The influence of human capital on economic growth within the European Union

Keywords: human capital, education, economic growth.

Human capital is the set of knowledge, skills, experiences and characteristics of every individual, which facilitates the creation of different forms of welfare and plays a fundamental role in the progress of the individual and of the community in the development of the society. Economists and specialists from other science domains dealt in their research with the influence factors of the process of the economic growth, finding in the current theoretical outline ideas which go more than two centuries back. Smith (1776), Schultz (1961), Becker (1975), Nelson and Phelps (1966), Romer (1986), Mankiw, Romer and Weil (1992), Benhabib and Spiegel (1994) Temple (2001), Kruger and Lindahl (2001), Pritchett (2001), Psacharopoulos and Patrinos (1993, 2004), Hanushek and Woessmann (2009) etc. are just some of those who proved that physical capital cannot, by itself, influence the increase of the income per capita and whose research efforts have led to an extremely voluminous literature, contributing to the widely accepted belief of the positive role of human capital circumscribed to education on people and the societies which they belong to, and on the world economy as a whole. Thus, the role of human capital was gradually shaped, even though at first it was not assimilated to an independent factor, having itself an origin and own determinant factors. However if within their studies, some authors have emphasized the doubtlessly positive role of the human capital in relation to the growth process, and this especially in the early 1990s, others bring new contributions to the analysis of this relationship showing themselves, tough, more sceptical in considering the role of the human capital, usually expressed through the education component, as a determining factor in this process.

Still, what is obvious is the constant attention it received, the causal relationship human capital - growth, which we find at authors everywhere, being still of great interest, even though this research has gone through several stages and results and the results obtained and the assessments outlined range from emphasizing the importance of education up to denying it. Literature on this topic is extremely broad and dynamic, rich in theory and practical lessons, proving to be a tool for continuing the research in light of the new evolutions and development of people and societies in the contemporary economy.

Therefore comprehending the complex relationship of influence between human capital and economic growth is important both for academic and practical perspectives. Starting from the analysis of theoretical and empirical literature, the issue of comprehending this relationship and its influence factors needs to be investigated and continued on the specific background of the current geo-political situation, characterized by major processes of liberalization and expansion of the forms of regional integration. Consequently, relevant previous impact of human capital could be investigated as part of a coherent and comprising understanding of the complexity of variables influencing economic growth. *The scientific novelty* of the topic studied derives from the comparative approach of the *special importance of human capital on the economic growth and the highlight of the best dimensions of education in the extended area of the European Union. The research method is based both on the neoclassical perspective of growth models and on the new endogenous theories of growth which incorporate the development of human capital as a key element in creating progress.*

Taking into account the points of view which agree or disagree with the impact of the human capital as well as the approaches which led to these results, continuing the research is more than appropriate for understanding the relationship between the increase of the income

per capita and the determinant and causal factors, which can improve their effects through mutual inter-conditioning, in the new economic, social and political background.

Therefore, *the aim* of this study is to develop, test and validate based on a conceptual research model, the influence of education on the GDP / capita, starting from relevant theories and empirical models from literature or implementing additional impact models and variables. To this general purpose there are subscribed several objectives, which are found in the chapters of the thesis. Thus, we have *first* considered a critical analysis of the specialty literature, comprising elements of founding the human capital concept and theory, as well as the main theoretical, neoclassical and endogenous models and empirical models approached in the perspective of both theoretical claims. *Then*, using these pieces of knowledge and based on statistical evidence, a second specific objective is related to the emphasis of the causal relationship human capital - economic growth and, at the same time, related to the method of approaching the human capital, which is to become a better performer in this relationship empirically validated on the EU countries as a whole and in various groups of countries, starting from certain characteristics or trends noticed in the panel data analysis.

The suggested research combines two basic theoretical considerations (presented in Chapters 1, 2 and 3), which provides a better conceptualization of the issue of interest, especially in the current context of the EU area extension by integrating some developing countries, which have recently got to a new development paradigm. Theoretical arguments brought up by the human capital theory, the neoclassical and endogenous growth models have provided solid foundations for expanding the research to a comparative perspective between old and new member states of the European Union, with major implications of some factors indicated in literature, but difficult to be assessed uniformly in the current European and global environment and area.

The term "human capital" is reflected not only in economics, but also in other areas of investigation, this study being focused only on the relevance of education as an important factor influencing the growth of the GDP / capita.

The study is based on and consolidates the results of other relevant studies in which most of the identified variables were considered and integrated into comprehensive models of quantitative and qualitative analysis. Our results mostly validate the role of education measured in different ways from one study to another, indicating, according to the specifically examined area, which of these predictor variables prove to be the most influential, or have greater explanatory power for economic growth. That's why, the database which the empirical analysis was built on was not limited to quantitative expressions of time series or cross-sectional data, but resulted in panel data for the European Union countries, either taken as a whole or put together in various subgroups, data expressed quantitatively as well as qualitatively.

To follow this approach, the thesis is divided into five chapters, as follows:

The introduction makes a global presentation of the research issue, of the purpose and objectives targeted by developing the study, a brief research methodology, the research context, the expected contributions and the limits of the study.

Chapter 1 explores the concept of human capital and investment in human capital, the theories developed on its basis showing the multitude of defining references and meanings, as well as the hypotheses and theoretical predictions, the advantages and disadvantages of the investment in human capital *via* education or the difficult issues of human capital measurement, given the key role of knowledge and skills in stimulating the economic growth. The chapter includes the development of the human capital theory as found in the works of Becker (1964), who founded the theory, as well as the criticism and the new approaches developed on the grounds of these new approaches regarding human capital.

Chapter 2 contains a critical analysis of the literature which integrates two major theories of growth: the neoclassical theory and the endogenous theories, pursuing the dimensions which the points of view of the theories are consolidated/reinforced on, in the numerous studies accepted, no matter if they support or not the idea that education plays a primary role in explaining economic growth. The first approach is the neoclassical growth model of Solow that treats technological progress as being included in the growth regression residue registered rate after accounting for the effects of the physical capital and labour force factors, at the same time being unable to explain the source of technical progress or to support the increase, except up to a constant state of equilibrium.

A key contribution in analyzing the impact of the human capital on growth is held by Romer (1986; 1990). According to him the long-term growth rate depends on the human capital level (Jones, 1995). Having these assessments as a basis, the endogenous growth models show that a constant growth also depends on the level of human capital, which is essential in the production of new ideas. Equally, one of the most important contributions is that of Lucas (1988), in which the production level is in accordance with the human capital stock, having as a variable the level of education measured by the years of schooling, but which makes it difficult to sustain growth on long term, which in order to be sustainable involves a limitless human capital (Temple, 2001, p. 62). Robert Barro (1989) uses the features of the endogenous models in order to study how to determine the increase of the per capita income, the investments in physical and human capital, and the population growth. He includes in the measured determinants of these influence variables aspects related to the governmental policy (including public infrastructure services, maintaining the property rights, governmental consumption and taxes) and the initial level of the income per capita. Nelson-Phelps (1966) formulates the idea of an inseparable link between the level of education and the technical progress, developing in an embryonic way, a more technological vision of the education role on economic growth (Aghion and Cohen, 2004). Regarding the economic growth, Aghion and Howitt (1998) argue that in the model of Nelson and Phelps (1966) it is determined by the stock of human capital, unlike the model of Lucas (1988), where the human capital accumulation is what influences growth positively.

Chapter 3 is an overview of the empirical studies on the relationship between education and economic growth, which can be divided at least into two main approaches: 1) wage equations which consider the return rate of the investment in education based on individual data (values) and 2) growth equations using time series data, in cross-section or panel section to estimate this causal relationship. The chapter includes an analysis of the empirical evidence on the relationship between education and economic growth in the perspective of the various measures which the human capital was assessed through and in the perspective of some neoclassical or endogenous specifications widely recognized within the empirical works. We sought to focus on studies which assess this relationship for a great number of countries, in different periods of time, having in mind the idea of an international comparability. We also aimed at highlighting empirical analysis models that have been found in other studies too and which could be developed in our study too. Thus, the main empirical studies which we have focused on, and whose results are either to support the human capital as important growth factor or of uncertainty or even of denial of this role, outlining the context and the variables that led to their foundation and the conclusions drawn from the results of the assessments undertaken.

As compared to the microeconomic assessment, the macroeconomic method for studying the effects of the investment in education, approach that is reflected, among others, in the studies of Mankiw, Romer and Weil (1992), Islam (1995), Benhabib and Spiegel (1994), Pritchett (1996; 2001) concludes too regarding divergent effects. If the first two scientific investigations are favourable to education as a determinant factor in the relation to

the economic growth, the last ones question this influence. During a sectorial analysis Barro and Sala-i-Martin (1995) get to a balance concerning the contribution of the physical and human capital.

Analyzing the literature about the relation education - economic growth there occur some major problems: first, the ones related to the differences in measuring the reference indicators of the human capital, both in the quantitative and qualitative approaches; then the differences in the size and the structure of the countries samples analyzed and the periods considered and, not least, differences related to the growth regression specifications and the assessment methods used. These so heterogeneous aspects which can be found throughout the entire theoretical and empirical literature is a challenge not only for the attempt to quantify the effects of education by their perspective, but also a challenge for a new study which, in the specific context of the EU expansion surely raises multiple problems in validating the empirical models and the developments in literature in general.

But before proceeding to such an analysis, *Chapter 4* contains the methodological approach proposed in the research conducted, starting from a conceptual research model, having as a support the theoretical and empirical developments in literature and which describes the complex relationship and the influence variables used in the application of the empirical analysis models developed (Chapter V). Thus, Chapter 4 includes the quantitative and qualitative approaches appropriate for such a study: suggested models, research methods, forming the groups of countries on the support of which econometric models are applied, the analysis unit, the influence factors and the multitude of their measured variables, analytical tools of the quantitative data, statistical methods used and implemented through a computer program for validating the empirical testing and validating the investigated relationship.

The assessment of the human capital as a factor influencing the growth in the European Union area, the assessment of the impact of the multiple measures of the influence (economic, social, demographic) variables, respectively the measurement of the increase effects of the GDP/capita, involves the use of *specific methods and models*. The empirical analysis is performed using *simple and multiple linear regression models, double log and semi log models, dynamic models*, with time lags of the variable explained (GDP/capita). In processing the growth regressions applied to panel data we have used both econometric models with random effects as well as with fixed effects, the results of which were differentiated with the help of the Hausman test. The validation of the hypotheses of the models developed in the empirical analysis involved the application of some specific tests: checking the homoscedasticity restriction with the help of the Breusch-Pagan Lagrangian Multipiler test using, the absence of residual variable correlations with the help of the Wooldrigde and Durbin-Watson test and the statistical significance of the coefficients in order to validate the influence of the independent variables on the explained one, using the Wald, the Wald modified, the Fischer and the t-student tests. The empirical models were processed through the Stata 11 program.

In this study, the emphasis is exactly on education, centred on international data, knowing international studies which have highlighted the importance of knowledge and skills in supporting the growth of the income per capita. Therefore, *Chapter 5* contains five main sections with models developed on the basis of some specifications and different measures of the variables influencing the GDP growth / capita, with a focusing on quantitative and qualitative assessors of the human capital, the testing of their hypotheses, the validation of the influence investigated through the perspective of assessing the obtained results. The models presented in the previous chapter were applied to the European Union countries, to groups of countries and separately to Romania's case, according to different time periods including the last two decades covered.

In quantifying the impact of the human capital in terms of education level, we have considered both the quantitative and the qualitative aspect of education. The nonfinancial and financial *quantitative variables*, used for defining human capital, are either the result of some calculations based on primary indicators from education, or they are found in different international databases being used in most studies on this topic: a) the product of the rate of enrolment in secondary or tertiary education - and the proportion of the school-age population (15-19 years for the secondary education system, respectively 20-24 years for the tertiary cycle) out of the total population number; b) the weighted average of the rates of enrolment in education; c) the education-related expenses per student; d) the proportion of the population by age groups who completed secondary education (20-24 years and 25-64 years respectively). The conclusions derived from the models considered are divergent: the indicator related to secondary education is not a good estimator that can explain economic growth; however, the results are relevant, meaningful and robust when human capital has as measure the tertiary enrolment rate relative to the population between 20-24 years of age. The weighted average of the rates of enrolment in education (in all three educational cycles) has a significant influence on growth, in all groups of surveyed countries, this measure being particularly relevant in the case of Romania. The expenditure on education per student is another measure that explains well the variation GDP/capita on the total of the EU countries, but has a particularly relevance in the case of the new member states. Regarding the proportion of population, according to age groups (20-24 years and 25-64 years respectively), having completed the secondary school system, this measurement of the human capital is not a conclusive estimator which one could judge through the positive effect of education on the increase of the GDP/capita. What is relevant, however, is that the education variable measured this way becomes a good estimator for the group of the 10 Central and Eastern European countries, new EU members. More specifically, an increase of 1% in the proportion of population having completed the secondary education system leads to an increase of 0.61% in the age group 20-24 years and 0.93% taking into account the population aged between 25-64 years. The explanation is that part of the population has completed these studies after the specific school years, contributing to the accumulation of human capital and to the increase of the per capita income. We may also infer that this aspect was more conspicuous in the former communist countries, where the proportion of the people who completed a secondary education system was lower and had a certain dynamic.

The qualitative variables of education perform well in explaining the increase of the GDP/capita, as shown by the results of models applied to all groups of countries analyzed. The effect is relevant and stable across the EU, with a statistical significance level of 0.1%, according to the estimates, an increase by 1% in the quality of education would lead to very large increases of the GDP / capita. Using dynamic models with gaps reveals the role of the quality in education as an important growth factor, a very good result being obtained in the EU countries as a whole. Even if the potential effect of education on growth were lower than in the case of the dynamic models without lag, it is particularly significant, robust, along with the impact of other influence variables (openness degree, inflation, life expectancy).

In *conclusion, the study may contribute* to knowledge in several ways: a) *from a theoretical perspective*, the study examines two basic economic theories, the neoclassical one and the new growth theories, in order to better understand the influence on economic growth through investments in education and the increase of the educational level. In these models, human capital is an important resource that participates in the creation of new ideas and this mechanism justifies the thesis according to which education is a key determinant factor of the increase of the per capita income. In the study undertaken within the empirical analysis, founded on the conceptual research model, results show that the theoretical model is validated with great explanatory power. Essentially, the study contributes to literature by validating

most of the explanatory variables in a comprehensive model; *b) then*, these models tend to show that several options are provided to policymakers who want to increase the production level, providing information which supports the confidence in the role of education in this process. The study contributes to the empirical literature incorporating models developed on *panel* data, integrating the results obtained in the empirical generalizations recognized in terms of the role and the implications of human capital in society.

The very complex issues captured on the approached topic, from conceptualization to implementation also lead to possible technical deviations or of understanding this analysis. However, the specific situation related to the relatively low availability of some accurate comparable data for the countries analyzed, according to time series, especially according to the qualitative aspect of education (which are essentially related to objective factors linked to the low number of international evaluation tests which the students in the countries concerned participated in, and only recently), creates difficulties in the correct assessment of the growth regressions, with direct implications upon some errors in the obtained results. Also, the possibility of validating only certain specifications - a result of the measures available to the human capital – of neoclassical origin could be a limit in the sense of considering human capital as exogenous growth factor, the impact of which is reduced until reaching the constant state of equilibrium. Yet, the validation of the endogenous growth specifications compensates this limitation, successfully validating the analyzed causal relationship.

All these results reveal the *particular importance of human capital on economic growth*, concluding on the *confirmation of the education - growth causal relationship*. This overall judgement results from the potential impact highlighted by the analyzed models, education contributing significantly to the increase of the GDP per capita both through its quantitative and qualitative aspect. However, *qualitative measures perform better than the quantitative measures*, especially when using endogenous growth specifications, in which human capital, influenced and enhanced in its turn by other factors, is a relevant, stable, robust, dynamic and essential factor.

Contents

Introduction 1

Chapter I
HUMAN CAPITAL IN ECONOMIC THEORY..... 9
1.1 Defining notions regarding the human capital 9
1.1.1 The human capital concept - genesis, contents, particularities 9
1.1.2 Advantages and disadvantages of human capital 15
1.2 Theoretical contributions regarding the human capital 17
1.2.1 Becker's human capital theory 17
1.2.2 Criticism brought to the theory of the human capital 21
1.2.3 The signaling theory and the filtering (selection) theory 23
1.3 Education and the efficiency of the investment in education 24
1.4 Measuring the human capital - the quantitative and qualitative dimension of education 28

Chapter II
ECONOMIC GROWTH THEORIES 36
2.1 From exogenous to endogenous growth..... 36
2.2 Exogenous growth - the neoclassical model of Solow 38
2.3 New growth theories (theories of endogenous growth) 44
2.3.1 Romer's model: human capital and technology 44
2.3.2 Lucas' human capital and externalities model 45
2.3.3 Barro's contributions regarding the economic growth factors 47
2.3.4 The Nelson-Phelps human capital model 49
2.3.5 The AK model with physical and human capital 52

Chapter III
EMPIRICAL ANALYSIS MODELS OF THE RELATION BETWEEN HUMAN CAPITAL AND ECONOMIC GROWTH 54
3.1 Empirical models with human capital 54
3.1.1 Mincer's model: wage equation..... 54
3.1.2 The Mankiw, Romer and Weil model or Solow's model adjusted with human capital 57
3.1.3 Pritchett's empirical developments..... 61
3.2 Results of the econometric tests with linear equations 63
3.2.1 Benhabib's and Spiegel's model..... 63
3.2.2 Islam's contribution to the analysis of the relation human capital – economic growth 66

Chapter IV
METHODOLOGY, ANALYSIS METHODS AND VARIABLES. THE CONCEPTUAL RESEARCH MODEL 72
4.1 The methodological approach 72
4.2 Conceptual and operational model: influence mechanisms and effects of the education on economic increase 73
4.3 Presentation of the developed models 78
4.3.1 Empirical analysis developed on the grounds of a multi-factor linear regression model 78

4.3.2 Empirical analysis developed on the grounds of the augmented model of Solow (Mankiw, Romer and Weil model, 1992) 80
4.3.3 The link between the educational level and the salary 81

4.4 Variables and databases used in the applied models 82
4.4.1 Describing the variables from within the models 82
4.4.1.1 The dependent variable 82
4.4.1.2 The independent (explanatory) variables 82
4.4.1.3 Databases used in collecting the data necessary for the application of the models 86
4.5 Models, methods and econometric tests 87
4.5.1 Econometric tests with panel data: random-effects model and fixed-effects model 87
4.5.1.1 Fixed-effects model..... 87
4.5.1.2 Random-effects model..... 88
4.5.1.3 Hausman test..... 88
4.5.2 Dynamic models 89
4.5.3 Methods of estimating the parameters 90
4.5.4 Testing the hypotheses for the econometric estimation of the parameters 91
4.5.4.1 The right definition of the specification: F test and Wald test. The R^2 determination coefficient 91
4.5.4.2 Tests to prove the homoscedasticity: Wald modified test and Breusch - Pagan Lagrangian Multiplier test 92
4.5.4.3 Tests to prove the hypothesis of the serial correlations absence (self correlation): Durbin-Watson and Wooldridge – Lagram Multiplier test 94
4.5.4.4 STATA statistical package..... 95
4.6 Descriptive statistics and variables correlation 95
4.6.1 Descriptive statistics of the variables of the models for the EU member states panel (UE-27) 96
4.6.2 The matrix of the correlation between variables 98
4.7 Statistical analysis of the relation between human capital and economic increase 99

Chapter V
EMPIRICAL ANALYSIS OF THE HUMAN CAPITAL INFLUENCE ON THE ECONOMIC INCREASE IN THE EUROPEAN UNION AREA 105
5.1 The analysis models structure of the causal relation between human capital and economic increase 105
5.2 Models developed on the grounds of physical capital, of human capital (financial and non-financial variables) and of active population 106
5.2.1 The specifications of the models according to the measure of the human capital; hypotheses 108
5.2.1.1 The rate of enrolment in the secondary and tertiary education system 108
5.2.1.2 The weighted average of the school enrolment rate..... 110
5.2.1.3 The education expenses per pupil 111
5.2.1.4 The proportion of the people who graduated from the secondary education system..... 111
5.2.2 Testing the hypotheses and estimating the parameters 112
5.2.3 Results and appreciations 113

5.3 Models developed on the grounds of the human capital (financial, non-financial variables), of the physical capital, of the total population number increase rate and of the active population stock 126
5.3.1 The specifications of the models according to the human capital indicators; hypotheses 126
5.3.1.1 The rate of enrolment in the secondary and tertiary education system 126
5.3.1.2 The expenses on education as a percentage of the GDP..... 127
5.3.1.3 The rate of enrolment in the secondary and tertiary education system, according to age groups – analysis made in Romania ... 128
5.3.2 Testing the hypotheses and the parameters 130
5.3.3 Obtained results..... 130
5.3.3.1 The results of the analysis of the human capital influence in the UE10 and UE17 case 134
5.3.3.2 The results of the analysis of the human capital influence in Romania's case 134
5.4 Models developed on the grounds of the qualitative dimension of the human capital 138
5.4.1 The importance of the scores in the international tests for assessing the performance of pupils on the economic increase *138*
5.4.1.1 The specification of the models and the influence variables 138
5.4.1.2 Testing the hypotheses and the parameters 139
5.4.1.3 Estimating the parameters and interpreting the results 139
5.4.2 The qualitative variable of the human capital in dynamic models with lag 143
5.4.2.1 The model specification 143
5.4.2.2 Testing the hypotheses and the parameters 144
5.4.2.3 Obtained results and appreciations 145
5.5 Models developed on the grounds of the human capital calculated according to Mincer's specification, of the active population and of the physical capital 147
5.5.1 The specification of the applied models 147
5.5.2 Testing the hypotheses and the parameters 148
5.5.3 Interpreting the obtained results..... 148
5.6 Synthesis of the results, limits and future research directions 155

Conclusions 160

Bibliography 165

Appendices 178