. (1992). A model of growth through creative destruction. *Econometrica*, 60, 323-51. <https://doi.org/10.2307/2951599>

Baltagi, B. (2008). *Econometric Analysis of Panel Data*. Chichester. 4th ed. Wiley.

Barbieri, L. (2005). Panel unit root tests: a review. *Journal of Statistics: Advances in Theory and Applications*, 1(2).

Barro, R.J. (1990). Government Spending in a Simple Model of Endogenous Growth. *Journal of Political Economy*, 98(5). <https://doi.org/10.1086/261726>

Barro, R.J. (1991). Economic growth in a cross-section of countries. *Quarterly Journal of Economics*, 106. <https://doi.org/10.2307/2937943>

Barro, R.J. (2003). Determinants of Economic Growth in a Panel of Countries. *Annals of Economics and Finance*, 4, 231-274

- Barro, R.J., & Sala-i-Martin, X. (2003). *Economic Growth*. MIT Press.
- Barro, R.J., & Sala-i-Martin, X. (1992). Public Finance in Models of Economic Growth. *Review of Economic Studies*, 59. <https://doi.org/10.2307/2297991>
- Baumol, W. (1986). Productivity Growth, Convergence and Welfare: What the Long-Run Data Show. *American Economic Review*, 76.
- Benos, N. (2009). Fiscal policy and economic growth: empirical evidence from EU countries. MPRA Paper. University Library of Munich, Germany.
- Bernanke, B.S., & Blinder, A.S. (1992). The Federal funds rate and the channels of monetary transmission. *American Economic Review*, 82(4).
- Blanco, L.R., Gu, J., & Prieger, J.E., (2016). The impact of Research and Development on Economic Growth and Productivity in the U.S. States. *Southern Economic Journal*, 82(3), 914-934. <https://doi.org/10.1002/soej.12107>
- Boldeanu, F.T., & Constantinescu, L., (2015). The main determinants affecting economic growth. *Bulletin of the Transilvania University of Braşov, Series V: Economic Sciences*, 8(57).
- Bond, S., Leblebicioglu, A., & Schiantarelli, F. (2004). Capital Accumulation and Growth: A New Look at the Empirical Evidence. Boston College Working papers in Economics, 591. <https://doi.org/10.2139/ssrn.561722>
- Brañas-Garza, P., Bucheli, M., & Garcia-Muñoz, T. (2011). Dynamic panel data: A useful technique in experiments. Department of Economic Theory and Economic History of the University of Granada. *The Papers*, 10(22).
- Bruno, M., & Easterly, W. (1998). Inflation crises and long run growth. *Journal of Monetary Economics*, 41, 3 [https://doi.org/10.1016/S0304-3932\(97\)00063-9](https://doi.org/10.1016/S0304-3932(97)00063-9)
- Cashin, P. (1995). Government Spending, Taxes and Economic growth. *IMF Staff Papers*, 42(2). <https://doi.org/10.2307/3867572>
- Cecchetti, S.G., Mohanty, M.S. & Zampolli, F. (2011). The Real Effects of Debt. *BIS Working Papers*, 352. Basel: Bank for International Settlements.
- Chugunov, I., Pasichnyi, M., Koroviy, V., Kaneva, T., & Nikitishin, A. (2021). Fiscal and monetary policy of economic development. *European Journal of Sustainable Development*, 10(1), 42. <https://doi.org/10.14207/ejsd.2021.v10n1p42>
- Coe, D., & Helpman, E. (1995). International R&D Spillovers. *European Economic Review*, 39. [https://doi.org/10.1016/0014-2921\(94\)00100-E](https://doi.org/10.1016/0014-2921(94)00100-E)
- Coe, D., Helpman, E., & Hoffmaister, A.W. (1997). North and South R & D Spillovers. *Economic Journal*, 107. <https://doi.org/10.1111/1468-0297.00146>
- Cooley, T., & Ohanian, L.E. (1997). Postwar British Economic Growth and the Legacy of Keynes. *Journal of Political Economy*, 105. <https://doi.org/10.1086/262079>
- Gelb, A. (1989). Financial policies, efficiency, and growth, 'Policy, Planning and Research Working Paper No. 202, Washington, D.C., World Bank, 1-39.
- Guerguil, M., Mandon, P. & Tapsoba, R. (2017). Flexible fiscal rules and countercyclical fiscal policy. *Journal of Macroeconomics*, 52. <https://doi.org/10.1016/j.jmacro.2017.04.007>
- Devarajan, S., Swaroop, V., & Heng-fu Zou (1996). The Composition of Public Expenditure and Economic growth. *Journal of Monetary Economics*, 37. [https://doi.org/10.1016/S0304-3932\(96\)90039-2](https://doi.org/10.1016/S0304-3932(96)90039-2)

- Dinopoulos, E., & Thompson, P. (2000). Endogenous Growth in a Cross-Section of Countries. *Journal of International Economics*, 51. [https://doi.org/10.1016/S0022-1996\(99\)00015-X](https://doi.org/10.1016/S0022-1996(99)00015-X)
- Easterly, W., & S. Rebelo. (1993). Fiscal Policy and Economic Growth: An Empirical Investigation. *Journal of Monetary Economics*, 32. [https://doi.org/10.1016/0304-3932\(93\)90025-B](https://doi.org/10.1016/0304-3932(93)90025-B)
- Fernandez, C., Ley, E., & Steel, M.F.J. (2001a). Model uncertainty in cross-country growth regressions. *Journal of Applied Econometrics*, 16. <https://doi.org/10.1002/jae.623>
- Fernandez, C., Ley, E., & Steel, M.F.J. (2001b). Benchmark priors for Bayesian model averaging. *Journal of Econometrics*, 100. [https://doi.org/10.1016/S0304-4076\(00\)00076-2](https://doi.org/10.1016/S0304-4076(00)00076-2)
- Frankel, M. (1962). The production function in allocation and growth: a synthesis. *The American Economic Review*, 52(5), 996-1022.
- Fung, B.S.C. (2002). A VAR analysis of the effects of monetary policy in East Asia. Monetary and Economic Department: Bank for International Settlements BIS Working Papers No, 119. <https://doi.org/10.2139/ssrn.846184>
- Grossman, G.M., & Helpman, E. (1991). Quality ladders in the theory of growth. *The Review of Economic Studies*, 58(1), 43-61. <https://doi.org/10.2307/2298044>
- Harrod, R.F. (1939). An Essays in Dynamic Theory. *The Economic Journal*, (49)193, 14-33. <https://doi.org/10.2307/2225181>
- Harrod, R.F. (1942). *Toward a Dynamic Economic*. London: Macmillan
- Hsiao, C. (1986). *Analysis of Panel Data*. Cambridge University Press. Cambridge.
- Kaldor, N. (1960), *Essays on economic stability and growth*, London, Duckworth, 302.
- Keynes, J.M. (1936). *The General Theory of Employment, Interest and Money*. Macmillan. London.
- Kleiber, C., & Lupi, C. (2010). Panel Unit Root Testing with R. Retrieved from https://r-forge.r-project.org/scm/viewvc.php/*checkout*/pkg/inst/doc/panelUnitRootWithR.pdf?root=punitroots (02.07.2020).
- Kumar, M.S., & Woo, J. (2010). Public Debt and Growth. IMF Working Paper Washington. D.C., 10/174. <https://doi.org/10.2139/ssrn.1653188>
- León-González, R., & Montolio, D. (2012). Endogeneity and panel data in growth regression: A Bayesian model averaging approach. Tokyo: National Graduate Institute for Policy Studies GRIPS Discussion Paper, 12/08.
- Levin, A., Lin, C.F., & Chu, C.S.J. (2002). Unit root tests in panel data: asymptotic and finite sample properties. *Journal of Econometrics*, 108. pp. 1-24. [https://doi.org/10.1016/S0304-4076\(01\)00098-7](https://doi.org/10.1016/S0304-4076(01)00098-7)
- Levine, R., & Renelt, D. (1992). A Sensitivity Analysis of Cross-Country Growth Regressions. *American Economic Review*, 82(4).
- Lichtenberg, F.R., & van Pottelsberghe de la Potterie, B. (1998). International R&D Spillovers: A Comment. *European Economic Review*, 42. [https://doi.org/10.1016/S0014-2921\(97\)00089-5](https://doi.org/10.1016/S0014-2921(97)00089-5)
- Lucas, R.E. (1988). On the Mechanics of Economic Development. *Journal of Monetary Economics*, 22, 3-42. [https://doi.org/10.1016/0304-3932\(88\)90168-7](https://doi.org/10.1016/0304-3932(88)90168-7)
- Mankiw, N.G., Romer, D., & Weil, D.N. (1992). A Contribution to the Empirics of Economic Growth. *The Quarterly Journal of Economics*, 407-437. <https://doi.org/10.2307/2118477>

- McGrattan, E. (1998). A Defence of AK Growth Models. Federal Reserve Bank of Minneapolis. *Quarterly Review*, 22(4). <https://doi.org/10.21034/qr.2242>
- Monamodi, N. (2019). The Impact of Fiscal and Monetary Policy on Economic Growth in Southern African Custom Union (SACU) Member Economies between 1980 and 2017: A Panel ARDL Approach. <https://doi.org/10.2139/ssrn.3480082>
- Moral-Benito, E. (2010). Panel growth regressions with general pre-determined variables: likelihood-based estimation and Bayesian averaging. CEMFI Working Papers, 1006.
- Moral-Benito, E. (2012). Determinants of economic growth: A Bayesian panel data approach. *Review of Economics and Statistics*, 94. https://doi.org/10.1162/REST_a_00154
- Nonneman, W., & Vanhoudt, P. (1996). A Further Augmentation of the Solow Model and the Empirics of Economic Growth for the OECD Countries. *Quarterly Journal of Economics*, (111)3, 943-953. <https://doi.org/10.2307/2946677>
- Nowak, W. (2006). Koncepcje konwergencji w teorii wzrostu gospodarczego [Convergence concepts in the theory of economic growth], in: Nierówności społeczne a wzrost gospodarczy [Social inequalities and economic growth].ed. Woźniak M.G., Rzeszów, Mitel, 2006, 253-266.
- Özer, M., & Karagöl, V. (2018). Relative effectiveness of monetary and fiscal policies on output growth in Turkey: an ARDL bounds test approach. *Equilibrium. Quarterly Journal of Economics and Economic Policy*, 13(3). <https://doi.org/10.24136/eq.2018.019>
- Pečarić, M., Slišković, V., & Kusanović, T. (2018). Public debt in new EU member states - panel data analysis and managerial implications. *Journal of Contemporary Management Issues*, 23(1). <https://doi.org/10.30924/mjcmi/2018.23.2.81>
- Phelps, E.S. (1961). The Golden Rule of Accumulation: A Fable for Growth, *American Economic Review*, (51)1, 638-643.
- Phelps, E.S. (1966). Model of Technical Progress and the Golden Rule of Research. *Review of Economic Studies*, (33)2, 133-145. <https://doi.org/10.2307/2974437>
- Rodrik, D. (2008). The real exchange rate and economic growth. *Brookings Papers on Economic Activity*, 39(2), 365-439. <https://doi.org/10.1353/eca.0.0020>
- Romer, P.M. (1986). Increasing Returns and Long-Run Growth. *The Journal of Political Economy*, (94)5, 1002-1037. <https://doi.org/10.1086/261420>
- Romer, P.M. (1990). Endogenous Technological Change. *The Journal of Political Economy*, (98) 5, part 2 (S71-S102). <https://doi.org/10.1086/261725>
- Sala-i-Martin, X. (1997a). I just ran four million regressions. Mimeo. Columbia University. <https://doi.org/10.3386/w6252>
- Sala-i-Martin, X. (1997b). I just ran two million regressions. *American Economic Review*, (87). <https://doi.org/10.3386/w6252>
- Sala-i-Martin, X., Doppelhofer, G. & Miller, R. (2004). Determinants of long-term growth: A Bayesian averaging of classical estimates (BACE) approach. *American Economic Review*, 94. <https://doi.org/10.1257/0002828042002570>
- Solow, R.M. (1956), A contribution to the theory of economic growth. *Oxford Review of Economic Policy*, 23(1), 3-14. <https://doi.org/10.2307/1884513>
- Solow, R.M. (1988). Growth Theory and After. *The American Economic Review*, (78)3, 307-317.
- Strongin, S. (1995). The identification of monetary policy disturbances: explaining the liquidity puzzle. *Journal of Monetary Economics*, 35. [https://doi.org/10.1016/0304-3932\(95\)01197-V](https://doi.org/10.1016/0304-3932(95)01197-V)

Suescun, R. (2020). A tool for fiscal policy planning in a medium-term fiscal framework: The FMM-MTFF model. *Economic Modelling*, 88, 431-446. <https://doi.org/10.1016/j.econmod.2019.09.053>

Tadesse, T., & Melaku, T. (2019). Analysis of the relative impact of monetary and fiscal policies on economic growth in Ethiopia. Using ARDL approach to co-integration: which policy is more potent? *Copernican Journal of Finance & Accounting*, 8(2). <https://doi.org/10.12775/CJFA.2019.010>

Talpos, I., Avram, A. & Hetes, R. (2013). The impact of fiscal policy on Gross Domestic Product in the European Union. A panel VAR model approach. *Annales Universitatis Apulensis Series Oeconomica*. 15(2). <https://doi.org/10.29302/oeconomica.2013.15.2.25>

Vinayagathasam, T. (2013). Economic growth and monetary policy in Asian developing economies. Dissertation. National Graduate Institute for Policy Studies.

Voda, A. D., Dobrotă, G., Dobrotă, D., & Dumitrașcu, D.D. (2022). Error correction model for analysis of influence of fiscal policy on economic growth in EU. *Journal of Business Economics and Management*, 1-20. <https://doi.org/10.3846/jbem.2022.16242>

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Joanna STAWSKA – Ph.D., assistant professor at the Department of Central Banking and Financial Intermediation, Faculty of Economics and Sociology; University of Lodz; Head of a research project financed by the National Science Center in the Sonata competition; Research manager for ministerial projects for Young Scientists. Author of over 80 scientific publications. Reviewer in many international scientific journals. Scope of research interests: monetary policy, fiscal policy, policy mix, public finance, game theory, enterprise investments, economic policy, banking system, financial system stability.
ORCID ID: <https://orcid.org/0000-0001-6863-1210>

Katarzyna MISZCZYŃSKA - Doctor of economic sciences. An assistant professor in the Department of Public Finance at the University of Lodz, Poland. Expert in health economics with a particular emphasis on public finance and econometric modelling. Author of several academic articles, monograph sections, analytical works. Between 2017 and 2019 leader of scientific grant Multicriteria assessment of efficiency of public hospitals in Poland and identification of determinants of their indebtedness financed by the National Science Centre in Poland.
ORCID ID: <https://orcid.org/0000-0003-4924-7605>

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