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THE EFFECT OF CAPITAL EXPENDITURE IN THE FORM OF FIXED ASSETS ON ECONOMIC GROWTH IN THE REPUBLIC OF SERBIA

УТИЦАЈ КАПИТАЛНИХ РАСХОДА У ФОРМИ ОСНОВНИХ СРЕДСТАВА НА ЕКОНОМСКИ РАСТ У РЕПУБЛИЦИ СРБИЈИ

Summary: *Since the middle of the last century, expert and research studies around the world have been measuring the impact of capital expenditures in the form of investments on economic growth and development. Investments are the basic tool for the business functionality, the national economy, and the profits creation. Capital expenditures can be of different types, as well as investments, and one of the basic forms of investment for economic growth, especially for developing countries, is investment in fixed assets. Therefore, this paper analyzes the impact of investments in fixed assets on the economic growth of Serbia, using regression modeling for the period 2004-2021. The results show that the impact of investments in fixed assets on GDP is positive, but not statistically significant yet.*
Keywords: *investments, GDP, OLS regression, Serbia*
JEL Classification: *C51, E22, O11*

Резиме: *Од половине прошлог века, стручне студије и емиријска истраживања се баве утицајем капиталних расхода у форми инвестиција на економски раст и развој широм света. Инвестиције или улгања су основно средство за функционалност пословања, националне економије и стварање профита. Капитални расходи могу бити различитог типа, као и улагања, а један од основних облика улагања за економски раст, нарочито за земље у развоју, су улагања у основна средства. Стога, у овом раду се анализира утицај улагања у основна средства на економски раст Србије, користећи регресионо моделирање за период 2004-2021. године. Резултати показују да је утицај улагања у основна средства на економски раст позитиван, али још увек не и статистички значајан.*
Кључне ријечи: *улагања, БДП, OLS регресија, Србија*
ЈЕЛ касификација: *C51, E22, O11*

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INTRODUCTION

Investments in fixed assets (IFA) are one of the most important factors of national income and one of the primary indicators of a country's production system progress. Fixed assets represent all those assets needed for the production process. The essential production factors or service activities are land, capital and labour (Čerović 2013). Fixed assets can be invested in several ways, such as investing in the form of money, material things or rights. The fixed assets distribution is done in various ways and depends on the company (Klincov and Jovanović 2015).

The goal of investing in fixed assets can be the creation of new production capacities, their increase, modernization or replacement of existing ones, and the like. Depending on the goal that fixed assets should reach, they can be classified according to the function of their economic use. At the national level, fixed assets in Serbia are divided into fixed assets in

preparation, in and out of operation (Rušović 2010; Stanković and Đorđević 2013; RZS 2018).

In the economic context of Serbia in the previous two decades, the cause of economic growth lies primarily in the high propensity of companies to invest (Vučković 2009). In 2022-2023, the rise of inflation and prices indicated a renewed high tendency to invest, which contributes to the accumulation of capital, both human and physical (Brajković 2022; Stakić 2022), as well as high participation of multinational companies (Mitrović, Jurcić and Joksimović 2017; Perić and Filipović 2018; Perić 2020; Perić and Stanišić 2020).

The literature holds theories and research on the impact of investment on economic growth from different perspectives. From a macroeconomic point of view, investments in physical capital are viewed in relation to their ability to stimulate growth in the aggregate. Since Solow (Solow 1962), investments and capital accumulation have been at the centre of the analysis of the dynamics of economic growth. Several studies at the macro level examine the relationship between investment and growth by comparing this relationship with other components of aggregate demand (e.g. consumption, exports, imports) in terms of the relative contribution each component makes to growth itself (Munnell 1992; Nazmi and Ramirez, 1997; Yu 1998; Blomström, Lipsey and Zejan, 1996; Qin, Cagas, Quising and He 2006; Wigren and Wilhelmsson 2007; Tvaronavičius and Tvaronavichiene 2008; Coccia 2010; Rikalović 2010; Song, Jiang, Song and Wang 2013; Primorac 2014; Jaiyeoba 2015; Olgić Draženović, Kusanović and Jurić 2015; Stojanović 2018; Nguyen 2021). On the contrary, according to the author's knowledge, the measurement of the impact component of IFA on GDP in Serbia has not been carried out recently from an econometric analysis point of view, more precisely, regression.

Therefore, this paper aims to determine the relationship between IFA and GDP in Serbia and quantify the impact of investment on economic growth in this country. There was an attempt to empirically determine to what extent IFA affect economic growth in Serbia, while controlling macro-indicators such as employment, exports and public debt.

The paper is organized as follows. In the following part, an overview of empirical studies is presented. The third part of the paper presents the data set and their description, the definition of variables, and the adopted econometric strategy. The fourth part of this paper delivers the results of the research as well as the accompanying discussion. This paper concludes with a final section that draws conclusions and discusses implications for economic policy and further research.

2. EMPIRICAL RESEARCH

From the point of view of the macroeconomic approach to research on the relationship between investments and economic growth, relevant studies were conducted. Analyzed were the effects of realized investments on economic growth on a sample of two eastern border regions of Russia - the Far Eastern Federal District and the Baikal region. The analysis compared these regions in the 2011-2018 period (Faleychik and Faleychik 2021). Official data from the Federal Statistical Service (Rosstat) were used for investment indicators, and the base year for prices was 2011. The primary indicator was IFA, based on which the authors measured their impact on the socio-economic development of these regions (GRP - gross regional product). The mentioned impact was measured using Geographical Information Systems (GIS) and comparative statistical analysis. The results indicated that investments and GRP of these two regions do not have a strong enough effect on sustainable economic development. The authors of this paper found that the main reason for the obtained outcome is an insufficiently developed institutional environment due to their high degree of dependence on the federal government, but also because investors undergo strict selection. These authors pointed out the necessity of creating policies and conditions for attracting large investors,

investing in human capital (also confirmed by Aganbegyan 2017) and stopping the depopulation process in these eastern regions to ensure stable economic growth.

Similar to previous research, A. A. Rumyantsev (2021) examined the relationship between IFA, the dynamics of investment in technological innovation, and economic growth in the northwestern regions of Russia. The results of this author's research revealed that the relationship between the indicators changes from year to year, and the main reason for this is market competition. Companies ensure competitiveness by, first of all, investing in fixed assets with the aim of innovation and modernization of production. In the second place, there are investments in replacing worn-out equipment. The more competitive companies are, the more significant the impact of investments on economic growth. More than a decade earlier, the research of Sergey Mitsek and Elena Mitsek (2009) showed that the most prominent influence on the GRP of Russia is the IFA of the construction industry, which indicates a change over the years in the dynamics of IFA in this country.

When it comes to the agricultural sector, the results of the econometric analysis for the period 2003-2010 showed that large enterprises have a higher level of technical efficiency compared to small enterprises because they had a higher level of IFA (Shchetynin and Nazrullaeva 2012). On the other hand, other authors (Nabieva, Davletshina, 2015) believe that the Russian Government should back IFA for the agricultural sector to recover and contribute to the economic growth of this country, especially the Republic of Tatarstan. For the period 2014-2019, Savkina G. M. (2021) determined that the major causes of the low rate of IFA in Russian agriculture are inflation, the structure of gross IFA and the low rate of capital investment.

A sample of seven Central Asian and Caucasian countries (Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Uzbekistan, Tajikistan and Turkey) was used to examine the long-term relationship between domestic savings and investment in fixed assets in relation to economic growth. World Bank data for the period 1993-2017 were used for econometric modelling. Using *the vector error correction model* (VECM) and *Granger causality analysis*, it was determined that gross domestic savings and investments in fixed capital have a significant positive impact on economic growth. Also, it was specified that domestic savings contribute to the growth of IFA (fixed assets). Based on these results, it is considered that decision-makers, at the level of companies and politics, should use savings for investments (Gövdeli, 2022).

Based on the theory of the endogenous economic growth model of the country, using data from the State Statistical Office of the Republic of Croatia for the period 1952-1990 and an econometric model, Škare Marinko (2001) found that investments in human capital (education and work) have a high positive impact on GDP growth of Croatia (Škare 2001). Many other studies conducted around the world (Akpolat 2014; Jaiyeoba 2015; Zaidi, Wei, Gedikli, Zafar, Hou and Iftikhar 2019; Collin and Weil, 2020; Mabrouki 2022; Riaz, Nisar and Yasmeen 2022) established that IFA, i.e. investment in human capital (education, work, health), is crucial for economic growth.

Empirical research on the impact of gross IFA on the economic growth of South Africa was conducted for the period 1995-2016 on quarterly data. Using regression models (Johansen cointegration and VECM), the results showed that domestic investments have a positive, statistically significant impact on employment and GDP. Also, it was determined that it is necessary to keep interest rates low in order to make the investment environment appealing for investors and so that the effect of investments on employment and growth is and remains positive (Meyer and Sanusi 2019; Nguyen 2021).

The relationship between IFA and GDP was determined using non-linear and asymmetric relationships on a sample of 36 member countries of the OECD (Organization for Economic Cooperation and Development) for the 1981-2019 period (quarterly data). The results indicated, among other things, that research and development (R&D) expenditures are a procyclical consequence of the GDP growth rate, imports, exports, and gross fixed capital

formation. R&D expenditures influence the growth of patents, as well as the development of international cooperation for the purpose of technological development. In addition, gross investments in fixed assets positively affect GDP, patents, the labour force and the external economy (Ahmad 2021).

A regression model, using data for Chinese provinces for the period 2000-2010, was constructed. It included variables such as output, GDP, GDP per capita, IFA (physical capital, human capital), technology level, employment rate, population (residents), employees in the R&D sector of medium and large enterprises per capita and similar (Boeing, Eberle and Howell 2022). Through a VAR (*Vector Autoregression*) model, these authors found that public investment in R&D (except in the case of residential buildings) boosts technological development and economic growth, even when the rate of private investment declines. More specifically, R&D subsidies granted to medium and large enterprises affect the increase of R&D capacity, especially human capacity, including the reduction of enterprise expenditure.

Considering the results of previous research on the impact of investments in fixed assets on economic growth, the following research hypothesis (H_0) is formulated in this paper: Investments in fixed assets do not have a positive and statistically significant impact on the economic growth of Serbia.

3. DATA SET AND ECONOMETRIC MODEL

For the empirical analysis of the impact of investment in fixed assets on the economic growth of Serbia, official data collected from the Republic Statistical Office (RSO) database are used. The time series of data covers the period from 2004 to 2021 and refers to all companies operating in Serbia. The description of the data (Table 1) provides the concretization of the used indicators based on which the trends in investment in fixed assets and the rate of economic growth of Serbia are observed and serve for the more efficient conclusion drawing about the obtained research results.

Table 1: Data description

Indicator	**Description of indicators according to RSO**
GDP	Gross domestic product, in millions of RSD, in current prices
Gross IFA	Gross investments in fixed assets, in total, in millions of RSD, in current prices
Export	Exports, total, in millions of RSD, in current prices
Employment	Number of employees, total
Public debt	Public debt, total, in % of GDP, in current prices

Source: author's presentation

Based on logical assumptions established on the theoretical approach to the topic and the study of RSO methodology (RSO 2018; RZS 2019), it is considered necessary to analyse not only the impact of IFA on GDP but also on their variations. The percentage change (Δ) represents the variation in the indicator between the current year *t* and the previous year *t-1*. Therefore, the significance of the impact of the annual variation of IFA on the annual variation of GDP is measured. Table 2 presents the data and the description of the variables.

Table 2: Descriptive statistics

	N	Range	Min	Max	Mean	Std. err. of Mean	Std. Dev.	Var
lnGDP	18	1.413	14.23	15.65	15.09	0.093	0.393	0.154
ΔlnGDP	17	0.013	0.001	0.013	0.006	0.001	0.004	0.000
lnIFA_brut	18	1.580	12.60	14.18	13.45	0.095	0.404	0.163
ΔlnIFA_brut	17	0.034	-0.014	0.020	0.007	0.002	0.010	0.000
ΔlnIFA_brut_1	16	20.20	-7.500	12.70	-0.311	1.039	4.155	17.26
ΔlnIFA_brut_2	15	90.17	-61.75	28.41	-2.734	4.769	18.47	341.21
lnExport	18	2.519	12.24	14.75	13.77	0.171	0.726	0.527
ΔlnExport	17	0.036	-0.006	0.030	0.011	0.002	0.010	0.000
lnEmployment	18	0.200	14.428	14.62	14.51	0.016	0.068	0.005
ΔlnEmployment	17	0.009	-0.006	0.003	0.000	0.001	0.002	0.000
lnPublicDebt	17	0.960	3.288	4.248	3.858	0.074	0.307	0.094
ΔlnPublicDebt	16	0.159	-0.088	0.072	0.004	0.010	0.042	0.002
Skewness	Stat. range -2.289 to 1.809				Std. Err. Range 0.536 to 0.58			

Source: Author's calculations

Descriptive statistics in this paper have the purpose of presenting the data used for analysis. Data are expressed in natural logarithms.

Variations in IFA are closely related to the formation of the domestic product. Specifically in the case of Serbia, IFA and GDP followed the same trend in the observed period, in both directions (positive and negative). Namely, according to the analysis of official data, both indicators suffered a decline between 2012 and 2014, between 2015 and 2016, and after 2019. The results of measuring their relationship will show whether this change is significant for GDP and investments in Serbia.

The methodology used is based on the multiple linear regression model, according to Milica Perić (2020). The purpose of Perić's work is, among other things, to provide a procedure that can be used to test the influence of independent variables on the dependent variable using time series with the effect of time *t* on an annual basis (Perić 2020). The model specification is as follows:

$$\Delta lnGDP_t = \beta_0 + \beta_1 \Delta \ln IFA_{brutt} + \beta_2 \Delta \ln IFA_{brutt-1} + \beta_3 \Delta \ln IFA_{brutt-2} + \beta_4 \ln Export_t + \beta_5 \ln Employment_t + \beta_6 \ln PublicDebt_t + \varepsilon_t$$

where $\Delta lnGDP_t$ is a dependant variable, β_0 is a constant in the regression, β_n are the regression coefficients ($\beta_n \Delta lnIFA\_brut_t$ are the coefficients of the independent variable and IFA lags for two years because their effect is not immediate, while $\beta_4 \Delta lnExport_t$, $\beta_5 lnEmployment_t$ and $\beta_6 lnPublicDebt_t$ are control variables) and ε_t is the model error. The estimation of the regression model uses the method of least squares (*Ordinary Least Square - OLS)* and a two-sided *t*-test with 5% significance (*p*-value).

4. RESULTS AND DISCUSSION

Before presenting the results obtained by regression modelling, the correlation of the used variables is analyzed to determine the nature and degree of their relationship. The symbol *r* represents the correlation coefficient.

Correlation analysis shows that gross IFA significantly correlates with GDP (r=0.605, p=0.01), exports (r=0.609, p=0.012) and public debt (r=0.484, p=0.049). It leads to the conclusion that IFA variations have a highly positive and significant relationship with the economic growth variation in Serbia. Although the nature of the relationship between parameters indicates the direction, degree and statistical significance of their relationship, it does not indicate the level of influence between them, which is determined using a regression

model. Given that there is a degree of association lower than 80% between certain described variables, it is unneeded to conduct multicollinearity tests. On the other hand, given the nature of the data and logical assumptions based on the foundations of the theory, multicollinearity tests were performed within the regression analysis.

Based on the collinearity test results, shown in Table 3, it was determined that there is no multicollinearity problem between the independent variables.

Table 3: Collinearity statistics

	Tolerance	**VIF**
ΔlnIFA_brut	0.578	1.730
ΔlnIFA_brut_1	0.887	1.127
ΔlnIFA_brut_2	0.792	1.263
ΔlnExport	0.632	1.582
ΔlnEmployment	0.730	1.370
ΔlnPublicDebt	0.645	1.551

Source: Author's calculations

Given that the VIF values are <6, the regression results are not questionable, and the analysis can be continued without hindrance. The results of the regression model are shown in Table 4.

Table 4: Regression model

ΔlnGDP		**Coefficients**					
			Unstandard.		**Standard.**		
			B	Std. Error	Beta	t	p
p-value	0.101	(Constant)	0.003	0.001		3.409	0.009
F-ratio	2.661	ΔlnIFA_brut	0.033	0.081	0.108	0.403	0.697
R-square	0.666	ΔlnIFA_brut_1	0.00004	0.000	0.053	0.245	0.812
Adj R Square	0.416	ΔlnIFA_brut_2	-0.00006	0.000	-0.358	-1.558	0.158
		ΔlnExport	0.166	0.100	0.428	1.665	0.135
Durbin-Watson	1.126	ΔlnEmployment	-0.106	0.316	-0.080	-0.335	0.746
		ΔlnPublicDebt	-0.027	0.021	-0.325	-1.276	0.238

Source: Author's calculations

In observing the variation model with the use of data transformed into natural logarithms (due to the normalization of the distribution of variables) and lagged IFA values, it is estimated that if there are changes in the independent variables by 1%, then it is expected that the dependent variable will change in the amount of the coefficient of the independent variable, while other independent variables are constant. In other words, a change of one IFA indicator to the extent of 1% leads to a change in the GDP growth rate in year *t* to the extent of the coefficient of that IFA indicator in the same year.

The results of the regression analysis indicate the absence of statistical significance between ΔlnGDP and ΔlnIFA_brut, as well as between ΔlnGDP and lagged values of ΔlnIFA_brut and control variables. According to the results of the regression analysis, if the gross IFA rises by 1%, GDP will increase by 0.033% in year *t*, basically by 0.00004% in the following year (*t*-1), which in this case cannot be unreservedly asserted because there is the absence of statistical significance (p=0.697 and p=0.812, respectively).

By analyzing the results of the regression model, it is specified that there is a positive impact of IFA on GDP in the year when the investments were realized, as well as after one year, based on which the null hypothesis is rejected. However, this impact turns negative two years after the investment realization (negative zero, i.e. -0.00006, p=0.158). Regardless of

the above, none of the results are statistically significant, most likely due to the length of the time series of the subplots used.

Whether it concerns gross IFA, lagged values of gross IFA or control variables, the model shows an absence of statistical significance when it comes to variations in year *t*. On the other hand, the model reliability is high when considering *R-Square* (66.6%) and *Adj. R-Square* (41.6%).

Given that the results showed that the regression model is not statistically significant (p=0.101), the regression model validity is checked to draw reliable conclusions about the results. The *Ramsey RESET* (Ramsey 1969) and the *Breusch-Pagan* tests (Breusch and Pagan 1979) are used to check the specification of the model, i.e. its validity. According to the *Ramsey RESET* test, there is no sign of model misspecification as the value of γ is not statistically significantly different from zero (p=0.181), indicating that the linear model is probably well specified. In the model where the dependent variable is square_resid, i.e. squared values of residuals (residuals are a normally distributed random variable with a constant standard deviation and are equal to zero on average) (Hayes and Cai 2007), the results of the *Breusch-pagan* test indicate that the statistical significance of the regression model is higher than 5% (p= 0.947), which means that there is no heteroscedasticity issue in this case.

In short, the diagnostics of residuals and stability of the model indicated that there is no heteroscedasticity and that the functional form of the used model is good. Therefore, it can be argued that the increase in investment variations does not significantly contribute to the GDP variation in a given year, on average, for the observed period. In other words, how much and in what way the IFA will vary in structure or amount on an annual level does not involve significant changes in GDP. It means that for GDP growth in year *t*, it is not relevant whether investments of any type will take place in the same year. It also corresponds to the logical conclusion that it takes more years for the effect of investments to be reflected in economic growth. In addition, it is not relevant to what extent IFA varies in a year as long as their quantity positively affects economic growth.

The analysis of the impact of investments in fixed assets on the economic growth of Serbia for the period 2004-2021 enables a comparison with other results obtained in the international literature. The literature shows that investments in fixed assets have a positive effect on economic growth (Boeing, Eberle and Howell 2022; Gövdeli 2022; Ahmad 2021; Meyer and Sanusi 2019; Škare 2001), but not strongly enough (Faleychik and Faleychik 2021) from the aspect of statistical significance. Also, the literature suggests an inverse relationship, i.e. IFA are a consequence of GDP growth (Ahmad 2021), which was not the subject of this research.

5. CONCLUSION

This paper analyzes the impact of investment in fixed assets on economic growth in Serbia for the period 2004-2021. The results showed that the increase in investments in fixed assets has a positive, but not statistically significant, effect on economic growth in the year of realization of the investments and one year after that. Their impact on economic growth turns negative two years after the investments, the primary reason probably being the investments payments in the circumstances of a stable economic system.

Given the lack of statistical significance of the regression coefficients, it is advisable for future research to use a more extended period and/or quarterly/monthly data. In the case of reproducibility of this research, it is recommendable to use non-linear models too. Also, it is desirable to determine whether there is an inverse relationship between investments and economic growth.

When considering the results of this research and the theoretical framework used for it, it is concluded that investment in fixed assets, either by type or quantity, is one of the primary conditions for the economic progress of a country. The permanence of production reproduction, and therefore social reproduction, is ensured by investing in fixed assets. Nevertheless, the amount of investment in fixed assets is not an indicator of the functionality of production capacities. The functionality of production capacities backs GDP growth when they are used (spent) - and show positive results - on society and economic growth as a whole. Therefore, it may be irrelevant to what extent investments in fixed assets vary from year to year as long as investments in fixed assets are paid off and as long as there are new investments in fixed assets (mainly to finance new production/service capacities, modernization of them and human capital). Also, it is necessary that the national economy, and the companies that operate in it, remain competitive so that investments in fixed assets have a more significant potential for a positive impact on GDP growth.

Finally, at the level of economic policy, decision-making on investments needs to be more decentralized to increase the degree of independence from the state apparatus for investing in fixed assets. It is essential to maintain a healthy level of several macroeconomic indicators to increase the probability of investments in fixed assets, especially the levels of inflation, exchange rate (when it comes to foreign direct investments, for example) and interest rates. In addition, it is advisable to finance small and medium-sized enterprises to a greater extent than large enterprises (public investments) because large enterprises find private investors more easily.

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