

THE CONTRIBUTION OF THE HIGHER EDUCATION SYSTEMS OF THE EU COUNTRIES TO ECONOMIC GROWTH

Anna A Firsova and Aleksander P. Tsypin

Prof. PhD, Saratov State University, Russia, Assoc. Prof., PhD, Samara State University, Russia

Abstract: The growing importance of universities in recent decades in the development of the economy determines the relevance of research that allows us to assess the impact of higher education on economic growth. Thanks to the creation of the theory of human capital, investments in education in many countries of the world began to be considered as one of the sources of economic growth along with investments in physical capital. The purpose of the research paper is to test the hypothesis of the impact of public spending on higher education on the economic growth of the EU countries. The article analyzes statistics data and compares intercountry research of the main indicators of the education system. The study uses econometric tools to analyze government spending on education and determine the impact of higher education expenses on the economic growth dynamics. The conclusions of the article contain quantitative results of the evaluation of the educational system in Europe and the impact of higher education on GDP growth.

Keywords: higher education, higher education expenses, economic growth, gross domestic product, European Union

Introduction

Higher education has a very important interdisciplinary significance in the context of sustainable development of economy. The role of education in the development of society determines the relevance of research to assess the impact of education on the national economy, living standards and economic growth.

Quantitative estimates of the impact of higher education spending on economic growth have remained a actual global scientific problem for several decades, justifying or refuting the need for public policies to increase funding for higher education, and leaving this aspect of the study of the contribution of higher education open to debate and discussion in the scientific community.

The purpose of the research paper is to test the research hypotheses of the impact of public spending on higher education on the economic growth of the EU countries and the differentiation of the growth rates in the EU founding countries and in the newcomers to the EU since 2004.

The study used the methods of economic, statistical and econometric analysis.

To achieve this goal, the following main research tasks were set and solved:

- formation of relevant indicators to determine the presence of correlations reflecting the dynamics of higher education;
- collection and preparation of empirical data for research, comparative analysis of quantitative characteristics of educational systems of the EU countries;
- creation of an econometric model and its testing on data from 25 EU countries.

Theoretical analysis

In recent decades the significant impact of human capital on economic growth has been widely recognized. Human capital is a strategic resource of economic progress. It is impossible to achieve competitiveness and sustainable economic development without investment in human capital. In modern conditions of post-industrialization and economic growth, based on the new technologies, the dominant role in the of human capital development is played by the education system, and especially the system of higher education.

The World Bank studies of 192 countries data have shown that their national wealth consists of 16% of physical capital, 20% of natural resources, and 64% of human capital (in Germany, Sweden and Japan the share of human capital reaches 80%).

The contribution of higher education to training, knowledge generation, diffusion of innovation, the creation of new technological structures and socio-economic development is a significant fact of economic growth in all countries.

The development of the theory of human capital and the study of the interaction of education and economic growth allowed to determine the quantitative contribution of education to economic development by the leading researchers of the 20th century.

Easterlin found the connection between the beginning of economic growth and the spread of education in different countries of the world and found that the lag between the reforms in the educational sector and the beginning of significant economic growth is 25-30 years.

Denison considered the relationship between the level of education and income of the economically active population and determined that the difference between the average income of persons of the same age by 3/5 is determined by the level of education, and the rest - personal abilities and other circumstances. According to Denison, the contribution of education to the growth of national income in the US and European countries ranges from 12 to 29%. Improving the quality of the workforce has led to a 14% increase in real national income in the United States.

Madison found that an increasing of 1 % in education expenditure leads to a 0.35 % increase in the country's GDP gross domestic product, and with the growth of the share of educated people in the total population of the country increases the rate of economic growth.

Blankno and co-authors have found that public spending on education by 1% increase the average rate of economic growth by 0.201% on the basis of world Bank data from 1960 to 2000 for 23 developed countries.

The organization for economic cooperation and development (OECD) published in 2004 the results of a study according to which an increase of 1 year of the average period of study for the inhabitants of a certain country leads to an increase in the GDP of the state by 3-6%. OECD experts emphasize that the higher the level of education in the country, the higher GDP and higher economic development indicators, longer life expectancy and better health. This shows that the quality and efficiency of education in the labour market have increased.

Bluestone estimated the economic impact of the university on the state's economy and the additional income from higher education on the materials of the University of Massachusetts in Boston. He established the excess of the level of salaries of workers with higher education over the salaries of workers with only school education. They were the findings that admitted to study in 1991 2572 students will earn during their working life additional \$ 1.05 billion for the total income of Massachusetts. This is well in excess of the \$ 34.1 million spent by the state while students are studying at this University in Massachusetts.

Thus, literature review in most cases confirms the thesis that one of the levers of accelerating economic growth is to increase spending on education. However, researches on the quantitative assessment of the impact of spending on higher education on the growth of gross domestic product of the country is not so common. This study continues to search for methods to assess the quantitative characteristics and effectiveness of the higher education system using tools of econometrics and statistics.

Ddata

In this study, the term "higher education" is interpreted broadly as a synonym for tertiary education (third-level education) according to The international standard classification of education (ISCED) adopted in the EU. Third-level education includes post secondary education, higher education: undergraduate and postgraduate education, doctoral studies, as well as vocational education and training.

It was tested two main hypotheses in this research:

H1: growth of public expenditure on higher education affects the rate of economic growth in the EU;

H 2: in the EU's founding countries the impact of higher education on economic growth is higher than in the newcomers to the EU since 2004.

For this purpose, a dummy variable D_i ($i = 1$ or 0) was introduced into the calculations:

- $D = 1$ for newcomer countries BGR, CZE, EST, HUN, LTU, LVA, POL, ROU, SVK, i.e. countries that joined the EU in 2004.

- $D = 0$ for the founding countries of the EU.

The databases of international organizations as The World Bank, The Organization for Economic Cooperation and Development and Eurostat were used for the study.

Analyzed set consists of 25 EU countries. Greece, Netherlands, Luxembourg were excluded from the population, as there are no data on public expenditure on education for the study period.

The system of indicators was formed, which characterizes the impact of spending on higher education on the development of the economy of the European Union. The main indicator characterizing the development of the country's economy and economic growth is the gross domestic product. To eliminate the economies of scale, the study used GDP per capita (Y).

Government expenditure per tertiary student (% of GDP per capita) theoretically influences the development of the economy and characterizes all expenditure on it (expenditure on teachers, university infrastructure, other educational expenses, etc.).

The study of the impact of spending on 1 student of tertiary education on economic growth, measured as GDP per capita (in USD), was carried out using correlation and regression analysis, which aims to identify significant dependencies and reflect the impact of factors on the result through the econometric model.

Empirical research

It should be noted that the variables "Government expenditure per student, tertiary (% of GDP per capita)" has an impact with a lag (delay) on the growth of GDP of the economy, as the effects of spending on higher education will appear in 4-7 years, when graduates will enter the labor market, adapt to the workplace and begin to create added value. This means that several years must pass between the moment of investment in education and human capital and the moment of its return.

To analyze the lag value, data on the dependent variable Y were taken in the current period (which corresponds to 2017), and the independent variables X were selected with different levels of time delay: 2010, 2011, 2012 and 2013. As a tool for substantiating the conclusions, the correlation method was used (table 1).

Table 1. Matrix of pair correlation coefficients of GDP per capita dependence on factors

Variables	Y	D	X_2010	X_2011	X_2012	X_2013
Y	1,00					
D	-0,64	1,00				
X_2010	0,63	-0,68	1,00			
X_2011	0,72	-0,71	0,93	1,00		
X_2012	0,66	-0,72	0,92	0,90	1,00	
X_2013	0,60	-0,63	0,89	0,88	0,97	1,00

Note: created by authors in STATISTICA package. The coefficients are statistically significant at 5% level.

Table 1 shows that the greatest effect (the strongest relationship) is observed between Y and the variable X_2011, i.e. the lag period is 6 years. This result does not contradict the logic, as the most common form of tertiary education is a bachelor's program (4 years) after which graduates need another 1-3 years to adapt to the labor market.

Also, the analysis of the pair correlation coefficients matrix shows that there is a strong feedback between the quantitative variables and the dummy variable, i.e. in the EU founding countries the investment effect will be higher than in the new countries. This is due to the fact that the education system in these countries had "Soviet roots" on the European system, which led to a decrease in the quality of education in the years of transition and some lagging behind the leaders of the Eurozone.

To confirm this statement, Student's t-test was used for independent samples and the analysis of averages for variables Y and X_2011 for two groups of Eurozone countries was carried out (table 2).

Table 2. The rating values of Student's t-test for mean values for the countries-founders and the newcomers countries of EU

Indicators	Average		t-value t-test	p-significance level
	Founders countries of EU	Newcomers countries of EU		
Y – GDP per capita в 2017 year (current US\$)	37495,66	16142,97	3,99	0,00
X_2011 – Government expenditure per student, tertiary 2011 year (% of GDP per capita)	32,93	20,63	4,81	0,00

Note: created by authors in STATISTICA package. The coefficients are statistically significant at 5% level.

The actual values of Student's t-test presented in table 2 are statistically significant. This indicates that there are significant differences between the averages of the two groups compared, which means that we put forward the hypothesis of significant differences. If we compare the obtained averages, the group of founders exceeds the group of newcomers countries 2.3 times in GDP per capital and 1.6 times in public expenditure per tertiary student.

Research result

The study revealed the following dependence of public spending on tertiary education in 2011 on the level of GDP per capita in 2017 (figure 1).

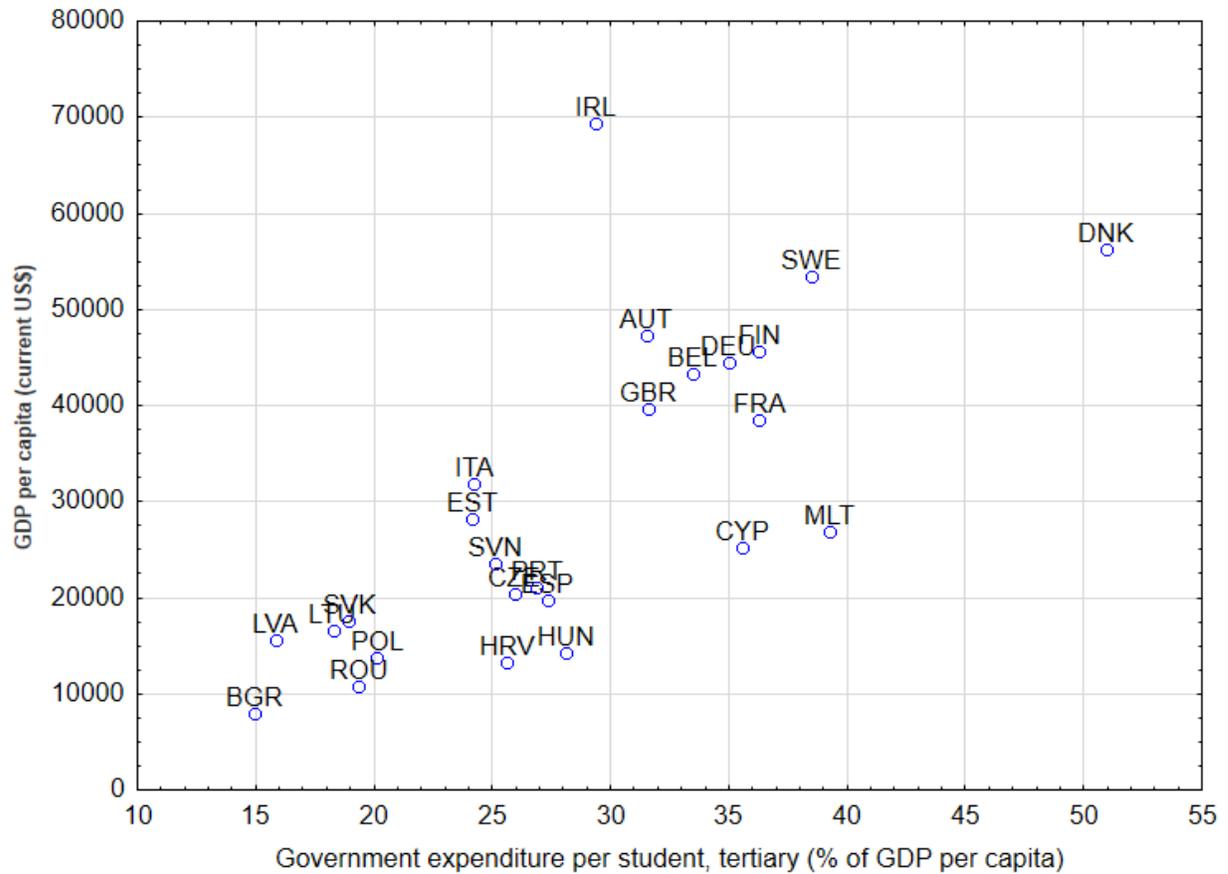


Fig. 1. Dependence of public expenditure on tertiary education in 2011 on GDP per capita in 2017

(Note: created by the authors in STATISTICA package, based on World Bank data.)

According to the data presented in figure 1, there is a direct correlation between the comparable indicators, i.e. with an increase in the share of expenditure on tertiary education, the level of GDP per capita will also increase.

Correlation and regression analysis was used for formalized quantitative description of the established dependence. The inclusion of variable D in the equation did not provide a statistically significant model.

The results of modeling the impact of public spending on tertiary education in 2011 (X) on the level of GDP per capita in 2017 (Y) is an econometric model in the form of a linear regression equation:

$$Y = -9490,39 + 1378,80X_{2011}, R=0,72; F(1,23)=24,33$$

Thus, with an increase in public spending on education of 1 student of tertiary education by 1%, GDP per capita in 6 years will grow by \$ 1378.80 per capita, while other factors remain unchanged.

The resulting econometric model shows statistically significant results, since the multiple correlation coefficient ($R = 0.72$) indicates a high relationship between the features (according to Chaddock scale).

The actual value of Fisher's F-test ($F=24.33$) indicates that the resulting model is statistically significant at 5% level.

The obtained model is statistically significant. On its basis, the simulation of different values of the dependent variable was carried out:

- the average values of public expenditure were calculated for the group of EU founders ($X_{2011}=32.93$) and the group of EU newcomers countries ($X_{2011}=20.63$);
- an extreme minimum value of 10% was used, which corresponds to the worst-case scenario;
- the situation was modeled in which the level of public spending will rise to, for example, a value of 60%, which corresponds to the most optimistic forecast (table 3).

Table 3. Projected GDP per capita for different versions of the dependent variable

Variables	Versions of the predicted			
	Realistic		Pessimistic	Optimistic
X_2011	32,93	20,63	10	60
Predicted Y	35914	18954	4298	73238
-95,0%CL	30456	12325	-7436	54399
+95,0%CL	41371	25584	16031	92077

Note: created by authors in STATISTICA package

According to the presented versions of the forecast, the best option is obtained with an optimistic version at 60% of public expenditure on tertiary education. At the same time, GDP per capita will grow to \$ 73000 per person, which is 2.4 times higher than the average level for the considered set of countries in 2017. With the minimization of spending on education and bringing them to the level of 10%, GDP per capita will decrease significantly, and the lower confidence limit is obtained with a negative sign, which contradicts the economic essence of the indicator. It is also worth noting that there are significant differences (exceeding 1.9 times) in the response to the model between the countries founders of the EU and newcomers to the EU.

Conclusion

The application of statistical and econometric quantitative methods to data sets characterizing the relationship between public expenditure on tertiary education and GDP per capita has enabled us to identify a number of important patterns, as outlined below.

First, the correlation analysis showed that the effect of public spending on higher education is manifested after 6 years. This is completely subject to the logic of the process, as the learning process takes an average of 4 years, and then the graduate needs to work for several years to adapt to real workplace and business life.

Second, it was found that in the EU's founders member states, the values of GDP per capita and public expenditure on education are higher than those of the newcomers to the EU since 2004. This fact is associated with the effect of catching-up economy and is fully consistent with the theoretical postulates of economic theory.

Third, the results of building a model of GDP per capita dependence on public spending on tertiary education showed its full adequacy to the actual data. The multivariate projections indicate an increase in the effect of increased expenditure in the future.

Thus, empirical studies show that increased funding for higher education institutions will contribute to economic growth, which should be taken into account in the implementation of higher education policies in the EU countries.

Acknowledgment

The reported study was supported by Russian Foundation for Basic Research, project “Development of methodology and tools for assessing the effectiveness of regional higher education system and modelling its balanced development”, № 18-010-01115

BIBLIOGRAPHY

1. Blankenau W. F., Simpson N. B. Public education expenditures and growth. *Journal of Development Economics*, 2004, Vol. 73, pp. 583–605.
2. Bluestone B. *UMASS/Boston: An Economic Impact Analysis*. Boston: John W. McCormack Institute of Public Affairs, The University of Massachusetts, 1993, January.
3. Boarini R., Olivera Martines J., Strauss H., Maisonneuve Ch. de la, Nicoletti G. at al. *Investment in tertiary education: Main determinants and implications for policy*. CESifo economic studies. Oxford, 2008, Vol. 54, No. 2, pp. 277-312.
4. *Can a Government Enhance Long-run Growth by Changing the Composition of Public Expenditure?*, Discussion Papers, University of Nottingham, Centre for Finance, Credit and Macroeconomics (CFCM), 2013, No. 01.
5. Derunova E. at all. *The study of the dynamics of innovative development of economy on the endogenous growth through multi-sector extension of the Solow model*. Biosciences Biotechnology Research Asia, 2014, Vol. 11, No. 3, pp. 1581-1589.
6. Easterlin R. *Why isn't the whole world developed?* *Journal of economic history*. Wilmington: 1981, Vol. 61, No. 1, pp. 1-19.
7. *Education at a Glance, 2017 OECD indicators*. URL: <http://www.uis.unesco.org/Education/Documents/45926093.pdf>
8. Firsova A., Ogurtsova E., Chelnokova O. *Regional higher education systems and sustainable regional economic development: functional approach*. In: *Proceedings of the International Scientific Conference "Competitive, Sustainable and Secure Development of the Regional Economy: Response to Global Challenges" (CSSDRE 2018)*, Part of series: *Advances in Economics, Business and Management Research (AEBMR)*, 2017, Vol. 39, pp. 618-622. .
9. Krueger A.B., Lindahl M. *Education for growth: Why and for whom?* *Journal of economic literature*. Stanford, 2001, Vol. 39, No. 4, pp. 1101-1136.
10. Maddison A. *Dynamic forces of capitalist development: A long-run comparative view*. Oxford; N.Y.: Oxford university press, 1991. XVI, 333 p.
11. Mincer J. *Schooling, Experience and Earnings/ Behavior & Social Institutions*, 1974, No. 2, p. 152.
12. Pankova S., Tsy-pin A. *Modeling the influence of socio-economic factors on gross regional product*. *Economic Analysis: Theory and Practice*, 2015, No. 45 (444), pp. 2-14.
13. Schultz Th. W. *Investment in Human Capital. The Role of Education and Research*. NY : The Free Press, 1971, 272 p.