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ECONOMICS OF HUMAN CAPITAL: THE ROLE OF SECONDARY AND TERTIARY EDUCATION IN THE POST-CRISIS ECONOMIC DEVELOPMENT OF THE EUROPEAN UNION

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Abstract

From the perspective of educational systems, formation and development of human capital are considered key determinants of economic growth in both literature and empirical studies. Starting from the neoclassical exogenous growth model of Solow (adjusted for human capital) and the endogenous growth model developed by Mankiw, Romer and Weil, this paper aims to assess how education affects economic development in four groups of states within the European Union. Also, the research aims to determine how government post-crisis policies in the field of education, can influence the quality of human capital and thus economic growth. By developing three models that use as independent variables various types of indicators that are related to education and based on an analysis of panel data, it follows that secondary and tertiary education affect economic growth differently. Thus, mainly there is a positive impact of tertiary education attainment rate and a negative impact of secondary school attainment rate on the growth of GDP per capita at the EU level, but the results differ when analyzing different groups of countries within the union.

Keyword: human capital, economic growth, education

JEL Classification: I25*, J24, O47*

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I. Introduction

Human capital is considered as one of the main determinants of economic growth, both empirical and theoretical research (Hanushek & Woessmann, 2010) showing that it contributes to economic growth by increasing productivity (Mankiw, Romer, & Weil, 1992) not only for the educated person but for the people around as well. But here comes a qualitative aspect, because what determines labor productivity and economic growth is not just the number of years of schooling, but also the type and quality of education, which varies quite enough among EU Member States. Also, it has been observed that education has a significant impact on increasing creative potential and by dissemination, improvement and implementation of knowledge into economic activities. Furthermore, researchers found a positive relationship between years of schooling and GDP per capita in the long run (Annicchiarico, 2012). It was also noted that education has a significant impact on the growth of the creative potential of learners, which can lead to a better dissemination and application of knowledge in economic activities.

In terms of foreign direct investments, the literature on the influence of education in attracting this type of investment is envisaged by Zhang-Markusen Theorem, which finds an inverse U shape curve between foreign direct investment and human capital (Zhang & Markusen, 1999). Graphical representation highlights that, when taking the decision to invest in a certain place, investors are not only interested in the low cost of labor, but also consider the quality of human resources. Therefore, even though some countries have lower labor costs (wages), in the absence of human capital development, they do not have the ability to attract foreign investors, this particularity can be seen especially in developing countries.

According to empirical evidence, investment in R & D is one of the factors of attraction of FDI and economic growth. However, some multinational companies choose to operate in the so-called *technological enclaves* (Blomstrom & Kokko, 2003), where neither products, nor technologies have similarities, in terms of novelty, with those existing in the immediate vicinity or at the global level. In such a context, it is irrelevant that the benefits to the economy could occur due to economies of learning or due to economies of scope, but it is important that decision (policy) makers apply appropriate measures that take into account the particularities of each location. Accordingly, when the operation of foreign firms and the existing ones have important similarities, local positive effects, including R & D, are more likely that they will lead to creating new jobs and

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increase the employment rate. Therefore, the existence of long-term positive effects on the local economy depends both on the ability to generate them and, later, to absorb them. However, given that the results are observed relatively late in the opening of a research project, increased spending on research and development is not always immediately beneficial for the economy in question.

Regarded as a determinant of development, innovations appear initially in companies, universities, and laboratories located in specific areas, or innovation clusters, entities whose existence is one of the priorities of the EU Member States. Subsequent spread (or diffusion) of such innovations and the effects they generate, may occur more easily between economic actors in close proximity (because innovation already exists tacit in nature) either because efficient use of the new products requires an element of learning by doing (Feser, 2002) or because of the need to offset the competitive advantage of other economic actors. Economic growth, attracting foreign direct investment and increasing employment rate of labor are thus facilitated by the location in a relatively small geographic area, but with a significant growth potential.

It is important to note that the results of a research project are observed relatively late, requiring a longer time period and to be used in order to generate a profit. The existence of long-term positive effects also depends on local economic capacity both to generate them and, later, to absorb them. Consequently, increased R & D investments is sometimes overshadowed in favor of investments whose result can be seen in a shorter time.

Development of education and thus of the human capital, seen as the main resource of an entity, be it a state or another type of socio-economic structure, became one of the most important prerequisites of development economic both nationally and across groups of countries, such as the European Union. In this respect, Europe 2020 Strategy provides the framework for a smart economic development, based on knowledge and innovation and creating opportunities to turn innovative ideas into products and services (European Commission, 2010). National policies in this area, some of the most important being set out in the National Reform Programs and strategies of supranational bodies reflect this aspect altogether, the main purposes being to facilitate access to education for all people and to increase the quality of education.

The models developed in this study are based on the Human Capital Augmented (adjusted) Solow Growth Model which was estimated by Mankiw, Romer and Weil (1992). To highlight the importance of different types of human capital for economic

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growth, as shown in empirical studies, MRW's growth specification has been applied to four groups of EU countries over the period 2000-2012, using different estimators of human capital. Various defining aspects of education and the difficulties in choosing an estimator of human capital as relevant to the education - economic growth relationship led us to a number of models that could highlight the role of one or other of these factors in GDP per capita growth, employment rate or foreign direct investment inflows. The proposed models include some estimators of human capital that are commonly found in the empirical literature, both in terms of stock and flow, respectively absolute values and proportions.

Given the complexity of education, scientific research aimed at analyzing the impact which it has on economic growth focused mainly on measuring the quantitative aspects of this process, such as: the number of graduates of a particular level of study, the number of schooling years for an adult, the youth enrollment rate in primary, secondary or tertiary education, public expenditures on education etc. Qualitative factors such as knowledge and capabilities that learners and develop over the years of study, even if they are, in fact, the real determinants of economic development, are more difficult to quantify and therefore their role is highlighted most often only in theoretical studies.

Different defining aspects of education and difficulties in choosing an estimator of human capital that is relevant to the education – growth relationship led to the development of a number of 3 models that highlight the role of a specific factor or the whole role of education on GDP per capita growth, the employment rate or foreign direct investment inflows. The models analyze both the influence of human capital indicators that are commonly found in the literature (e.g. gross domestic expenditure on R&D, absolute value of graduates) and the impact of less taken into account factors, such as the pupil/student - teacher ratio or the student mobility rate.

The use of a specific estimator for the human capital implies a choice between a variable for the flow and one for the stock, usually approximated by the school enrollment rate, taking into account the fact that, when testing the education-growth relationship, general reference is made to the level of education attained. Moreover, analyzing education and its impact on economic development it is important to take into account the institutional framework of the economy and of the education system as well.

According to Pritchett (1996), the tuition rate may not be an appropriate measure of human capital and does not reflect economic reality, as the relationship between the population's number of years of education and the proportion of the school-age

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population enrolled in the education sector is not a direct one. Pritchett shows that there is a negative correlation between the growth rate of population stock and the initial rate of school-age population being enrolled in the educational system (giving the example of the United Kingdom in the 1960s, which has experienced high rates of school enrollment, but low growth rate of the population stock). Nevertheless, the enrollment rate in education is one of the measures most commonly used to analyze the impact of human capital on GDP per capita growth (Barro, 1991; MRW, 1992; Islam 1995 etc.). Even so, we decided to take the attainment rate as a proxy for education, given the fact that this could be a more accurate measure of the education outcomes.

Furthermore, it is difficult to choose between the variables of education, whereas the rate of population aged 15-19 included in primary and secondary education does not take into account those who repeat a school year, the school dropouts and the stock of the school population at the beginning and at the end of the year, hence resulting in inconsistencies with the human capital. Also, it is difficult to quantify a process whose fundamental dimension is one qualitative, especially considering the fact that achieving a level of education does not provide the same skills everywhere and evermore. The quality of teachers/lecturers and the quality of textbooks seems to be more important for economic development than quantifiable values like the years of schooling or the share of education expenditure in the GDP, even if these variables are themselves important.

II. Methodological insights of models and data presentation

Empirical studies and econometric models applied to economic growth led to a widely accepted view in the literature concerning the positive impact of human capital on growth in GDP per capita. Given the results, numerous studies performed have provided new information on education-growth relationship, focusing their analysis on samples of countries of different sizes, certain periods of time considered, using existing international databases or building some new ones, regressing different indicators of human capital (some of them based on a plurality of indicators), or using Mathematical, Statistical and Econometric methods and procedures. Diversity (or even the divergences) in the results found in the literature reveals, once again, the heterogeneity of educational systems, the

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fact that education is not homogeneous and the effects of this process are difficult to quantify.

In regards to the comparison, the main focus was showing the discrepancies that yet exist within the European Union. We expect in this case, to have different results in all the four groups of countries, result that could help us understand where the education has already reached a high level, where it is growing fast, and, especially, where the policy makers need to take attitude in order to equalize or harmonize the trends. It is noteworthy that the decision to analyze these four groups of EU Member States was taken considering the different characteristics of the economic environment in both developed and developing countries of the European Union. Depending on the results and the differences highlighted, both policymakers and individuals or companies, in their capcity as stakeholders, should adopt measures to capitalize on the growth potential they hold and possibly to harmonize the existing trends across the EU.

The four groups on which we have focused and the reasons for them are:

- The UE 28 countries: where one should have the global picture in sight when trying to understand a trend, a comparison, or when trying to relinquish uncertainties if theory is going in the wrong way by reference to empirical evidence. Also the countries were selected in order to highlight trends that are registered in a group of countries that is only to some extent homogeneous, but which aims to develop all Member States and to reduce disparities;
- The Eurozone: where a big motivator is the opposition between countries that try to achieve the economic and fiscal framework (e.g.: economic development, living standards, deficit, fiscal regulation, labor migration etc.) imposed by the European Union in order to adhere to the Eurozone, and the ones that try to exit it with the purpose of independence in establishing its own economic/fiscal/monetary policy (e.g.: Greece – with one reason, United Kingdom – with another);
- The UE 10 countries: the ones who joined in 2004, and the ones that are most likely to need the support in some areas, but could offer their support and views to the European Union in other sectors;
- Last but not least, the last steps of integration with Romania, Bulgaria and Croatia, where we expect the same trend, or the same direction of results, but in a much more pregnant way.

The conceptual framework

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As it could be presumed and as we mentioned at the start of our assertion, there are a variety of econometric methods of analyzing the impact of education, so in the following we only briefly present the ones we used in measuring the impact on growth determinants. With respect to this, we started from the simple linear regression model, which is most often used in analyzes, estimating a regression between two variables, where the dependent variable is affected by the independent one. However, the proposed analysis is not limited to regressions between the two sets of data but, more importantly, over multiple indicators spanning across several nations over several years.

In this context, the research methodology was based on macroeconomic data, and so we used a panel based macroeconometric model. For common understanding and because we used this method consistently, the basic formula can be expressed as follows:

$$Y_{it} = \sum_{k=1}^{k} \beta_{kit} X_{kit} + \varepsilon_{it} \quad (1)$$

Further on, methods used in the regression models, which we tried to connect in terms of data and due to economic reasons, but which we won't detail here due to the vast literature behind them, are based on fixed effects and random effects. They are commonly seen in the literature on hierarchical linear models, se we tested, which ones should be used for the regression with the Hausman test. The result showed clearly that the random effect would need to be considered for our regression analysis.

Furthermore, for a correct determination, a double-log model was used. It is known that there are some reasons for using this in practice, such as when comparing different groups of subjects, many techniques are better when the variability of the groups is roughly the same within each group (in regards with the homoscedasticity), many techniques work better with symmetric data that are better if they are single-peaked, as well as it is easier to describe or prove relations between certain variables when there is a strong linear. Given all of the above, the final estimation from can be written as:

$$\log(Y_{i\,t+1}) = \beta_1 + \beta_2 \log(X_{1it}) + \beta_3 \log(X_{2it}) + \cdots + \beta_k \log(X_{kit}) + \mu_{it}$$

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For a proper development and for an explanation of the structure used in arriving to our result, the most significant followed hypotheses in the models were based on the general assumptions for the regression models, some of them such as presented by Son et al. (2012), and some enhanced in other consecrated studies:

a. *Correct definition of the model* is based on what we found in the literature on choosing correctly the variables to be used in the analysis, in order to have a sound theoretical economic consistency and one that can be demonstrated statistically. For enhancing this we used the prospective criteria in order to select the independent indicators. In other words, this implies selecting a criteria (e.g.: R^2 in our case) and testing each independent variable with the dependent one, in individual regressions, the most influential one being integrated in the next incrementing steps with the rest of the independent variables. We thus arrived at the point in which our model could not be improved by adding other macroeconomic control variables. In the end, these hypotheses can be statistically tested by analyzing statistical tests such as: Fischer - used for fixed effects models, and Wald - used for random effects models.

Additionally, we also decided to do a statistical test for checking the stationarity of the variables, for checking the absence of the unit root. For this we used the Lagrange Multiplier for residual values of the variables used in the regression, achieved through a Fischer-type stationarity test (based on the augmented Dickey Fuller unit root test on each panel). Moreover, if the variables of a model are not stationary, then it can be demonstrated that the initial assumptions are not valid. In other words, the values may not adopt a "t" statistic distribution. We conclude that, by using this test, and by rejecting the null hypothesis of unit root, that some of the panels are stationary.

b. *The multiple regression model is not affected by exogenous variables collinearity* where it is mandatory to see if between our independent variables we have strong correlations. No such correlations were found between our independent variables.

c. *The variance of residual variables is invariable*, thus defining homoscedasticity property, as well as the residual variables are random elements of zero mean. The used test was Breusch-Pagan Lagrangian Multiplier, which tests whether the estimated variance of the regression residual variables is dependent on the independent variables. From the aforementioned dependence point of view the Wald test for group heteroscedasticity is also used in the fixed effects models. For this the null hypothesis is similar to the Breusch-Pagan one. The result of each regression showed that we rejected

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the null hypothesis and concluded that heteroskedasticity is present in our regressions. This is not a road blocker, but for further developments the reason should be analyzed.

d. *Residual variables should not be auto-correlated*, a requirement that can be also stated as the absence of serial correlation of the residual variables in the panel data. Although this is not a significant problem for small data sets, serial correlations can cause the standard errors of the coefficients to be lower than they are in reality, thus increasing the regression coefficients. This analysis was conducted using a Wooldridge Lagrange Multiplier test. Result on our dataset show the lack of this autocorrelation.

Last, but definitely not least, the undertaking of this task was made with the help of Stata 12 econometric package.

Data used for the empirical analysis

In developing the complementary part of the project we start with the presentation of the data that was used for the empirical analysis. Thus, the data with which we want to develop the empirical study can be separated into the dependent indicator and independent indicators:

a. *The dependent indicators for measuring the growth effects*:

- The evolution of *GDP/capita* at current market prices;

- The evolution of the *employment rate*, persons in employment as a share of the population of working age (15- 64 years of age);

- The evolution of *foreign direct investments* inflows stocks as % of GDP;

b. *Independent indicators, determinants of economic growth*

- *Secondary education* by *edu_sec ratio*: the share of population with upper secondary and post-secondary non-tertiary education (ISCED levels 3 and 4) education attainment and *grad_sec:* absolute value of graduates in ISCED 3 and 4;
- *Tertiary education rate* by edu_ter ratio: the share of population with first and second stage of tertiary education (ISCED levels 5 and 6) education attainment and *grad_ter:* absolute value of graduates in ISCED 5 and 6.
- *The pupil/student - teacher ratio:* ratio of students to teachers (ISCED 1-3);
- *Student mobility*: students (ISCED 5-6) studying in another EU-27, EEA or Candidate country - as % of all students;
- *Research and development expenditures:* Gross domestic expenditure on R&D as % of GDP.

One could argue that only one indicator of education should be used, a composite one, but with such an approach a subjective influence would be placed on the data set. In

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this case we decided not to place subjective weights to the independent indicators and regress them transparently, so we can further analyze the influences in turns.

III. Results and discussion

As it can be seen in the *APPENDIX 1. Regression results for models and country groups*, estimated elasticity coefficients show the percentage change of GDP per capita at a 1% change in the variable that the coefficient represents.

Evaluation of the three models in terms of theoretical criteria involves an analysis of the sign and the size of the estimated coefficients. According to the literature, a plus sign is expected for the estimated coefficients of research and development expenditures and human capital variables, regardless of their type, except for the pupil/student-teacher ratio where we expected to obtain a minus sign.

The results show that there is a negative relationship between the human capital, expressed by the secondary and post-secondary non-tertiary education attainment ratio and GDP/capita. This situation is certified by the fact that human capital variable coefficients have a negative sign for three out of four groups of countries analyzed, namely EU-28, Eurozone and EU-10. The notable exception was the results obtained in Romania, Bulgaria and Croatia, where we found a positive, large and significant coefficient for this explanatory variable.

The explanation may lie in the fact that their economies still rely pretty much on the production of goods that do not require a high degree of processing and for this reason needing a less skilled workforce. Therefore, an increase in the enrollment ratio in secondary and post-secondary non-tertiary education can have positive results, as corresponds to the demand for workers expressed by companies that operate in those states. Therewith a positive influence is obtained when we analyze the impact of the attainment ratio in secondary and post-secondary non-tertiary education on attracting foreign direct investments and on the employment rate, here again the largest coefficient being obtained for the group of countries consisting of Romania, Bulgaria and Croatia. Consequently, an increase in the proportion of people who have completed secondary education can have positive effects on the economy, to the extent that it corresponds to the demand for labor expressed by the operators.

The results above contradict partially the findings of Mankiw, Romer and Weil, whose model record a plus sign to the human capital variable, expressed by the enrollment

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rate in secondary education as well. MRW (1992) conclude that by increasing the enrollment rate in secondary education of people aged 12-17 years with one percent will result an increase by 0.66% in GDP/capita for non-oil producing group (98 countries), 0.73% increase in GDP/capita for an intermediate group consisting of 75 countries and 0.75% increase in GDP/capita for 22 OECD countries.

This situation could generate a debate regarding what level of access to education is desirable, but prior to implementing a strategy in this field, decision makers should bear in mind the fact that when it comes to education there is a significant time lag before we can see the effects on economic growth. According to Stevens and Weale (2003) high levels of GDP per capita are correlated with high levels of (primary) school enrollment some twenty-thirty years earlier. It is also important to mention that the negative influence of secondary education on economic growth seems to be higher in the developed countries than it is in the developing ones. A possible explanation is provided in the same research conducted by Stevens and Weale, as they observe that in developing countries non-market activities are probably to be more important than in developed countries and so more difficult to be registered in the official statistics. Nevertheless, the results obtained in this study are analogous with those determined by Islam (1995), which concludes that the effect is the exact opposite of the expected outcome. In fact, more and more authors show that the MRW model results are less convincing when we look outside the period in which the data were analyzed, respectively, after the Second World War and until 1985.

The situation is similarly to that obtained previously, also when we analyze the impact of the number of graduates of secondary and post-secondary non-tertiary education and where we get a negative effect at EU-28 with all independent variables, but there are also some positive effects on foreign direct investments (EU-10, where a 1% increase in the number of secondary school graduates increases by 0.25% the volume of foreign direct investment inflows) and on the employment rate (RO, BG and HR). Thus, it seems that some multinational companies are influenced more by the investments in pre-university level, because these could provide a basis for future employees.

The situation changes when we consider human capital by the instrumentality of the tertiary education attainment rate. The positive sign of the coefficient of human capital variable confirms theoretical predictions regarding a positive influence on GDP per capita for three out of four groups of EU countries, as the results in the fourth group (RO, BG and HR) are not statistically significant. The human capital variable coefficients approximated by the enrollment rate in tertiary education are between 0.37 and 0.44,

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showing that an increase by 1 % in the tertiary education attainment rate will generate an increase in GDP per capita with values between 0.37% (EU-28) and 0.44% (EU-10). This indicates that a greater number of highly–qualified individuals supports the economic growth. Considering this, by increasing the number of highly educated individuals, countries can apply new technologies that may induce and increase productivity or they can even create new technologies in order to improve their economic growth.

Positive effects are a recorded as well when the endogenous variable is represented by foreign direct investment inflows stocks or employment rate, which highlights the importance of tertiary education for the post crisis economic development of the European Union.

As far as this goes for the R&D expenditures, the sign of the coefficient in all models is also positive, illustrating the influence that it has on economic growth, similar to the outcomes of other models that examine the research and development-growth relationship (Ulku, 2004; Congressional Budget Office, 2005). Research and development expenditures coefficients have values being in the range 0.16-1.28, higher values being registered for East European developing countries (Romania, Bulgaria and Croatia). The average influence in EU-28 (a comparable value being recorded for Eurozone and a significantly lower one for EU-10) of this variable is still one fourth compared to the impact on GDP/capita growth in Romania, Croatia and Bulgaria, countries with one of the lowest gross domestic expenditure on R&D as % of GDP within the European Union. Meanwhile, negative values recorded when the dependent variable was foreign direct investment inflows stocks or employment rate. This could be explained by the fact that foreign investors in these countries, which are at the same time employers, are operating a business that does not require high-skilled works and prefer to rely solely on the low level of wages when taking the decision to invest.

As expected, the ratio of students to teachers has a negative sign in all models and for all four groups of countries because an increase in the ratio means that fewer teachers are available for each student or pupil, which can adversely affect the quality of education and thus economic development.

The last indicator included in our econometric models, the student mobility ratio registered a positive sign in all models and for all four groups of countries. When analyzing the impact on GDP/capita, the coefficient values are in the range 0.25-0.58, higher values being registered again in Romania, Bulgaria and Croatia, countries in which we have also the highest influence (0.89) of student mobility on attracting FDI. The

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results confirm the positive influence of international mobility programs in education for the economies of origin.

V. Conclusions

The relationship between human capital and economic development instrumented by GDP / capita, employment rate or FDI is not linear, multiple equilibria are possible and there are significant differences depending on which type of economy is analyzed. In developed economies, foreign companies are encouraged to use cutting-edge technologies and processes that require specialists with higher education. Thus, there is a positive contribution in increasing demand for skilled workers and thus improve educational processes. On the other hand, in less developed economies, foreign companies tend to use simple technologies and thus contribute only marginally the development of human capital.

Even if it is likely that an increase in the secondary school attainment rate has a negative effect on economic growth in some countries, it is still true that a high level of education (tertiary education) leads to a faster growth, and it also important to note that returns to education diminish with levels of development, being higher in the less developed countries. However, education is needed as a means of development not only for countries, but also for individuals, where a shortage of educated people could potentially lead to economic stagnation or even economic decline.

Thus, from the results of the conducted research and from the analysis of other empirical studies, we can conclude that human capital affects the economic growth and education can generate significant externalities. Our results confirm this aspect of the *economics of education*, considering that there are large discrepancies among the four groups of EU Member States in terms of both sign and statistical significance of the explanatory variables used in growth models. Therefore, it is recommended to adapt educational policies both at national and EU level in order meet the socio-economic requirements. Also, research in this area should continue, eventually by analyzing a larger number of states, for longer periods and by considering other indicators for human capital as well.

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APPENDIX 1. Regression results for models and country groups

y=logarithm of one period lagged dependent variable x=logarithm of independent variables	EU - 28			EU - EUROZONE			EU - 10 (2004)			RO, BG, HR		
	y=GDP/c	y=FDI	y=E.R.	y=GDP/c	y=FDI	y=E.R.	y=GDP/c	y=FDI	y=E.R.	y=GDP/c	y=FDI	y=E.R.
	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se
Education_secundary	-0.279*	0.657***	0.019	-0.577***	0.492*	0.051	-0.589*	-0.376	-0.018	4.071***	9.910***	1.185***
	(0.12)	(0.18)	(0.03)	(0.12)	(0.22)	(0.03)	(0.23)	(0.26)	(0.06)	(0.76)	(1.25)	(0.22)
Education_tertiary	0.370***	0.594***	0.025	0.414***	0.718***	0.056**	0.444**	1.033***	0.087*	-0.395	1.689**	0.123
	(0.08)	(0.13)	(0.02)	(0.08)	(0.13)	(0.02)	(0.14)	(0.15)	(0.04)	(0.37)	(0.6)	(0.11)
Graduate_secundary	-0.209***	-0.224***	-0.029**	-0.021	-0.115	-0.032**	0.001	0.253**	-0.011	-0.154	0.36	0.089*
	(0.04)	(0.07)	(0.01)	(0.05)	(0.08)	(0.01)	(0.08)	(0.09)	(0.02)	(0.14)	(0.22)	(0.04)
Graduate_tertiary	0.378***	0.256***	0.023*	0.161***	0.108	0.029*	0.305***	0.022	0.01	0.454***	-0.05	-0.049
	(0.04)	(0.06)	(0.01)	(0.04)	(0.07)	(0.01)	(0.06)	(0.08)	(0.02)	(0.11)	(0.17)	(0.03)
Teach_student_ratio	-0.317**	-0.475**	-0.038	-0.259*	-0.447*	0.009	-0.04	-0.332*	-0.012	-1.367**	-0.271	0.216
	(0.11)	(0.18)	(0.03)	(0.12)	(0.2)	(0.03)	(0.15)	(0.16)	(0.04)	(0.46)	(0.75)	(0.13)
R&D_expenditures	0.274***	0.087	0.032*	0.328***	0.189*	0.024	0.163*	0.190*	0.009	1.289***	-1.272***	-0.177***
	(0.05)	(0.08)	(0.01)	(0.05)	(0.09)	(0.01)	(0.07)	(0.08)	(0.02)	(0.18)	(0.29)	(0.05)
Student_mobility	0.252***	0.137*	-0.001	0.274***	0.027	0.012	0.410***	-0.047	-0.009	0.580**	0.893**	0.089
	(0.04)	(0.06)	(0.01)	(0.04)	(0.07)	(0.01)	(0.06)	(0.07)	(0.02)	(0.2)	(0.33)	(0.06)
Constant	8.290***	0.212	4.165***	9.472***	0.914	3.779***	6.622***	0.406	3.990***	-6.772	-45.642***	-2.334*
	(0.71)	(1.07)	(0.16)	(0.66)	(1.22)	(0.17)	(0.98)	(1.23)	(0.25)	(4.1)	(6.7)	(1.18)
R-squared	50.5	7.02	35.92	70.05	7.18	44.16	27.34	0.69	18.76	94.8	86.58	65.92
Wald	734.51	254.78	48.52	534.26	217.84	65.89	512.99	372.2	31.16	510.72	180.59	54.15
N obsservations	336	336	336	216	216	216	120	120	120	36	36	36
	* p<0.05,	** p<0.01,	*** p<0.001									

Source: Own preparation using data from Eurostat and Stata 12 econometric package.
Legend: GDP/c = Gross domestic product/capita, FDI = Foreign direct investment, E.R. = Employment rate