

MULTIFACTOR MODEL OF ECONOMIC GROWTH IN THE DANUBE REGION OF BULGARIA

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Abstract: The economic growth in every country ensures continuing increase of well-being of citizens, the main goal of every economic policy. The search of solutions for realization of high economic growth implies the investigation of the factors for rapid economic development, leading to a higher standard of living. Solow's theory reveals the connection between the three main factors of economic growth - investments, labor and technological progress.

The research investigates these factors for the Danube region in Bulgaria. It includes 11 Bulgarian administrative units.

A model has been created to test the impact of growth factors according to Solow's theory on the produced Gross Domestic Product (GDP). In a previous study by the same author¹⁵, the impact of investments has been calculated for all types totally. Therefore, the impact on the growth of foreign and domestic direct investments is now being studied separately. All factors will be tested together with aim to find the strongest one. It perhaps gives the way for advancing development of Danube region by usage of instruments not put in the practice until now.

The economic analysis notes the strongest impact of foreign direct investments in the region on the aggregate supply, measured with GDP and shows they add more to GDP, because of better management, nowadays technology and techniques. The statistical analysis shows the coefficient of determination for the population on GDP is more significant. The correlation coefficient is negative, but with a very significant value. The economic growth in Danube region is delayed due to decreasing of population in the region. The economic analysis confirms external and internal migration influence negatively on the economic growth. The coefficient of determination for educated citizen is lower compared with investments and population. But nowadays business requires very good educated people in the modern industries and digital transformation of the economy. The innovations influence on economic growth in Danube region on a small scale. The resources are limited and that most of them are non-renewable. The economic crisis after the pandemic of COVID 19 requires economic growth to be realized at the account of higher productivity, not of more resources and it makes the innovation the most important factor of raising GDP.

Keywords: economic growth, factors of economic growth, regional development

1. INTRODUCTION

The economic growth in every country ensures continuing increase of well-being of citizens, the main goal of every economic policy. The search of solutions for realization of high economic growth implies the investigation of factors for rapid economic development, leading to a higher standard of living. Solow's theory reveals the connection between the three main factors of economic growth - investments, labor and technological progress.

The research investigates these factors for the Danube region in Bulgaria. It includes 11 Bulgarian administrative units. The Danube region has GDP per capita lower than the national average. It requires advancing development, higher than the average for the country to reduce and eliminate imbalances compared to other areas in the future. Achieving of this goal can be realized by utilizing the region's existing human, natural, capital and institutional resources, as well as the region's comparative advantages over others (by Samuelson).

2. MODEL

Solow's theory defines three factors of economic growth - investments, labor and technological progress. The theory shows the ratio of savings is a key factor for the level of capital intensity. A higher level of savings provides a larger stock of capital and investments growth and hence a higher level of GDP. The population growth in Solow's theory is also one of the main factors for the continuing growth of the economy with a stable rate, because it indicates the disposable labor force. However, if population growth is not accompanied by an increase of investments, it will decrease the capital stock per one worker and reduce the productivity of labor. It will delay the economic growth.

¹⁵ Assenova, K., Current stage and perspectives for the advancing development of Danube region - Factors of growth, Journal Knowledge, Vol.34.1, 2019, p. 2545-4439

The third factor of economic growth after investments and employment is the technical progress. It should be noted that in the neoclassical theory of technological progress they achieve does not mean the replacement of human labor with machines, but qualitative changes of the production. In Solow's theory, technical progress is the only condition for the continuing growth of life standards measured as an income per capita. Thus, R. Solow's theory emphasizes technological progress as main basis for sustainability welfare growth and allows to be found the optimal growth option, providing maximum consumption.

The study creates model with the factors of economic growth according Solow.

The baseline model is following:

$$GDP = \beta_0 + \beta_{11} x_{11} + \beta_{12} x_{12} + \beta_{21} x_{21} + \beta_{22} x_{22} + \beta_{31} x_{31} e_{i,t} \quad (1)$$

Where

GDP – Gross Domestic Product annually for the region

x_{11} – direct foreign investments annually for the region

x_{12} – direct local investments annually for the region

x_{21} – population annually in the region

x_{22} – citizens graduated less primary school annually for the region

x_{31} – total R&D Expenditure annually for the region, R&D – Research and development activities

3. LIMITATIONS OF THE RESEARCH

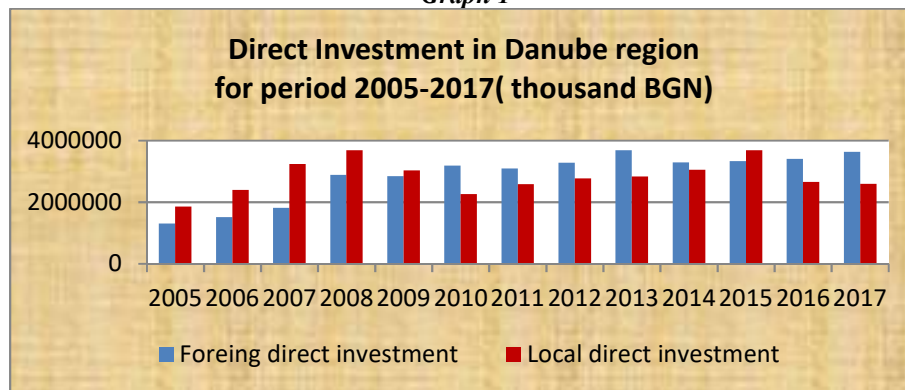
- Because the different way to be made the data by National statistic – with or not accumulation, monthly, quarterly or annually, chronologically presented – the different variables are recalculated to be mathematically compatible;
- The research recognizes the primary factors - capital, labour force and technical progress.
- The foreign direct investments deliver to the economy more innovative technology and techniques, new approach for education and management of human resources. The foreign direct investments are recalculated in BGN.
- The local direct investments add more resources for technological and technical improvement of industry.
- The disposal labour force in the region depends on the population. The part of population in the region migrates to main sites of the region and abroad.
- The innovations are measure with total R&D Expenditure for the region.

4. FACTORS OF GROWTH – DATA PRESENTATION

The foreign direct investments rise with strong rate during the period 2005-2008 – respectively with 15.83 %, 20.36 % and 58.48%. Between years 2009 - 2011 there are two years with negative rate. The biggest decrease of foreign direct investments is in 2014 with minus 10.59 %. Last three years of research period they increase with small pace from 1 to 6.70 %.

The local direct investments increase strongly during the same period as foreign. It is between 2005-2008 – respectively with 29.16%, 34.78% and 13.92%. In next two years they reduce sharply with minus 17.85% and minus 25.91 %. Between 2012 and 2015 local direct investments raise from 2% to 14%. The biggest negative change is in 2016 when they reduce with minus 27.90 % and this tendency continues in 2017. The direct investments in Danube region are below:

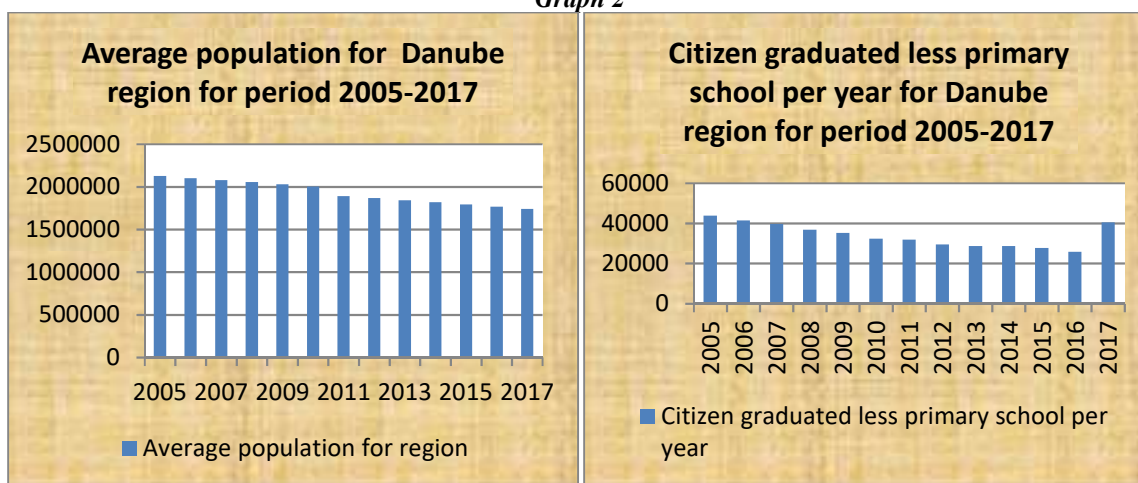
Graph 1



Source: Bulgarian National Statistic

The population in Danube region reduces with stable scale during the period 2005-2017. The deduction is between 1.19 % and 1.16% respectively in 2006 and 2009 on annual base. The strongest reduction for period is in 2011 with minus 5.62 %. The reason for this process probably connected with internal migration to main sites in the country and external – to the countries of EU, when level of income is much higher compare with such in Bulgaria. For the last years of investigated period, the population of Danube region reduces with stable rate comes to 1.50 % in 2017. It depends on: demographic policy not stimulating the more birth, structure of population with more adults, internal and external migration. The educated labor force is main factor for higher productivity in nowadays and pre-determinates the competitiveness of economy. Due to reducing population for investigated period “citizen graduated less primary school,, every year in the region are less compare with previous. The changes are in 2006- minus 5.68%, in 2010 – minus 8.14%, 2015 – minus 3.32%. The educated labor force in the region is not enough and it lead to lack of qualified workers. The educated people in Danube region with less primary school increase in the last year of investigated period due to come of minority group to the school. The date is presented below:

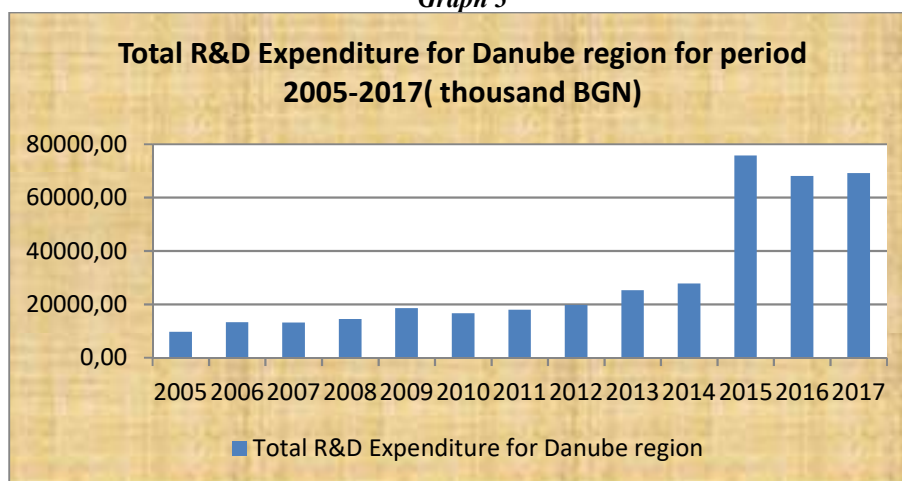
Graph 2



Source: Bulgarian National Statistic

The total R&D Expenditure impacts the productivity and competitiveness strongest in every county. For Danube region they raises during the whole period 2005-2017. In 2006 they increase with 38.07%, 2009 – 28.30%, 2012 – 10.04% and in 2015 – with 173.09%. Gradually this positive change of R&D Expenses is delayed and for the last year of investigated period is only 1.53%. The smaller spending for science and innovation makes worse competitiveness of production in the region in the long run.

Graph 3



Source: Bulgarian National statistic

5. RESULTS

On Tab. 1. Model Summary is given the coefficient of determination of the multifactorial regression model. As expected, the coefficient is $R^2 = 0,954$, which means almost a functional link. Also, the coefficient is statistically significant (Table 2, Sig. $< \alpha = 0,10$).

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
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ANOVA^b

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	39297526,434	5	7859505,287	50,970	,000 ^a
Residual	1079380,335	7	154197,191		
Total	40376906,769	12			

a. Predictors: (Constant), RNIRD, LDI, GRDLESSPS, FDI, AvPopulation

b. Dependent Variable: GDP

1	,987 ^a	,973	,954	392,67950
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In Table 3. Coefficients - are defined the standardized coefficients for the multifactor regression model for each factor of economic growth.

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	18909,383	5548,657		3,408	,011
	FDI	,001	,000	,572	3,978	,005
	LDI	,001	,000	,145	2,020	,083
	AvPopulation	-,007	,003	-,532	-2,738	,029
	GRDLESSPS	,077	,031	,252	2,495	,041
	RNIRD	,006	,009	,073	,610	,561

a. Dependent Variable: GDP

The statistical analysis shows the coefficient of determination for foreign and local direct investments is significant. The economic analysis notes strongest impact of investments in the region on the aggregate supply measured with GDP. The investments have two effects: direct-increasing the aggregate demand and there for aggregate supply for current year and indirect - additional multiple effects on the aggregate demand and the GDP in next several years. The capital expenditure, because long duration of each stage of their turnover, retains the impact on the aggregate demand and therefore on the GDP for long period of time. As known from the theory, as a result - income increases and employment reduces not only in sectors, where the capital spending made, but in others. It leads to an increase of aggregate demand, not only through investment (I), but also indirectly through the consumer spending (C). The correlation coefficient of foreign direct investments, calculated for the region is stronger than for local and probably shows foreign direct investments add more to GDP, because better management, nowadays technology and techniques. The higher income paid in foreign companies adds to multiply effect of these investments through consumption.

The statistical analysis shows the coefficient of determination for the population is magnitude. The correlation coefficient is negative, but with very significant value – minus 0.532. The economic growth in Danube region is delayed due to decreasing of population in the region. On this base, the economic analysis confirms external and internal migration influence negatively on the economic growth. It is a reason for lack of enough human resources. Reducing population is the reason for realization of GDP under potential for the region.

By the statistical analysis is found the coefficient of determination for educated citizen is lower compared with investments and population. From one side, nowadays business requires good educated people in the modern industries and digital transformation of the economy. From other side, in Bulgaria more significant impact on the

aggregate demand and therefore on the GDP has the consumer spending. It will increase when the disposal income changes positively. Such income depends on the number of employees, level of income and taxes. The income taxes have low level in Bulgaria. By current stage of economy the number of good educated people influence on the employment and the productivity, define the income and consumption. The last item impacts on GDP.

The innovations lead to higher productivity. As productivity increases, the volume of goods and services produced raises. The growth of innovations and of productivity brings huge benefits to consumers and businesses. Workers' wages increase in proportion to the increase in productivity. They have more money available and can buy more goods and services. It increases consumption and stimulates positive change of GDP. At the same time, the business is becoming more profitable, which allows investments and hiring more employees. It increases GDP too. The innovation activity in Bulgaria is lower compared to the most innovative economies of the EU. The reason could be in the low-tech feature of the Bulgarian economy and the lack of appropriate incentives to encourage companies to be innovative. The EU market assumes that companies will invest more in their technology upgrade to survive the growing competition. The data for local investments above does not confirm it. It is a reason does not realize potential GDP in the economy. The correlation coefficient for R&D Expenditure is lower compared with other factors of growth. This ratio must be considered critically, because it is not particularly significant. The R&D Expenditure influences on economic growth in Danube region on small scale. In this case they does not lead to more innovations.

6. CONCLUSION

The economic growth in every country ensures continuing increase of well-being of citizens, the main goal of every economic policy. The search of solutions for realization of high economic growth implies the investigation of factors for rapid economic development, leading to a higher standard of living. Solow's theory reveals the connection between the three main factors of economic growth - investments, labor and technological progress.

The research investigates these factors for the Danube region in Bulgaria. The Danube region has GDP per capita lower than the national average. It requires advancing development, higher than the average for the country to reduce and eliminate imbalances compared to other areas in the future. The study creates model with the factors of economic growth according Solow. The statistical analysis shows the coefficient of determination for foreign and local direct investments is significant. The economic analysis notes strongest impact of investments in the region on the aggregate supply, measured with GDP. The correlation coefficient of foreign direct investments, calculated for the region is stronger than for local and probably shows they add more to GDP, because better management, nowadays technology and techniques. The impact of population on level of GDP is negative. The economic growth in Danube region is delayed due to decreasing of population in the region. On this base, the economic analysis confirms external and internal migration influence negatively on the economic growth. The number of educated citizen is lower every year compared with previous. By current stage of economy the number of good educated people influence on the employment and the productivity, define the income and consumption. The last item impacts on GDP. The innovation leads to higher productivity. As productivity increases, the volume of goods and services produced raises. The growth of innovation and of productivity brings huge benefits to consumers and businesses. The innovation activity in Bulgaria is lower, compared to the most innovative economies of the EU. The reason could be in the low-tech feature of the Bulgarian economy and the lack of appropriate incentives to encourage companies to be innovative. The R&D Expenditure influences on economic growth in Danube region on small scale. But they defines small number of innovations in the country.

The study confirms strong impact of investments and disposal labor force. It requires usage of new instruments for stimulating their positive development. The innovations do not add sustainable to economic growth. Due to it, they could encourage in the future.

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