IMPACT OF REALIZED INVESTMENTS IN NEW FIXED ASSETS ON GROSS DOMESTIC PRODUCT IN SERBIA

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ABSTRACT

The research subject is the analysis of the impact of the value of realized investments in new fixed assets on the gross domestic product (GDP) of Serbia in the period from 2012 to 2021. The research was conducted with the aim of determining which economic activity, according to the value of realized investments, contributes the most to the creation of the value of Serbia's GDP. The defined goal was realized by applying the multiple regression method, and the starting model contained the value of realized investments in four activities, which are: manufacturing; electricity, gas, steam and air conditioning supply; transportation and storage; agriculture, forestry and fishing. The occurrence of multicollinearity between independent variables was checked by the tolerance coefficient, VIF coefficients and Eigen values, and their values indicate the presence of weak multicollinearity, which is a consequence of the impact of realized investments in agriculture, forestry and fishing. The result of the set regression model shows that the greatest contribution to the creation of Serbia's GDP is made by the realized investment value in the electricity, gas, steam and air conditioning supply (Standardized Beta Coefficients 0.687, Sig. = 0.012).

Introduction

Gross Domestic Product (abbr. GDP) shows the value of final products and services that the country produces during one calendar year. The economic strength of a country is most often measured by the total GDP and GDP per capita. GDP is an indicator of economic growth and living standards of a country and is most often used to compare

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economic development between countries (Abbas et al., 2011; Chamberlin, 2011). According to Chamberlin (2011), GDP, as a measure of economic activity, it is a useful indicator of production and suitable for use in productivity assessments. However, as a measure of economic well-being, it has several limitations. This measure of real income differs from real (money) GDP by taking into account capital consumption, net income and transfers from abroad, and uses a consumption deflator rather than a general GDP deflator, so that output is valued in terms of consumption units (Chamberlin, 2011).

The contribution of certain activities to the creation of GDP varies by country. For example, Isidro (2022) using data from the World Bank, she observed, for example, that the participation of agriculture in the creation of GDP in the countries of the world ranges from 4% to even 25%. Also, GDP is affected by numerous factors, and which factors, in what strength and combination will affect the GDP of each country, differs from country to country.In the scientific and professional literature, many examples dealing with the analysis of the impact of various factors on the creation and change of the country's GDP can be found.

Iordache et al. (2011), by using multiple linear regression, analyzed the influence of three different factors on the realized GDP in Romania (unemployment rate, annual inflation rate and exchange rate), indicating by the correlation method that the exchange rate has a positive and strong influence on the country's GDP. According to Milutinović (2022), economic differences between countries, viewed through GDP per capita, can arise due to unequal human capital between countries.

Important factor that affects the value of GDP is FDI. Using a panel dataset of bilateral flows of FDI, Bevan and Estrin (2004) study the determinants of FDI in western European countries (mainly in the European Union), and in the Central and Eastern European ones, and they find following the most important determinants of FDI: *"unit labor costs, gravity factors, market size, and proximity"* (Bevan, Estrin, 2004, p. 775). *The mentioned authors also pointed out that "host country risk proves not to be a significant determinant"* (Bevan, Estrin, 2004, p. 775). FDI are key initiator of long-run economic growth in all developing country (Dinh et al., 2019; Nosheen, 2013; Pantić et al., 2022; Dumitraşcu et al., 2013; Rahaman, Chakraborty, 2015; Stanciu et al., 2019; Sarker, Khan, 2020). However, other macroeconomic factors also play an important role in explaining economic growth in these countries. Thus, according to Dinh et al. (2019) long-term economic growth in developing countries is driven by money supply, human capital, total domestic investment and domestic credit to the private sector.

Izuchukwu (2011) analyzed the impact of the agricultural sector on the economic development of Nigeria. He formed a multiple linear regression model, where the achieved GDP was a parameter for economic development (dependent variable), and for agricultural indicators (dependent variables) he took the following values: domestic savings, state expenditures in agriculture and FDI in the agricultural sector. Through research, he came to the result that all three predictors have an impact on GDP, but that the biggest impact is achieved by state savings.

In this paper, the authors analyzed the impact of the value of realized investments in new fixed assets on the realized value of GDP in Serbia in period 2012-2021 in four activities: (1) Manufacturing; (2) Electricity, gas, steam and air conditioning supply; (3) Transportation and storage; and (4) Agriculture, forestry and fishing. The choice of the first three economic activities was conditioned by the high average annual participation of the investments made in these activities in the total investments of Serbia in the period 2012-2021. The choice of the fourth economic activity (Agriculture, forestry and fishing) conditioned the high contribution of this sector to numerous performances of the national economy. Namely, agriculture in Serbia significantly contributes to the employment of the working-age population, contributes positively to the foreign trade balance, provides food to the population and the livestock sector, provides industry with raw materials, and still significantly encourages the development of rural areas (Grujić Vučkovski et al., 2022).

With the application of multiple regression, the aim of the paper is to determine which economic activity, according to the value of realized investments in new fixed assets, contributes the most to the creation of the total value of GDP.

Literature review

According to the World Bank classification (World Bank, 2022), Serbia belongs to the group of upper middle income countries (for 2021, the group of countries where the range of gross national income per capita ranges from 4,256 to 13,205 USD). When it comes to GDP per capita, compared to EU countries, Serbia still lags far behind. Namely, in 2019, GDP per capita in European Union 28 was EUR 32,150, while in Serbia it is only EUR 6,620 (EUROSTAT Database, Economy and finance, National accounts, Main GDP agregates, GDP at market prices). It is concluded that GDP per capita in 2019 is five times lower in Serbia compared to the European Union 28. The same ratio of realized GDP per capita in the territory of the European Union 28 and Serbia has been achieved during 2018, and this ratio has also been noticed by authors Grujić et al. (2021).

According to Statistical Office of the Republic of Serbia (SORS), Municipalities and regions of the Republic of Serbia, in the period 2012-2021, the highest average annual share of investments by activities in the total realized investments was recorded by Manufacturing (25.3%). At the same time, in the analyzed period (2012-2021), investments in Agriculture, forestry and fishing grew on average annually at a higher rate than in the manufacturing (2.1%, versus 0.8%, respectively).

Unfortunately, Serbia has economic activities that in the ten-year period (2012-2021) recorded average annual decreases in investments, which are: financial and insurance activities -3.9%, real estate activities -1.8%, accommodation and food service activities -0.5%, other service activities -2.2% (SORS, Municipalities and regions of the Republic of Serbia). Aso, agriculture plays a vital role in the national economies of Serbia and all Western Balkan Countries (WBC), but this sector shows lower technical efficiency

compared to EU countries. This is primarily result of lower productivity, dominance small scale family farms, high land fragmentation, small and unstable support for rural development and difficult access to finance (Erjavec et al., 2021; Horvat et al, 2020; Savić, 2022; Kotevska et al., 2015; Nikolić et al. 2017; Sanfey, Milatovic, 2018; Volk et al., 2019).

Macroeconomic stability has been established in Serbia in the last few years, primarily due to the successfully implemented fiscal consolidation (Randjelovic, 2020). In the group of Southeastern European countries (Bosnia and Herzegovina, Croatia, Montenegro, North Macedonia, Romania, Serbia and Slovenia), Serbia shows good macroeconomic indicators (Marjanović, Zubović, 2020). The country managed to transform itself into a growing economy with low inflation, fiscal surpluses, reduced public debt, reduced external imbalances and recovery in the labor market (Marjanović, Zubović, 2020). According to the multiplicative and seasonal aspects of the trend analysis, the projections for Serbia show a gradual increase in GDP, FDI, national competitiveness and a decrease in the unemployment rate in the next 5 years (Vukmirović et al., 2021).

GDP growth in Serbia shows a strong correlation with the growth of industrial production, but also with the inflow and outflow of FDI (Vasa, Angeloska, 2020; Vukmirović et al., 2021). Capital investments have a statistically significant positive effect on the long-term performance of domestic companies (Grozdić et al., 2020), and consequently on GDP. At the same time, the tax treatment of investment projects (which differ by the type of funds, activity and source of financing) in Serbia has a uniform burden, which indicates the absence of discrimination and distortionary effects of taxation and can be considered as a confirmation of tax neutrality (Luković et al., 2021).

Beke-Trivunac et al. (2021) proved the effect of investments in fixed assets on the growth of employment in Serbia. Analyzing the period 2013-2020, these authors point to a high correlation between annual investments in fixed assets and employment growth, emphasizing that these investments are the most significant generator of new job openings, i.e. employment growth. Despite all of the above, Serbia's economic growth is insufficient for faster convergence with European countries, and one of the causes of slow growth is found in low domestic private and public investments over a longer period (Randjelovic, 2020). As for public investments, although they have seen growth in recent years, Serbia still lags behind the countries of Central and Eastern Europe and the Western Balkans in terms of their size and participation in GDP (Randjelovic, 2020).

In addition, investments are still low in fixed assets. On the example of sector A (Agriculture, Forestry and Fishing) in the Republic of Serbia, in the period 2013-2018, the fixed assets financing indicators indicate a lack of capital for financing new investments, which is mostly compensated by long-term borrowing at the level of enterprises and short-term borrowed sources at the level of entrepreneurs in the analyzed sector (Bogićević et al., 2021).

Materials and methods

The analysis of the indicators began with an overview of the interannual rates of changes in GDP and GDP per capita in the area of the European Union 28 and Serbia in the period from 2012 to 2019. After that, an overview of the average annual participation and PGSP (in %) of the value of realized investments by activity in the total value of investments in Serbia from 2012 to 2021 was given. The average annual rate of change (*equation 1*) was calculated according to the following formula (Fay et. al., 2006):

$$\gamma = \left(\left[\frac{\delta_n}{\delta_1} \right]^{\frac{1}{n-1}} - 1 \right) * 100 , \qquad (1)$$

where γ - the average annual rate of change, δ_n – the absolute value of the last member of the time series, δ_1 – is the absolute value of the first member of the time series, n – the number of members in the series (ie, the number of years).

In the follow-on of the paper, research was conducted on the analysis of the impact of realized investment values according to activities on the total GDP of Serbia. Our research is based on determining the value of investments made in nineteen groups of activities monitored by the Statistical Office of the Republic of Serbia (abbr. SORS). The exact values of realized investments according to activities are given by SORS's publication Municipalities and Regions in the Republic of Serbia. This publication publishes data on municipalities, cities and regions of Serbia from various areas of social and economic development. The data taken from this document represent the basic source of data for the application of statistical methods in the period from 2012 to 2021.

In the paper, first of all, an analysis of the descriptive statistics of investments in Serbia by activity was carried out. After an insight into the structure, as well as due to the complexity of the data, the values of realized investments in certain activities, due to their low values, were shown collectively and marked as *"other activities"*. These activities include: accommodation services; financial activities; real estate activities; professional, scientific and technical activities; administrative activities; education; human health and social work activities; arts; other service activities. If we look at the average annual share of the total realized investments, we see that *other activities* make up only 14.5%.

In aim to set up a valid regression model, the authors include in the analysis the first three economic activities that achieve the largest average annual participation in the total investments of Serbia from 2012 to 2021, that are: *manufacturing; electricity, gas, steam and air conditioning supply; transportation and storage.* Also, the authors include the activity of *agriculture, forestry and fishing* because it employs a high percentage of the working age population in Serbia. According to the data published in the Labor Force Survey in the Republic of Serbia (SORS, 2022) during 2021 15% of the population aged 15-89 of the total population is employed in this activity, which is why this branch is right behind the manufacturing, which employs 19.8% of the population in this age group.

The regression model set in this research has the following form (*equation 2)*:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots \beta_n X_n + \varepsilon_n, \quad (2)$$

where: Y – value of dependent variable, X_1, X_2, ..., X_n – value of independent variables, β_0, β_1, β_2, ..., β_n – regression parameters, ε_n – random error.

The multiple regression model is set so that GDP represents the dependent variable, while the independent variables are represented by the realized values of investments of the mentioned activities. Regression model get the new form (*equation 3)*:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon, \quad (3)$$

in our case it is: Y – GDP of Serbia (current prices), X_1 – the value of realized investments in the manufacturing (current prices), X_2 - the value of realized investments in electricity, gas, steam and air conditioning supply (current prices), X_3 - the value of realized investments in transporting and storage, X_4 - the value of realized investments in agriculture, forestry and fishing, β_0, β_1, β_2, β_3, β_4 – regression parameters, ε - random error.

In the established model, the *initial hypothesis* has the following form:

H_0: β_0, β_1, β_2, β_3, $\beta_4 = 0$ (the observed coefficient is not statistically significant).

In the same model, *alternative hypothesis* has the following form: H_1: β_0, β_1, β_2, β_3, $\beta_4 \neq 0$ (the coefficient is statistically significant).

The evaluation of the hypotheses was given after analyzing the values of the obtained coefficients.

The SORS database and the publication *Municipalities and Regions in the Republic of Serbia* recorded, only in domestic currency (RSD), the investments values by economic activities and for easier understanding of the obtained values, using the average annual exchange rate[4], the values in the domestic currency were converted to EUR.

Firstly, the established model was evaluated by interpreting the results of descriptive statistics of the realized GDP of Serbia in the observed period.

After these analyses, the correlation between the independent variables in the set model will determine the fulfillment of the initial assumption in terms of whether there is a certain degree of linkage between the predictors (independent variables), as well as whether the presence of multicollinearity affects the achieved regression results.

4 The average official middle exchange rate of the dinar against foreign currency in the year is calculated as the arithmetic mean of the official middle exchange rates that were applied on working days of the year (https://nbs.rs/en/finansijsko_trziste/medjubankarsko-devizno-trziste/kursna-lista/prosecni-kursevi/index.html).

The presence of multicollinearity between independent variables will be done in three ways, and the mathematical formulas are best presented by the authors Adeboye et. al. (2014). Therefore, the presence of multicollinearity on the regression standard error coefficient will be confirmed using the following indicators: *tolerance level, VIF (Variance Inflation Factors) coefficient, Eigen values.*

The tolerance level is calculated according to the following formula $1 - R^2$, where R^2 is coefficient of determination and represents the result of regression analysis. The tolerance level can also be explained as the influence of one independent variable on another independent variable in the established regression model. Lower values of the tolerance coefficient are considered to indicate a high level of multicollinearity. If the value of this coefficient is around 0.4, it can be said that there is weak multicollinearity.

VIF represents the reciprocal valu $\frac{1}{}$ the tolerance coefficient and is calculated according to the following formula $\frac{1}{1-R^2}$. The VIF value indicates the size of inflation in the standard errors. If the VIF value is greater than 2.50, it means that there is a relatively high level of multicollinearity between the predictors.

Using *Eigen values* we can determine the closeness between variables. When the value for Eigen value is close to zero then it indicates linear dependence in the analysis and more closely determines the properties of independence.

The previously mentioned analyzes contributed to determine that the activity of electricity, gas, steam and air conditioning supply had the greatest influence on the creation of the GDP of Serbia in the analyzed period, and a linear trend model was shown for this branch of the economy. The graphic representation of this result indicates how the change in realized investments in the most dominant activity will affect Serbia's GDP in the next three years. The initial equation has the following form (*equation 4)*:

$$y = bx+a, \qquad (4)$$

where: y – value of dependent variable, x – value of independent variable, a *i* b - parametric values.

All the above-mentioned analyzes were carried out in aim to determine the accuracy of the obtained data and the correctness of the conclusions reached.

Statistical data processing was carried out using the SPSS 25 software package.

Results and discussion

Table 1. shows the indicators of the descriptive statistics of the realized values of the GDP of Serbia from 2012 to 2021 (SORS, eletronic database, national accounts, annual national accounts, Gross domestic product, total and per capita).

Table 1. Descriptive statistics of GDP of Serbia from 2012 to 2021 (in EUR, mln)

Variable	Mean	Std. Deviation	Minimum	Maximum	Coefficient of variation (in %)
GDP	40,637.0	6,384.5	33,679.3	53,329.3	15.7

Source: Author's calculation based on SORS databases.

The average realized value of Serbia's GDP in the ten-year period was EUR 40,637.0 mln, with the maximum value recorded in 2021 and the minimum in 2012 (*Table 1.)*. The standard deviation value shows us the average deviation from the average value, and in our case it is EUR 6,384.5 mln. The value of the coefficient of variation shows the slight variability of Serbia's GDP (15.7%).

The results shown in *Table 2.* indicate the following:

- The manufacturing has the highest average annual realized value of investments of EUR 1,443 mln, and the lowest water supply; sewerage, waste management and remediation activities with only EUR 111.4 mln;
- The highest average deviation from the average value of investments was observed in the activities of public administration and defense; compulsory social security, and the lowest in the area of the water supply; sewerage, waste management and remediation activities;
- The least investments were recorded in the water supply; sewerage, waste management and remediation activities, and the most in the manufacturing;
- Wholesale and retail trade as well as agriculture, forestry and fishing have the lowest variability of realized investments in Serbia.

Table 2. Descriptive statistics of realized investments according to activities in time 2012-2021 (in EUR, mln)

Variable	Mean	Std. Deviation	Minimum	Maximum	Coefficient of variation (in %)
Agriculture, forestry and fishing	144.6	25.6	101.0	183.3	17.7
Mining and quarrying	256.4	154.3	113.7	531.6	60.2
Manufacturing	1,443.0	323.8	1,098.1	1,943.7	22.4
Electricity, gas, steam and air conditioning supply	571.2	169.6	330.5	909.6	29.7
Water supply; sewerage, waste management and remediation activities	111.4	20.7	74.5	149.1	18.6
Construction	454.5	183.4	205.0	811.7	40.4
Wholesale and retail trade; repair of motor vehicles and motorcycles	440.6	70.7	321.0	553.3	16.1
Transportation and storage	549.6	382.6	259.4	1,294.9	69.6
Information and communication	462.4	137.4	302.3	710.3	29.7
Public administration and defence; compulsory social security	627.1	640.1	137.0	1,910.9	102.1
Other activities*	829.3	180	481.6	1,073.1	21.7

Source: SORS, Municipalities and Regions in the Republic of Serbia for analized years.

*Other activities include: accommodation services; financial activities; real estate activities; professional, scientific and technical activities; administrative activities; education; human health and social work activities; arts; other service activities.

Table 3. shows the variability of the regression model of the dependent variable Y (GDP, current prices) and independent variables X_1, X_2, X_3 and X_4, where X_1 – the value of

realized investments in the activities of manufacturing (current prices), X_2 - the value of realized investments in the activities of electricity, gas, steam and air conditioning supply (current prices), X_3 - the value of realized investments in transportation and storage activities (current prices), X_4 - the value of realized investments in activities of agriculture, forestry and fishing (current prices).

Table 3. Coefficient of correlation, coefficient of determination, standard error of the regression model of realized investments values of selected economic activities on Serbia's GDP

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.964	.929	.872	22804.6800

Source: Author's calculation based on SORS databases.

The correlation coefficient shows us that there is a strong positive link between the variables (0.964). The coefficient of determination shows us that 92.9% of the variation in the GDP of Serbia can be explained by the strong influence of the realized investment values of the analyzed activities, while the corrected coefficient of determination shows that 87.2% of the variability of the GDP of Serbia depends on the value of the investments realized in the observed economic activities. The remaining 12.8% is the influence of other factors (eg, other economic activities that are excluded from further analysis due to their low participation in the total realized investment value, as well as other influences that are not the subject of the analysis). The standard error of the regression shows that there is a deviation from the regression line of the sample in the amount of EUR 22,804.6800 mln.

The results of testing the assumed regression model in *Table 4.* show us that the set model is statistically significant, as indicated by the value in the last column (0.004).

Table 4. Evaluation of the significance of the set regression model

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	34085405239.255	4	8521351309.814	16.386	.004
	Residual	2600267141.245	5	520053428.249		
	Total	36685672380.500	9			

Source: Author's calculation based on SORS databases.

In the next table *(Table 5.),* we see positive values for β_0, β_2, β_3, β_4, while value for β_1 is negative. The set regression model has the following form (*equation 5)*:

$$Y = 252988.002 - 3.894\ X_1 + 25.862\ X_2 + 8.583\ X_3 + 10.148\ X_4 + \varepsilon \quad (5)$$

Table 5. The results of the set regression model

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	252988.002	55228.206		4.581	.006		
	Manufacturing	-3.894	4.364	-.197	-.892	.413	.289	3.455
	Electricity, gas, steam and air conditioning supply	25.862	6.666	.687	3.880	.012	.452	2.213
	Transportation and storage	8.583	3.157	.514	2.719	.042	.396	2.525
	Agriculture, forestry and fishing	10.148	58.187	.041	.174	.868	.259	3.855

Source: Author's calculation based on SORS databases.

The data presented in *Table 5.* show us that the realized value of investments in the activities of *electricity, gas, steam and air conditioning supply* has the greatest influence on the realized value of Serbia's GDP, because the standardized beta coefficient is the highest (0.687). This conclusion also confirms the value for Sig. (0.012), which means that this activity is statistically more significant and contributes more to the creation of Serbia's GDP compared to the remaining three.

Analyzing the value of the non-standardized beta coefficient for the activities of *electricity, gas, steam and air conditioning supply*, we observe that if the value of investments increases by EUR mln., then the GDP of the country increases by EUR 25.862 mln. In other words, if we want to increase Serbia's GDP, then we must intensify investments in this activity.

Agriculture, forestry and fishing make the smallest contribution to the creation of Serbia's GDP, as the standardized beta coefficient is the smallest (0.041).

Regarding the negative value of the unstandardized beta coefficient was observed in the manufacturing, we conclude that if the value of investments in the manufacturing increases by EUR mln, the realized value of Serbia's GDP decreases by EUR 3.894 mln. Therefore, the increase in investments in the manufacturing industry affects the reduction of the country's GDP. Therefore, it is recommended that more investment funds direct to the remaining three activities.

In the continuing of the paper, the regression model and the parameters used will be tested. In order to assess if the parameters $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4$ are correct, and they are not affected by errors, we must conduct another testing.

For testing β_0 parameter, we consider the following hypotheses (*equation 6)*:

$$H_0: \beta_0 = 0 \text{ and } H_1: \beta_0 \neq 0 \qquad (6)$$

The standard error of β_0 variable is β_0 = 55228.206. The value of the statistic test is *t* = 4.581. Because t = 4.581, with a Sig. = 0.006, we confirm that the null hypothesis is rejected because the parameter is significant with a possibility of risk of 5%.

For β_1 parameter, we considered the hypotheses (*equation 7)*:

$$H_0: \beta_1 = 0 \text{ and } H_1: \beta_1 \neq 0 \quad (7)$$

The standard error of β_1 is β_1 = 4.364. The value of the statistic test is t = - 0.892. Because the variable t is equal with -0.892, with a Sig. = 0.413, we accept the null hypothesis, at a significance limit level of 5%, which means that the manufacturing has not a good influence on the model.

For testing β_2 parameter, we consider the following hypotheses (*equation 8)*:

$$H_0: \beta_2 = 0 \text{ and } H_1: \beta_2 \neq 0 \quad (8)$$

The standard error of β_2 variable is β_2 = 6.666. The value of the statistic test is t = 3.880. Because t = 3.880, with a Sig. of 0.012, we consider the null hypothesis false, and that the parameter is significant from a statistical point of view, which means that electricity, gas, steam and air conditioning supply is the valid parameter at a significance limit level of 5%.

For testing β_3 parameter, we consider the following hypotheses (*equation 9)*:

$$H_0: \beta_3 = 0 \text{ and } H_1: \beta_3 \neq 0 \quad (9)$$

The standard error of β_3 variable is β_3 = 3.157. The value of the statistic test is t = 2.719. Because t = 2.719, with a Sig. = 0.042, we consider the null hypothesis false, and that the parameter is significant from a statistical point of view. This means that transportation and storage is the valid parameter at a significance limit level of 5%.

For testing β_4 parameter, we consider the following hypotheses (*equation 10)*:

$$H_0: \beta_4 = 0 \text{ and } H_1: \beta_4 \neq 0 \quad (10)$$

The standard error of β_4 variable is β_4 = 58.187. The value of the statistic test is t=0.174. Because t = 0.174, with a Sig. = 0.868, we accept the null hypothesis, at a significance limit level of 5%, which means that the agriculture, forestry and fishing has not a good influence on the model.

The conclusion of these five testes is that only the intercept parameter (β_0), and parameters of electricity, gas, steam and air conditioning supply as well as transportation and storage were accepted as highly influencing on the GDP.

The correlation between the independent variables in the set model will determine whether there is a certain degree of connection between the predictors, as well as whether their connection affects the achieved regression results. The degree of connection between the predictors was determined using the tolerance level, VIF and eigen value (*Table 5. and Table 6*.).

The obtained values in the *Tolerance* column are around 0.4, so we conclude that the values of realized investments are weakly collinear according to the analyzed economic activities in the observed period. The presence of weak multicollinearity between the value of realized investments according to activities is also indicated by the VIF coefficient, which ranges up to 3.8. We conclude that the set regression model is valid, and there is weak multicollinearity between the predictors.

Table 6. Diagnosing the influence of independent variables on the presence of multicollinearity

Model	Dimension	Eigen value	Condition Index	Variance Proportions				
				(Constant)	Manufacturing	Electricity, gas, steam and air conditioning supply	Transportation and storage	Agriculture, forestry and fishing
1	1	4.762	1.000	.00	.00	.00	.00	.00
	2	.190	5.001	.02	.00	.00	.48	.00
	3	.030	12.550	.12	.00	.78	.13	.01
	4	.012	20.064	.36	.69	.21	.19	.00
	5	.005	30.370	.50	.31	.00	.19	.98

Source: Author's calculation based on SORS databases.

The Eigen value of 4.762, 0.190, 0.030, 0.012 and 0.005 for β_0, β_1, β_2, β_3 and β_4 give low values for variables. However, Eigen values are closest to zero when the Condition Index achieves a very high value. In our case, the highest value of the Condition Index is 30.370 for β_5. This result indicates that the current multicollinearity is largely due to the influence of the independent variable X_4 (realized value of investments in agriculture, forestry and fishing).

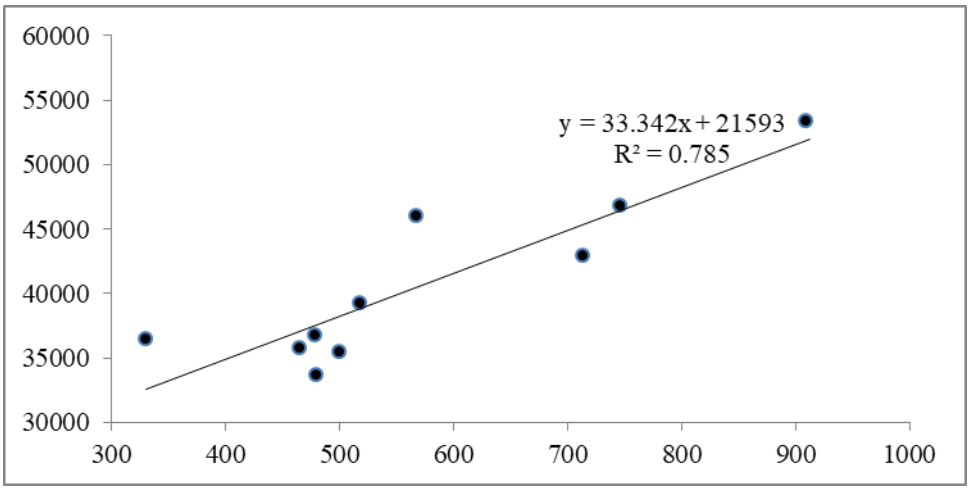
Based on the obtained results of the set regression model, we concluded that the greatest influence on the creation of Serbia's GDP has the realized value of investments in the electricity, gas, steam and air conditioning supply, while the presence of multicollinearity between the predictors comes from the realized value of investments in the activity of agriculture, forestry and fishing.

Considering that the set regression model showed that the biggest influence on Serbia's GDP is the value of realized investments in the electricity, gas, steam and air conditioning supply, in the following text a simple linear regression model with a trend line is given. This model should show how the change in the value of realized investments in the above mentioned activity will affect Serbia's GDP in the next three years. Accordingly, the initial equation of the linear regression model is of the following form (*equation 11)*:

$$y = bx+a, \qquad (11)$$

which is in our case: y – GDP of Serbia (dependent variable), x – value of investments realized in the activity of electricity, gas, steam and air conditioning supply (independent variable), a and b - parametric values. The graph below (*Figure 1.)* shows the trend of the linear regression model with the analyzed variables.

Figure 1. Linear regression model of Serbian GDP movement in the period 2022-2024



Source: Author's calculation based on SORS databases.

Based on the graphic above, we conclude that if the value of investments in the electricity, gas, steam and air conditioning supply were to increase EUR 1 mln in the next three years, we could expect an increase in Serbia's GDP by EUR 33.342 mln.

Golusin and Ivanovic (2011) point to low energy efficiency in the Serbian economy, which is based on "*outdated and dirty technologies*", as well as the need for greater application of the Kyoto Protocol and pulling on foreign investments to raise energy efficiency, and all with the aim of strengthening competitiveness of Serbia on global term. The mentioned authors indicate that "*application of different mechanisms aiming to increase energy efficiency in Serbia, could contribute to the increase of GDP annual growth rate from 5% to 7%, which cannot be achieved by any other economic instrument*".

Renewable energy sources are especially important and increasingly significant in the energy systems of all countries. Sabic et al. (2017) and Karakosta et al. (2012) indicate that Serbia has adapted the institutional environment and incentive measures in order to attract FDI in the field of renewable energy sources. At the same time, Sabić et al. (2017), by applying Inward FDI Performance Index, they conclude that Serbia is appealing to investors in the field of renewable energy sources, also that inflows of FDI in this field have positive impact on Serbian's economic growth.

Conclusion

With the application of a multiple regression model, the research showed that, compared to other activities, the GDP of Serbia is influenced to the greatest extent by investments in new fixed assets in the activity of electricity, gas, steam and air conditioning supply. Although this activity does not achieve a high average annual participation in the value of GDP and AARC, the conclusion was made in accordance with the value parameters of descriptive statistics, the value of the standardized beta coefficient and the evaluation

of the parameters used. The graphic presentation with a trend line showed that if the value of investments in the electricity, gas, steam and air conditioning supply were to increase by 1 million EUR in the next three years, we can expect an increase in Serbia's GDP by EUR 33.342 mln.

The set regression model showed that the impact of the transportation and storage activities on the value of GDP cannot be ignored either, although the statistical significance is lower compared to the previously mentioned branch of the economy. Realized investments in agriculture, forestry and fishing contribute to the creation of GDP, but do not have a statistically significant impact. Certainly, this activity records an average annual participation in total investments and average annual growth rates, which are higher than in other branches of the economy. Realized investments in the manufacturing affect the value of Serbia's GDP, but the impact is not statistically significant. For this activity, we can say that it has the highest value of the average annual participation in the total investments in the country, while the value of PGSP is lower than the value achieved by the activity of agriculture, forestry and fishing, and wholesale and retail trade.

The obtained results can help economic decision makers, indicating the contribution of past and future investments by individual activities to the growth of Serbia's GDP. The results can also provide support to public policy creators in order to adapt the institutional framework and support policy to domestic and foreign investors, in all activities, given the established positive contribution of investments in most activities to GDP growth.

The conducted research also has its limitations, because the results of the research and the realized values of the country's GDP are influenced by other factors that were not analyzed in this paper, and should be mentioned: FDI, industrialization level, prices, exchange rate, value of public debt, employment , etc. The directions of future research could include the indicators just mentioned, because each of them affects the creation of GDP to a certain extent.

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Conflict of interests

The authors declare no conflict of interest.

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