# Government Financial Support of Higher Education and its Role in Economic Prosperity of a Society

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Abstract. This study focuses on the role of government higher education funding in building the economic capacity of national economy. Contemporary development and competitiveness of any country crucially depends on innovations. The ability of business to provide them is directly connected with available human capital resources. Government financial support of education ensures human capital development. Government budget funding of education is one of the biggest sources of higher education funding, and thus influences economic prosperity fostering GDP per capita growth. The article purpose is to examine government higher education expenditures impact on GDP per capita growth. The research methodology uses panel data analysis based on R statistics. The data sources are the World Bank and OECD. Literature review reveals methods of education funding and the role of government. Then, five hypotheses are posited that describe possible impact of government education funding on GDP per capita growth. To test them, four models are used. The appropriate model to reveal the government higher education funding role is the fixed-effect model. It validates the strong impact of the share of higher education expenditures in the total government expenditures on the GDP per capita growth.

**Keywords:** Higher Education, Government Education Expenditures, Economic Growth, GDP per capita.

### 1 Introduction

Education is one of the key factors of a country success in the global world. Educational level of the population, the quality of education and access to education services lay the groundwork for economic development and determine institutional vectors for sustainable development. Governments of high-income countries make substantial investments in the development of education and foster favorable environment for private investments in educational sector. At the same time, expenditures on education funded by using money of taxpayers cause vast discussions. Some considerations concern problems of redistributions when taxpayers do not want to pay for services which they do not use. Other discussions are induced by the problems of proper quality of education even under high level of government expenditures in this sector.

Successful development of a country depends on many factors. The educational level of the population plays one of the leading roles in the prosperity of a society. Access to the primary education creates a requisite for further tuition. At the same time, the quality and accessibility of higher education, especially in science and technology, affects a country's development capacity in economic, innovation and other aspects. That is why this research is focused on the assessment of impact of higher education funding on the national economies development.

The research aim is to assess the impact of higher education funding through taxpayers' money on the level of economic development. The structure of the study includes:

- literature review on the issues of education funding in the world;
- research methodology;
- the assessment of government higher education expenditures impact on the level of economic development (GDP per capita growth);
- conclusions.

Based on data analytics, this paper uncovers dependency of economic development on government higher education expenditures. The obtained results demonstrate that the most appropriate model to reveal the government higher education funding role is the fixed-effect model. This model shows the strong positive impact of the share of higher education expenditures in the total government expenditures on the GDP per capita growth. At the same time, education expenditures measured as GDP share reveals negative dependence. This issue can be explained, on the one hand, by research limitations of this paper, and on the other hand, by other factors, among which differences in the rates of GDP growth and growth of governments higher education funding, natural limits of education expenses, and existence of vast range of factors influencing GDP per capita.

The paper has several limitations. First of all, the sample includes mainly high and medium-income countries. Secondly, the time horizon of panel data covers period of 2006-2015 that is caused by absence of all necessary data. At the same time, government education expenditures demonstrate predominantly long-term effects that can be more clearly observed through the period of 10-20 years or more. Thirdly, the paper examines only the government expenditures on education and their influence on economic development, while other expenses are beyond this study. At last, the research analyzes economic development expressed as GDP per capita growth while doing business index, innovation index, human development index, life expectancy and other indicators of economic development are beyond the study.

## 2 Literature Review

Public funding of education is justified by the craving for equitable access to education for all people. According to Douglass, policy in education funding doesn't concern taxpayers' income redistribution only; it also involves issues of social and economic mobility, economic competence, money, policy and big business (Douglass, J.A. [7])

The structure of education funding in the USA and Western European countries depends on the level of education. Obviously, the basic level of education generates the biggest utility for a society as it forms a requisite for all competencies development and other levels of tuition. In the case of schools, public expenditures prevail over the private funding because a government determines and guarantees the basic level of education necessary for society development. On the other hand, competencies enhancing economic development are ensured predominantly by vocational and higher education (Friedman [17]). Nowadays, the role of public finance in funding the vocational and higher education is diminishing. This trend is caused mostly by austerity policy, budget deficit and high levels of public debt.

Public mood also influences government education expenditures. The public opinion research by Busemeyer, Marius R. Garritzmann, Julian L. Neimanns, Erik Nezi [4] proves that people favor government education subsidies. Meanwhile, not all the sectors demonstrate equally high level of people support: higher basic (elementary) and vocational education expenditures are more preferable than increasing expenditures on higher and preschool education.

There are different methods for education funding. According to them, all the countries can be divided into three groups (European Commission/EACEA/Eurydice [9]):

- Formula-based funding that applies generally accepted standards and criteria for determining the amount of funding for every institution. In the beginning of 2000s, only 13 European countries applied formula-based funding (Levacic, R. [11]). Nowadays, this method is widely used especially due to the World Bank activity (Alonso, Juan Diego and Alonso Sánchez [1]). The formulas use indicators that can be divided into several groups (Mihály Fazekas [14]): (1) basic indicator – number of students and graduates according to the levels; (2) indicators of needs; (3) indicators as reported by training and educational plans; (4) indicators based on characteristics of educational institution.
- 2. Funding based on the agreed budget supposes that an educational institution prepares budget, and a public authority should approve it (C. Jencks, J. Areen [15]).
- 3. Discretional approvement of funding by an authority, the volume of which is determined individually or on a contractual basis.

The study of reforms in higher education funding in different countries in Europe, Asia and America revealed the key trends (Nagy Kováts, Németh [16]):

1. Diversification of higher education funding. This process should contribute to the higher efficiency of budget resources disposal.

2. Transformation of mechanisms for public funding of higher educational institutions. In order to increase universities' sensitivity to the demand and needs of customers, governments transfer part of the funds to the households or business in the form of subsidized loans or tax allowances [2], [3], [5].

Furthermore, changes in mechanisms of direct public funding are observed: (i) education budget is divided into two separate directions – funding of education and research activities; (ii) almost all countries use formula-based approach to the education funding; (iii) universities funding depends on the performance indicators; (iv) budget assignments are based on block-grants that foster universities autonomy especially strengthening on issues of public funding distribution.

At the same time, alternative sources of education funding are ambiguous; they cause discussions and searching for evidence of their effectiveness [6], [10], [17]. Performance-contracts are becoming more and more popular as one of the methods for education funding especially for higher educational institutions (Lung M., Moldo-van I., Nistor Lung A. [12]). Their advantages are connected with the possibility of determining indicators and goals based on the sectoral strategic goals that should be reached by universities. This practice allows governments to influence universities' activities.

Share of public funding of education, provided on the performance-contracts based, differs between countries. However, most governments have embedded this practice into the education funding scheme. The unified set of indicators for contracts is absent. The same is true for the contracts maturity that varies from 1 to 5 years among countries. European countries usually apply such indicators as students' performance indicators, academic mobility, graduate employment rate, place of a university in the ranking, quality of university infrastructure, and other.

The study of public funding of education (Marginean I. [13]) focused on government education expenditures per capita and as GDP share. The analysis of public expenditures impact on education took into account social indicators such as education coverage according to the elementary, secondary and higher education; young people with full secondary education, and children that drop out school. The research results demonstrated substantial differences both between countries and levels of education. At the same time, the study revealed that there is a dependence between public expenditures on education and analyzed indicators for elementary and secondary education only. This is caused by the government policy in this sector: elementary and secondary education are usually funded by government budget unlike higher education where expenditures are usually considered as human capital investments.

#### 3 Methodology

The study hypothesizes that increasing government expenditures on higher education has a positive effect on the dynamics of GDP per capita. The analysis was carried out using R software. Four models were used for the analysis: pooling, random, within, and between. Data for analysis are available from World Bank and OECD data bases on tertiary educations expenditures. Data were organized as a panel data. The panel consists of indicators for twenty-seven countries for time horizon 2006-2015. The study includes mainly high and medium-income countries. Countries included into panel are Australia; Austria; Azerbaijan; Belarus; Brazil; Colombia; Czech Republic; Denmark; Estonia; Finland; France; Germany; Hong Kong SAR, China; Hungary; Ireland; Japan; Latvia; Lithuania; Norway; Poland; Portugal; Slovak Republic; Spain; Sweden; Switzerland; Ukraine; United Kingdom. The total number of observations amounts to 262.

Five hypotheses were posited:

- Hypothesis 1: increasing share of education expenditures in the total government expenditures positively affects growth of GDP per capita;
- Hypothesis 2: increasing share of higher education expenditures in the total government expenditures positively affects growth of GDP per capita;
- Hypothesis 3: increasing share of higher education expenditures in the total education expenditures positively affects growth of GDP per capita;
- Hypothesis 4: increasing share of education expenditures in GDP positively affects growth of GDP per capita;
- Hypothesis 5: increasing share of higher education expenditures in GDP positively affects growth of GDP per capita.

#### 4 Results

The first stage of analysis determined GDP per capita growth (GDPGROWTH) as a dependent variable; while independent variables included:

- 1. the share of education expenditures in the total government expenditures, % (EEINTOTALGOVEXP);
- 2. the share of higher education expenditures in the total government expenditures, % (HEINTOTALGOVEXP);
- 3. the share of higher education expenditures in the total education expenditures, % (HEINTOTALGOVEXPEDUC);
- 4. the share of education expenditures in GDP, % (GOVERNEXPEDUCINGDP);
- 5. the share of higher education expenditures in GDP, % (GOVENEXPHEINGDP).

The results of statistical analysis are presented in Table 1.

Residuals:					
Min.	1st Qu.	Median	3rd Qu.	Max.	
-15.032009	-1.871411	0.028507	2.087064	20.270745	
Coefficients:					
	Estimate Std.	Error	t-value	Pr(> t )	
(Intercept)	7.86965	4.61141	1.7066	0.0891163	
EEINTOTALGOVEXP	1.35033	0.35819	3.7698	0.0002029 ***	
HEINTOTALCOVEXP	-3.86866	1.27219	-3.0409	0.0026033 **	

Table 1. The Hypotheses Testing Results

HEINTOTALGOVEXPEDUC	-0.14419	0.20896	-0.6900	0.4907911		
GOVERNEXPEDUCINGDP	-4.49925	1.06688	-4.2172	3.434e-05 ***		
GOVENEXPHEINGDP 12.17901 3.90780 3.1166 0.0020382 **						
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1						

Source: calculated by authors based on the World Bank and OECD data

The obtained results demonstrate that the most significant impact on GDP per capita growth has:

- the share of education expenditures in the total government expenditures;
- the share of education expenditures in GDP.

Lower level of impact on GDP per capita growth produces another two factors:

- the share of higher education expenditures in the total government expenditures;
- the share of higher education expenditures in GDP.

Analysis evidences that the share of higher education expenditures in the total education expenditures does not influence the GDP per capita growth. The reason of it can be the diversification of universities funding resources that diminishes the significance of government influence.

Panel is not balanced because data on Azerbaijan, Belarus, Columbia and Hong Kong are not available for some years. For more reliable results, models with fixed effects, random effects and between were built. The fixed-effect model is an ordinary model of linear regression in which the free terms vary by economic units i. In this model, the standard assumptions are the same as in the ordinary linear regression:

Assumption 1. Zit factors are independent of *ɛit* for all *i* and *t*.

Assumption 2. Errors  $\varepsilon$  it are independent and equally distributed quantities, E( $\varepsilon$  it )=0, 2 2 ()  $\int \Sigma E \Sigma$  it = for all i and t.

The fixed-effect model should be used in the case when every economic unit is "special", and is not a result of a random selection from a general population.

Table 2 presents the obtained results of above mentioned models.

Table 2. The Testing Results for Models with I	Fixed Effects, Random Effects and Between
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Dependent variable:					
	GDPGROWTH				
	(polled)	(random)	(fixed)	(between)	
EEINTOTALGOVEXP	1.4***	1.4***	2.0***	0.7	
	(0.4)	(0.4)	(0.5)	(0.5)	
HEINTOTALCOVEXP	-3.9***	-3.9***	-1.8	-1.9	
	(1.3)	(1.3)	(1.7)	(1.9)	
HEINTOTALGOVEXPEDUC	-0.1	-0.1	-0.1	-0.2	
	(0.2)	(0.2)	(0.4)	(0.2)	
GOVERNEXPEDUCINGDP	-4.5***	-4.5***	-5.9***	-2.7***	
	(1.1)	(1.1)	(1.8)	(1.4)	
GOVENEXPHEINGDP	12.2***	12.2***	4.5	7.3	
	(3.9)	(3.9)	(7.6)	(4.9)	
Constant	7.9*	7.9*		8.0	

	(4.6)	(4.6)		(4.9)
Observations	262	262	262	27
R2	0.1	0.1	0.2	0.4
Adjusted R2	0.1	0.1	0.1	0.3
F Statistic	7.9*** (df =	39.4***	11.4*** (df	2.9** (df =
	5; 256)		= 5; 230)	5; 21)
Note: *p<0.1; **p<0.05; ***p<0.01				

Source: calculated be authors based on the World Bank and OECD data

The testing of the models significance demonstrates: 1. F-statistic: 2.9071 on 5 and 21 DF, p-value: 0.037925 > pFtest(m.fe, m.pooled) 2. F test for individual effects data: GDPGROWTH ~ EEINTOTALGOVEXP + YEINTOTALGOVEXP + YEINTOTALGOVEXPEDUC + ... F = 1.8684, df1 = 26, df2 = 230, p-value = 0.008412 alternative hypothesis: significant effects > phtest(m.fe, m.re) 3. Hausman Test data: GDPGROWTH ~ EEINTOTALGOVEXP + HEINTOTALGOVEXP + HEINTOTALGOVEXPEDUC + ... chisq = 28.124, df = 5, p-value = 3.443e-05 alternative hypothesis: one model is inconsistent > plmtest(m.re, type = "bp") 4. Lagrange Multiplier Test - (Breusch-Pagan) for unbalanced panels data: GDPGROWTH ~ EEINTOTALGOVEXP + HEINTOTALGOVEXP + HEINTOTALGOVEXPEDUC + ... chisq = 0.24092, df = 1, p-value = 0.6235alternative hypothesis: significant effects 5. F test data: GDPGROWTH ~ EEINTOTALGOVEXP + HEINTOTALGOVEXP + HEINTOTALGOVEXPEDUC + ... F = 11.353, df1 = 5, df2 = 230, p-value = 8.411e-10 > pwaldtest(m.re, test = "Chisq") 6. Wald test data: GDPGROWTH ~ EEINTOTALGOVEXP + HEINTOTALGOVEXP + HEINTOTALGOVEXPEDUC + ... Chisq = 39.368, df = 5, p-value = 2.002e-07

The values of determination coefficients are low. In other words, the model describes the studied dependency poorly. However, even under the low coefficient of determination, it is obvious that the third factor (the share of higher education expenditures in the total education expenditures) doesn't influence the tested variable – GDP per capita growth. It means that the third hypothesis is not confirmed.

The obtained results caused the next step. To balance the database, indicators for Azerbaijan, Belarus, Columbia and Hong Kong were excluded. At the same time, five

dummy indicators were included to the model. Table 3 presents the results of regression analysis.

	Dependent var	iable:			
	GDPGROWTH				
	(polled)	(random)	(fixed)	(between)	
EEINTOTALGOVEXP	1.1	1.1	0.2	2.3*	
	(0.7)	(0.7)	(0.8)	(1.1)	
HEINTOTALCOVEXP	-2.0	-2.0	7.5**	-8.9*	
	(2.9)	(2.9)	(3.5)	(4.7)	
HEINTOTALGOVEXPEDUC	0.3	0.3	-0.1	1.5**	
	(0.4)	(0.4)	(0.5)	(0.5)	
GOVERNEXPEDUCINGDP	-1.9	-1.9	-2.3	1.1	
	(1.8)	(1.8)	(2.1)	(2.7)	
GOVENEXPHEINGDP	0.7	0.7	-14.2	-6.3	
	(6.9)	(6.9)	(9.2)	(10.3)	
DUMMY1	0.6	0.6	4.0	0.01	
	(0.9)	(0.9)	(6.0)	(0.8)	
DUMMY2	1.3	1.3	7.0	0.3	
	(0.9)	(0.9)	(5.5)	(0.8)	
DUMMY3	1.4	1.4	1.9	1.9**	
	(0.9)	(0.9)	(3.7)	(0.8)	
DUMMY4	1.4	1.4	-2.1	1.9**	
	(0.9)	(0.9)	(2.5)	(0.8)	
Constant	-4.9	-4.9		-35.3**	
	(9.9)	(9.9)		(12.9)	
Observations	230	230	230	23	
R2	0.1	0.1	0.2	0.6	
Adjusted R2	0.1	0.1	0.1	0.4	
F Statistic	3.5*** (df =	31.3***	6.9*** (df =	2.4* (df =	
	9; 220)		9; 198)	9; 13)	
Note: *p<0.1; **p<0.05; ***p<0.0	)				

Table 3. The Testing Results of the Model Based on the Balanced Database

Source: calculated be authors based on the World Bank and OECD data

The results of models significance testing are the following:

F test for individual effects
 data: GDPGROWTH ~ EEINTOTALGOVEXP + HEINTOTALGOVEXP +
 HEINTOTALGOVEXPEDUC + ...
 F = 2.4167, df1 = 22, df2 = 198, p-value = 0.0007056
 alternative hypothesis: significant effects
 > phtest(m.fe, m.re)
 2. Hausman Test
 data: GDPGROWTH ~ EEINTOTALGOVEXP + HEINTOTALGOVEXP +
 HEINTOTALGOVEXPEDUC + ...
 chisq = 46.784, df = 9, p-value = 4.306e-07

alternative hypothesis: one model is inconsistent 3. F test data: GDPGROWTH ~ EEINTOTALGOVEXP + HEINTOTALGOVEXP + HEINTOTALGOVEXPEDUC + ... F = 6.9449, df1 = 9, df2 = 198, p-value = 1.089e-08 > pwaldtest(m.re, test = "Chisq") 4. Wald test data: GDPGROWTH ~ EEINTOTALGOVEXP + HEINTOTALGOVEXP + HEINTOTALGOVEXPEDUC + ... Chisq = 31.315, df = 9, p-value = 0.0002613

After the application of dummy variables, the calculation revealed the increased value of the determination coefficient for the between model. Hausman Test demonstrates that the use of random-effect model is inappropriate. Moreover, Table 3 shows that the first factor (the share of education expenditures in the total government expenditures) doesn't have a significant impact on the examined indicator. It means that the first factor is not confirmed.

The obtained outcomes require the model correction: the share of higher education expenditures in the total education expenditures is excluded, because it has strong correlation with the first factor. The regression statistics results are presented in Table 4

	Results Descrip	otion		
	Dependent variable:			
	GDPGROWTH			
	(Pooling)	(Fixed)	(Between)	
EEINTOTALGOVEXP	0.8	-0.9	0.2	
	(0.6)	(0.5)	(0.7)	
HEINTOTALCOVEXP	-0.8	11.5***	7.1**	
	(2.5)	(2.6)	(3.0)	
GOVERNEXPEDUCINGDP	-2.7*	-2.0	-2.0	
	(1.5)	(1.2)	(1.6)	
GOVENEXPHEINGDP	3.7	-22.3***	-15.4**	
	(5.7)	(5.9)	(7.1)	
DUMMY1	0.7	2.5	4.1	
	(0.9)	(9.0)	(6.0)	
DUMMY2	1.4	1.9	7.0	
	(0.9)	(7.7)	(5.5)	
DUMMY3	1.3	-2.5	2.0	
	(0.9)	(6.3)	(3.7)	
DUMMY4	1.3	-3.7	-2.1	
	(0.9)	(4.4)	(2.5)	
Constant	2.6	-0.04		
	(2.0)	(0.3)		
Observations	230	207	230	
R2	0.1	0.2	0.2	

Table 4. The Regression Statistics Results for the Finally Corrected Database

Adjusted R2	0.1	0.2	0.1		
F Statistic	3.8*** (df = 8;	$7.5^{***}$ (df = 8;	7.8*** (df = 8;		
	221)	198)	199)		
Note: *p<0.1; **p<0.05; ***p<0.01					

Source: calculated be authors based on the World Bank and OECD data

The obtained results reveals that the most appropriate is the fixed-effect model. For the examined sample, this is a consistent outcome because economic units (countries) are examined by the same groups of indicators and time intervals. The calculations witness that the biggest influence on per capita GDP growth has:

- the share of higher education expenditures in the total government expenditures (positive impact equals +11.5);
- the share of education expenditures in GDP (negative impact equals -22.3).

In this way, the second hypothesis (increasing share of education expenditures in GDP positively affects growth of GDP per capita) is confirmed, and the fifth hypothesis (increasing share of higher education expenditures in GDP positively affects growth of GDP per capita) is not.

These opposite impacts can be explained by several factors. First of all, this paper has research limitations connected with countries data available and time horizon. Secondly, GDP per capita and government education funding can demonstrate different growth rates. Thirdly, total education expenses in national economy are not limited by the government funding. This fact puts limits on government impact on GDP growth. Furthermore, education expenses have their natural limits at a certain period of time. Finally, government education expenditures are just one of the numerous factors influencing GDP per capita growth. Thus, these study results form basis for further research.

#### 5 Conclusions

All the countries have national specifics in funding education. Literature review showed that governments use mixed sources and various mechanisms to fund education. Government funding of education should ensure, among others, equitable access to the education services for all people. Budget expenditures have different share in the total amount of education expenses depending on the type of education (basic, vocational or higher) and national practice.

Governments use various methods for education funding: formula-based funding; funding based on the agreed budget; discretional approval of funding; educational vouchers and others. The latest European tendencies proves the quick spreading of formula-based approach in universities funding.

Higher education funding in the world demonstrates several common tendencies:

- diversification of funding sources;

- transformation of government support: governments more and more use subsidized loans and tax allowances for individuals and business to induce higher sensitivity of universities to the customers' demand;
- applying the formula-based education funding;
- funding according to the university performance indicators (so called performance contracts);
- disposal of block-grants in higher education funding.

Funding of education concerns not only quality and access to the education services or income redistribution issues, but also labor resources, business environment, innovations, and sustainable development. To examine the influence of higher education expenditures on GDP per capita growth, the study posed 5 hypotheses: (1) increasing share of education expenditures in the total government expenditures positively affects growth of GDP per capita; (2) increasing share of higher education expenditures positively affects growth of GDP per capita; (3) increasing share of higher education expenditures in the total education expenditures positively affects growth of GDP per capita; (4) increasing share of education expenditures in GDP positively affects growth of GDP per capita; (5) increasing share of higher education expenditures in GDP per capita; (5) increasing share of higher education expenditures in GDP per capita.

To obtain reliable results, models with fixed effects, random effects and between were used. The most appropriate model to reveal the role of government higher education funding proved to be the fixed-effect model. The fixed-effect model shows the strong positive impact of the share of higher education expenditures in the total government expenditures on the GDP per capita growth. At the same time, education expenditures measured as GDP share reveals negative dependence. This issue can be explained, on the one hand, by research limitations of this paper, and on the other hand, by other factors, among which differences in the rates of GDP growth and growth of governments higher education funding, natural limits of education expenses at a certain period of time, and existence of vast range of factors influencing GDP per capita. These are the questions for further research as well as dependence of innovation and doing business environment on education expenditures.

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