INVESTMENT IN RESEARCH AND DEVELOPMENT AND THEIR IMPACT ON ECONOMIC GROWTH (GDP GROWTH) OF BOSNIA AND HERZEGOVINA

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Abstract: By investing in research and development, Bosnia and Herzegovina can achieve a competitive advantage in the market and play an important role in supporting research and development, because it can facilitate investments through tax policies and measures, cooperation between science, the state and companies, etc. It is important to note that all attempts to support stronger investments in research and development are fully justified, as they lead to economic growth and technological progress to Bosnia and Herzegovina. However, it is important that incentives are created in a way that not only implies investment growth, but also ensures their efficiency. More plastically, it is not only important how much will be invested in R&D, but also how, that is, what exactly will be invested in. Using theoretical models, numerous empirical studies have been conducted that examine the importance of investment in research and development and their impact on economic growth (GDP growth). Such empirical research differs in the selected variables, the type of statistical analysis and the results. The paper uses regression analysis models for selected macroeconomic indicators in the observed period. The aim of the research is to assess the effects of selected macroeconomic factors, especially the impact of investment in research and development on the growth of gross domestic product (dependent variable), and to answer the question whether investment in research and develo-pment (GERD) in Bosnia and Herzegovina is satisfactory?

Keywords: Research and development, Pearson correlation coefficient, Model Summari, Gross domestic product, growth

THE INTRODUCTORY PART

Research and innovation play an essential role in supporting smart and sustainable growth and job creation. While contributing to the creation of new knowledge, research is crucial for the development of new products and technologies, processes and services that enable higher productivity, industrial competitiveness and ultimately prosperity.

In countries with high productivity per capita, research and innovation, and technology development are the main factors of multifactor productivity[1]. The gap between the EU and the US in the intensity of research and development in the business sector[2] is due to the fact that the EU has less opportunity to develop large companies with a strong intensity of research and development based on scientific and technological achievements, especially in ICT. It is a stylized fact that new companies in the EU are growing slower than in the US and that fewer of them are able to break into the ranks of the world's largest companies[3].

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[1] *Global Competitiveness Report 2016-2017,* World Economic Forum, Geneva, 2017, (https://www.lazarski.pl)

[2] The R&D intensity in the business sector in 2015 was 1.25% in the EU, compared to 1.99% in the US. The level of research and development in the business sector is significantly higher in other major economies: „Korea (3.28%), Japan (2.58%) and China (1.59%)" (https://www.ec.europa.eu)

[3] Veugelers and Cincera, "Europe missing yollies" ("Europe lacks young leading innovators"), policy summary, Bruegel, Brussels, 2010.

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The economic growth and development of Bosnia and Herzegovina is influenced by numerous factors, the most important being the gross domestic product. The choice of these factors is a subjective question of decision makers and analysts (researchers). „The paper uses four independent variables that are included in regression model, and the order of inclusion in the model is as follows: research and development, trade volume, unemployment and inflation. In addition to them, there are other factors important for the functioning of economies: supply and demand for goods and services, unequal distribution of income, political situation, etc. Likewise, natural factors have an equally important impact on economic growth: climate change, diversifica-tion and sustainable development. In order to quantify the relationship between economic growth and other macroeconomic indicators, we chose an extended model of multiple linear regression using the Enter method and regression procedures, as well as residual analysis. The Enter method gradually includes independent variables, and then one by one the variables are removed from the model (according to the previously set criteria)"[4].

„The goals of the Strategy for the Development of Science in BiH are the construction and development of Bosnia and Herzegovina as a new, modern society, known as the „knowledge society", in which knowledge is the main creative force in personal, economic, social, in cultural and material progress"[5].

1. PREVIOUS RESEARCH

Why would investing in R&D be important for a country in general, and for Bosnia and Herzegovina in particular? First, it should be recalled that it has long been shown[6] (Solov, 1956) that the long-term growth rate of economies is determined by technological progress, with technological progress affecting the efficiency of traditional inputs of production, labor and capital (later human capital was included in the models)

„Solov's model of economic growth, often known as Solov-Swan's neoclassical model of growth, because this model was independently discovered by Trevor W. Swan and published in The Economic Record in 1956, allows the determinants of economic growth to be separated into increasing inputs (labor and capital) and technical progress. The reason why these models are called "exogenous" growth models is that the savings rate is considered to be exogenous. Subsequent work derives savings behavior from an inter-temporal framework to maximize utility. Using his model, Solov (1957) calculated that about four-fifths of the growth in American production per worker could be attributed to technical progress"[7].

One of the basic endogenous models of growth is Romer's model, which was presented in the paper Endogenous Technological Change in 1990[8]. In this paper, Romer did not reject Solov's explanation of long-term growth, but developed a model that explained how investing in research and development affects technological progress and what influences incentives for entrepre-neurs to invest in research and development. (financing costs play a big role).

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[4] https://www.degruyter.com

[5] Kovači, A., Habibija, E., Šarić, A., (2018), "Analysis of Gross Domestic Expenditu-Res On Research and Development in South East European Countries", *Integrated Politics of Research and Innovations.*

[6] https://www en.wikipedia.org

[7] https://en.wikipedia.org/wiki/Robert_Solow

[8] https://www.dokodoc.com.

Since then, Romero's model is one of the most commonly used theoretical models to explain the importance of investing in research and development. Using this theoretical model in a series of empirical studies to date, we conclude that investing in research and development has a positive impact on economic growth. This message is also important for Bosnia and Herzegovina, because the contribution of technological progress to growth is extremely small (average: 0.202% of GDP, period 2005-2019).

In his paper, Mervar[9] states that models of endogenous growth see economic growth as an endogenous result of the economic system, in contrast to the neoclassical model in which economic growth is determined by an exogenously determined rate of technological progress.

Malešević and Ćorić[10] conclude that in the model of endogenous growth related to research, the equilibrium GDP growth rate per worker is determined by investing in research and development. This conclusion means that economic policy makers should encourage investment in research and development. The equilibrium GDP growth rate per worker also depends on the productivity of research. Viewed from a microeconomic perspective, economic policy makers can do little because there are no measures that would, say, affect creating better ideas. Viewed from a macroeconomic perspective, economic policy makers can still to some extent influence the productivity of research through various measures that would affect the quality of education in a country (with emphasis on

higher education) and improve the quality of education of people working in research processes.

Attempts to encourage stronger investment in research and development are fully justified, especially if their role is placed in the context of the country's potential growth and technological progress. However, it is important that incentives are created in a way that not only implies investment growth, but also ensures their efficiency.

2. RESEARCH METHODOLOGY

The research uses a model of single and multiple regression analysis using the databases of the "Statistical Office of Bosnia and Herzegovina"[11] for the observed period (2005 - 2019).

Gross domestic product (dependent variable) is analyzed, which is in the function of research and development, volume of trade (market openness), value of high-tech products in total exports, as well inflation and unemployment for the observed period, (T = 15 and one country N = 1). Statistical data are taken from the database of the (http:// www. redete.org) the internet (http://www.bhas.ba/Calendar/) and Eurostat (vhttps:// ec.europa. eu/eurostat/databrowser/view/rdegerdtot/ default/table?). Model analysis and comparison is performed using IBM SPSS Statistics v21.

2.1. Dependent variable

In the single and multiple linear regression model, the value of GDP was analyzed as a dependent variable. „Gross domestic product. GDP - gross domestic product represents the total value of all final goods and services produced in a given period of time in a given territory.

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[9] Mervar, A. (1999), A review of economic growth research models and methods. *Economic Trends and Economic Policy*, 9 (73), p. 20-61.

[10] Malešević Perović, L. and Ćorić, B. (2013), Macroeconomics: Theory and Politics. Split: *University of Split-Faculty of Economics*

[11] http://data.un.org

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GDP is expressed in monetary units, and includes only goods and services intended for further processing and production. GDP indicates a measure of production activities and is a generally accepted indicator of the state of a particular economy"[12].

2.2. Independent variables

In a simple linear regression model, the value of GDP was tested as a dependent variable and the value of investment in research and development was tested as an independent variable. In the multiple linear regression model, the variables analyzed as independent are:

- R&D - Investing in research and development is a proxy variable for technology. The most important indicator of the distribution is gross domestic expenditure on research and development - GERD.

- TRG - Trade in goods means a proxy variable of market openness (exports + imports);

- NZP - Unemployment, should answer the question whether it has an impact on GDP growth / decline?

- INF - Inflation in Bosnia and Herzegovina should answer the question of what impact it has on the GDP (growth / decline) ?

3. RESEARCH RESULTS

Gross domestic product is expressed according to the production approach in millions of EUR (Table 1.). When calculating GDP and other

macroeconomic aggregates, a methodology harmonized with the systems of „national accounts (SNA 93) the European System of National Accounts (ESA 95)"[13], and (SNA 2008)[14], international standards and recommendations was applied. GDP is the most frequently used aggregate (SNA) and is indicator of overall economic activity. We can conclude that in the observed period, the most significant increase in GDP compared to the previous year was in 2018, when GDP grew by 6,59%.

Table 1: GDP, R&D and percentage share of R&D in GDP for Bosnia and Herzegovina in the observed period (Author, 2020; based on sources from the BiH Bureau of Statistics)

| Year	GDP, million euros	R&D, one thousand euros	R&D,% of GDP
2005.	9025	2.708	0,055
2006.	10255	7.179	0,070
2007.	11529	3.459	0,030
2008.	13048	18.267	0,140
2009.	12679	39.305	0,310
2010.	12969	35.016	0,270
2011.	13412	38.895	0,290
2012.	13408	35.575	0,265
2013.	13692	43.995	0,321
4014.	13989	36.686	0,262
2015.	14618	35.083	0,240
2016.	15290	32.109	0,210
2017.	16043	32.181	0,201
2018.	17100	33.318	0,195
2019.	18012	36.024	0,200

Extremely small expenditures in R&D were recorded in 2005, only 0,055% of GDP. However, from 2010 to 2019, we have investments in R&D between 0,20% of GDP-0,27% of GDP. The largest investments in R&D were realized in 2013 (0,321% of GDP). (Chart 1). The projection for the EU in 2020 is 3% of GDP.

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[12] Stanić, S., Račić, Ž., 2019. „Analysis of macroeconomic factors effect to gross domestic product of Bosnia and Herzegovina using the multiple linear regression model", *Economics,* Volume 7, No.2-2019, ISSN 2303-5005, pg. 91-95

[13] Menon, P., (2018). "The rise of the shadow economy: An Indian perspective", *Journal of Public Affairs*.

[14] http://www.tsu.ge

Bosnia and Herzegovina has invested the least in R&D of all Western Balkan countries

Graph 1: Share of R&D in GDP, (%) (Author, 2020)
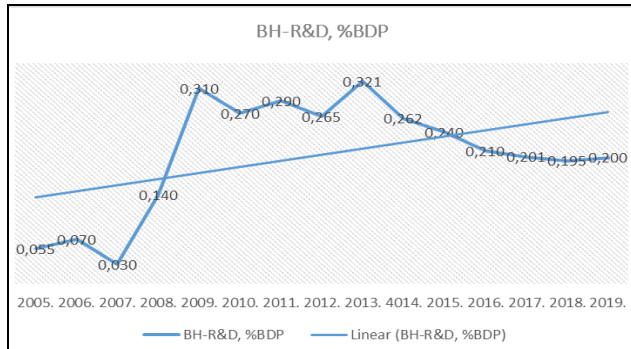
Based on the above, the application of the single linear regression model in this study can be expressed as follows:

$$GDP = f(R\&D)$$
$$GDP = a + b \cdot R\&D$$

where is:

GDP – dependent variable,
R&D – independent variable,
a, b – parameters

The following data are used in the application of the single linear regression model (Table 2):

Table 2: Data for the use of the linear regression model (Author, 2020)

$$\bar{x} = \frac{\sum x}{n} = \frac{429,8}{15} = 28,653 \qquad \bar{y} = \frac{\sum y}{n} = \frac{205069}{15} = 13671,27$$

$$b = \frac{\sum xy - \bar{x}\sum y}{\sum x^2 - \bar{x}\sum x} = \frac{6182028,99 - 28,653 \cdot 205069}{14942,52 - 28,653 \cdot 429,8} = \frac{306186,933}{2627,461} = 116,53$$

$$a = \bar{y} - b\bar{x} = 13671,27 - 116,53 \cdot 28,653 = 10.332,34$$

$$BDP = a + b \cdot R\&D = 10.332,34 + 116,53 \cdot R\&D$$

The coefficient of determination is calculated using the formula:

$$R^2 = \frac{a \cdot \sum y + b \cdot \sum xy - n \cdot \bar{y}^2}{\sum y^2 - n \cdot \bar{y}^2}$$
$$= \frac{10.332,34 \cdot 205.069 + 116,53 \cdot 6.182.028,99 - 15 \cdot 186.903.623,41}{2.883.245.007 - 15 \cdot 186.903.623,41}$$
$$= \frac{35.680.118,52}{79.690.655,85} = 0,4477$$

$$r = \sqrt{R^2} = \sqrt{0,4477} = 0,6691$$

The correlation coefficient of 0.6691 indicates a moderately strong influence ($0.5 \leq r \leq 0.8$) of the R&D on the GDP. Correlation is positive, and the linear regression shows an yes increase in investment in R&D of EUR 1 million increases GDP by EUR 116.53 million.

The inclusion of data in the statistical software IBM SPSS v21 confirmed the results of the research (Table 3), because the correlation coefficient is (r = 0.668 ≈ 0.6691 and $R^2 = 0.447 \approx 0.4477$). A positive correlation was also confirmed. The approximate values of the parameters a (a = 10334,808 ≈10332.34) and b (b = 116,434≈116.53) and the linear regression diagram (Table 4 and Graph 2) were also confirmed.

Year	Xi (R&D)	Yi (BDP)	X·Y	X²	Y²
2005.	2,71	9025	24457,75	7,344	81450625
2006.	7,18	10255	73630,90	51,552	105165025
2007.	3,46	11529	39890,34	11,972	132917841
2008.	18,27	13048	238386,96	333,79	170250304
2009.	39,31	12679	498411,49	1545,28	160757041
2010.	35,02	12969	454174,38	1226,40	168194961
2011.	38,90	13412	521726,80	1513,21	179881744
2012.	35,58	13408	477056,64	1265,94	179774464
2013.	44,00	13692	602448,00	1936,00	187470864
2014.	36,69	13989	513256,41	1346,16	195692121
2015.	35,08	14618	512799,44	1230,61	213685924
2016.	32,11	15290	490961,90	1031,05	233784100
2017.	32,18	16043	516263,74	1035,55	257377849
2018.	33,32	17100	569772,00	1110,22	292410000
2019.	36,02	18012	648792,24	1297,44	324432144
Ukupno:	429,80 (mil.eura)	205069 (mil.eura)	6182028,99	14942,52	2883245007

Table 3: Model Summary (Author, 2020)

| Model Summary									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,668ᵃ	,447	,404	1841,762	,447	10,494	1	13	,006
a. Predictors: (Constant), R&D									

Table 4: Coefficients for dependent variable GDP and independent variable R&D, (Author, 2020)

Coefficientsᵃ												
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B		Correlations			Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1 (Constant)	10334,808	1134,452		9,110	,000	7883,974	12785,643					
R&D	116,434	35,943	,668	3,239	,006	38,783	194,085	,668	,668	,668	1,000	1,000
a. Dependent Variable: BDP												

They are analyzed Tolerance and VIF values (Variance Inflation Factor, variance factor). „Tolerance shows how much of the variance of a given independent variable is not explained by the variances of other independent variables in the model. When this value is very small ($T \leq 0.1$), it indicates a huge correlation with other variables, ie multicollinearity"[15]. In our study Toleravce is for the independent variable T (T = 1), multicollinearity is not disturbed. VIF is the reciprocal value of Tolerance (VIF = 1 / T). If the value of VIF is> 5, then this data indicates multicollinearity. In our study, VIF is one (1) for the mentioned variable, which indicates the absence of multicollinearity.
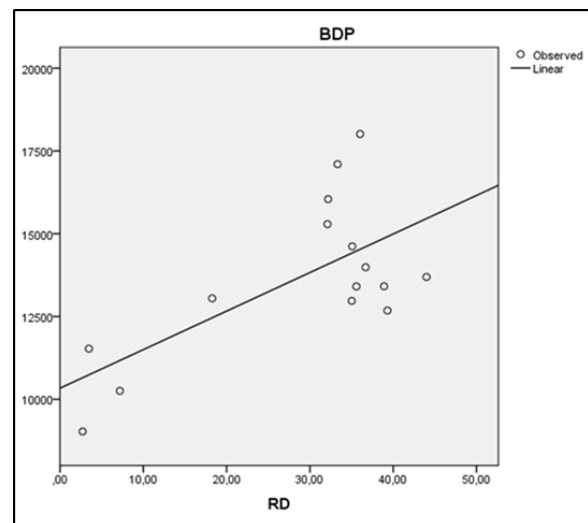
Graph 2: Linear dependence diagram of GDP = a + b · R&D (Author, 2020)

„The standard multiple linear regression model measures the impact of multiple independent variables on a dependent variable"[16]. Multiple linear regression is a regression function that shows the linear dependence of one dependent random variable on several other independent random variables[17].

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[15] https://www.mafiadoc.com

[16] http://www.link.springer.com

[17] http://www.ijerd.com

Table 5: Macroeconomic indicators of the BH economy from 2005 to 2019 (Author, 2020)

Year	GDP, million euros	Total investment in R&D, million euros	Volume of trade in millions of euros, (TRG)	Value of high tech products in total exports, million euros	Unemploy ment, millions of people (NZP)	Inflation,% (INF)
2005	9025	2,708	7651	19,34	0,509224	3,8
2006	10255	7,179	8464	31,69	0,519224	6,1
2007	11529	3,459	10141	33,58	0,520014	1,5
2008	13048	18,267	11762	106,39	0,477609	7,4
2009	12679	39,305	9145	65,04	0,510534	-0,4
2010	12969	35,016	10590	58,05	0,522989	2,1
2011	13412	38,895	12143	84,08	0,536728	3,7
2012	13408	35,575	11817	72,32	0,550255	2,1
2013	13692	43,995	12042	85,7	0,553481	-0,1
2014	13989	36,686	12722	97,66	0,547134	-0,9
2015	14618	35,083	12700	103,39	0,537568	-1
2016	15290	32,109	13079	110,77	0,512496	-1,1
2017	16043	32,181	14951	135,67	0,478191	1,2
2018	17100	33,318	15940	152,13	0,437783	1,4
2019	18012	36,024	15846	188,92	0,509224	1,1

„The interdependence of random variables in the multiple linear regression model can be represented by the following regression equation"[18]:

$$GDP_{it} = \beta_0 + \beta_1 * R\&D_{it} + \beta_2 * TRG_{it} + \beta_3 * NZP_{it}. + \beta_4 * INF_{it} + e,$$

In the study conducted, the dependent variable is GDP, and the independent variables are: R&D, TRG, NZP and INF.

Statistics v21, the Analysis of standard multiple regression was performed, which determined the dependence between the observed variables, based on the database shown in Table 5. It should be emphasized that using this module, multiplex linear regression, will be determined individual relationships and relationships between GDP (dependent variable) on the one hand and independent variables on the other (R&D, TRG, NZP and INF).

Based on the output, attention will be based on the output tables. In the model of standard multiple regression, it is necessary to check the collinearity of the variables, ie. do the independent variables show a weak relationship with the dependent variable (Table 6)? „Correlations, show the values of the Pearson correlation coefficient between all variables"[19]. GDP is most strongly correlated with market openness-TRG (0.966), followed by GDP with R&D (0.668), R&D with INF (-0.579), R&D with TRG (0.569), GDP with inflation-INF (-0.465); TRG with NZP (-0.359), and the weakest correlation is R&D with unemployment-NZP (0.208), ie. there is a weak relationship between these variables (r ≤ 0.3).

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[18] https://www.degruyter.com

[19] http://www.degruyter.com

Table 6: Pearson correlation coefficient values between all variables (Author, 2020).

		BDP	R&D	TRG	NZP	INF
Correlations						
BDP	Pearson Correlation	1	,668**	,966**	-,326	-,465
	Sig. (2-tailed)		,006	,000	,236	,081
	N	15	15	15	15	15
R&D	Pearson Correlation	,668**	1	,569*	,208	-,579*
	Sig. (2-tailed)	,006		,027	,458	,024
	N	15	15	15	15	15
TRG	Pearson Correlation	,966**	,569*	1	-,359	-,359
	Sig. (2-tailed)	,000	,027		,189	,189
	N	15	15	15	15	15
NZP	Pearson Correlation	-,326	,208	-,359	1	-,269
	Sig. (2-tailed)	,236	,458	,189		,333
	N	15	15	15	15	15
INF	Pearson Correlation	-,465	-,579*	-,359	-,269	1
	Sig. (2-tailed)	,081	,024	,189	,333	
	N	15	15	15	15	15
**. Correlation is significant at the 0.01 level (2-tailed).						
*. Correlation is significant at the 0.05 level (2-tailed).						

„It is very important for investors that the country is open to the market, that is that there are no trade restrictions. Therefore, greater market openness is expected to attract more domestic and foreign R&D investment. Research conducted in this paper leads to the conclusion that market openness has a strong impact on the inflow of investment in R&D. R&D represents gross domestic expenditure on research and development (GERD) as a % of GDP, which is a variable for technology"[20]. Research indicates that greater investment in R&D leads to a significant increase in GDP. Reducing unemployment and inflation will also increase GDP.

„Using the Enter method, where the initial situation implies that all independent variables are included in the model, without any restrictions. Then one by one the variables are excluded from the model according to predefined criteria associated with the value of F for removal statistics"[21]. When evaluating the results (small sample) it is necessary to consider the Adjusted R-square, the value of the F-test in testing the significance of all independent variables in the equation, the corresponding p-value of the F-test and the average regression error or standard regression deviation. The more representative the model, the closer the coefficient of determination is expected to be 1, for the higher the value of the F-test, lower the standard deviation of the regression. The following Table 7 shows all the indepe-ndent variables retained in the regression model, a according to predefined statistical criteria.

Table 7: Overview of all Variables Enterd/Removed in the regression model (Author, 2020)

Variables Entered/Removed[a]			
Model	Variables Entered	Variables Removed	Method
1	INF, NZP, R&D, TRG[b]		Enter
a. Dependent Variable: BDP			
b. All requested variables entered.			

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[20] Šušić, M. (2018). Influence of foreign direct investments on economic development of the Republic of Serbia. *Journal of Process Management. New Technologies* , 6(4), 50-64.

[21] https://www.degruyter.com

Next Table 8 shows, Model Summary, and key information about the validity of the regression model.

Table 8.: Model Summary

Model Summary[b]										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	,983 a	,965	,952	524,769	,965	69,847	4	10	,000	1,705
a. Predictors: (Constant), INF, NZP, R&D, TRG										
b. Dependent Variable: BDP										

The results between GDP as a dependent variable and independent variables (R&D, TRG, NZP and INF) are presented. For the small sample (N = 15). The results show that the correlation coefficient between of the dependent variable (GDP) and the independent variables (R&D, TRG, NZP and INF) is 0.983, which means that their relationship is very strong. Based on the data for the F-test (F = 69,847 and Sig. = 0,000), it can be concluded that the between the dependent variable (GDP) and the independent variables (R&D, TRG, NZP and INF) is very strong relationship.

Coefficient of determination (square R) is 0.965, which means in to 96.5% of the variability of the dependent variable (GDP) could be explained by the effect of independent variables (research and developpment, market openness, unemployment and inflation). Adjusted R Square of 0.952 is close to the value of R Square (0.965), due to the favorable relationship between the number of variables included in the model and the total number of observations. Multiple linear regression can be expressed by the following equation:

$GDP_{it} = \beta_0 + \beta_1*R\&D_{it} + \beta_2*TRG_{it} + \beta_3*NZP_{it}. + \beta_4*INF_{it} + e,$

where is:

GDP - dependent variable,

R&D,TRG,NZP i INF - independent variables,

β_0 – constant,

$\beta_1, \beta_2, \beta_3, \beta_4$ – unknown parameter with independent variable,

e - error that reflects all impacts that do not originate from the research and development, market openness, unemployment and inflation.

Table 9. Shows the Unstandardized Coefficients - under B and Standardized Coefficients under β.

Table 9.: Unstandardized Coefficients - under B and Standardized Coefficients under β.

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	8368,708	3616,875		2,314	,043	309,807	16427,608					
	R&D	32,208	15,600	,185	2,065	,066	-2,551	66,967	,668	,547	,121	,431	2,320
	TRG	,752	,087	,782	8,646	,000	,558	,946	,966	,939	,508	,422	2,369
	NZP	-8573,842	5910,563	-,112	-1,451	,178	-21743,397	4595,714	-,326	-,417	-,085	,577	1,732
	INF	-99,992	70,146	-,107	-1,425	,184	-256,286	56,303	-,465	-,411	-,084	,617	1,621
a. Dependent Variable: BDP													

Here it is necessary to analyze the values of Tolerance and VIF (Variance Inflation Factor, factor of increasing variance). „Tolerance shows how much of the variance of a given independent variable is not explained by the variances of other independent variables in the model. When this value is very small (T ≤ 0.1), it indicates a huge correlation with other variables, ie multicollinearity"[22]. In our study, the tolerance for all independent variables is greater than 0.1 (R&D: T = 0.431> 0.1; TRG: T = 0.422> 0.1; NZP: T = 0.577> 0.1; INF: T = 0.617 > 0.1), so the assumption of multico-llinearity is not violated. VIF is the reciprocal value of Tolerance (VIF = 1 / T). If the value of VIF is> 10.0, then this data indicates multicollinearity. In our study, the VIF of all variables is less than 3 (highest VIF = 2,369), which is significantly below the average point 10.

Furthermore, the independent variable (TRG) most individually contributes to the clarification of the dependent variable GDP (Beta -β = 0.782), followed by the independent variable R&D (β = 0.185), and the NZP (β = -0.112). The smallest variable in the individual explanation of the dependent variable (GDP) has the independent variable INF (β = - 0.107)

Research has shown that based on the assumed regression coefficients, multiple linear regression can be expressed by the following equation:

$$GDP = \beta_0 + \beta_1*R\&D + \beta_2*TRG + \beta_3*NZP + \beta_4*INF = 8.368,708 + 32,208 \cdot R\&D + 0,752 \cdot TRG - 8.573,842 \cdot NZP - 99,992 \cdot INF$$

If investment in R&D increases by (1) million euros, there will be an increase in GDP by 32,208 million euros.

If unemployment is reduced by 1,000 workers, GDP will increase by 8,573842 million euros.

CONCLUSIONS

The correlation coefficient of 0.6691 indicates a moderately strong influence (0.5≤ r ≤ 0.8) R&D on the GDP. By including data in the statistical software IBM SPSS v21, the research results were confirmed, because the correlation coefficient (r = 0.668 ≈ 0.6691 and R^2 = 0.447≈0.4477). A positive correlati-on was also confirmed.

Approximate values of the parameters a and b (a = 10.334,808 ≈10332.34), (b = 116.434≈116.53) were confirmed. Linear regression shows that an increase in investment in R&D of EUR 1 million increases GDP by 116.53 million eurs.

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[22] https://www.mafiadoc.com

Research showed that the Square R is 0.965, which means that 96.5% of the variability of the GDP could be explained by the effect of variables: research and development, market openness, unemployment and inflation, while other factors are negligible (3.5%).

GDP most strongly correlated is with market openness-TRG (0.966),followed by GDP with R&D (0.668), R&D with INF (-0.579), R&D with TRG (0.569), GDP with inflation-INF (-0.465); TRG with NZP (-0.359), and the weakest correlation is R&D with unemployment-NZP (0.208), ie. there is a weak relationship between these variables (r ≤ 0.3).

It's research confirmed the hypothesis: Investments in R&D have a positive impact on growth GDP, which will encourage structural reforms and enable Bosnia and Herzegovina to adapt to the EU economy. By focusing on new, knowledge- and technology-based products, and increasing the export of high-tech products, positive effects on economic growth in Bosnia and Herzegovina will be achieved.

The results of the research can be useful to the Institutes for the Development of Economic Development Strategies and Economic Policies for making optimal decisions in order to resolve any shocks and crises, so that their activities are more precisely directed towards economic growth and to overall progress of BH economy.

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