LUND UNIVERSITY
School of Economics and Management

Master programme in Economic History

A CROSS-SECTION ANALYSIS OF THE RELATIONSHIP BETWEEN OUTPUT COMPOSITION AND COMPOSITION OF EDUCATION EXPENDITURE

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ABSTRACT:
In this thesis, a new theoretical framework is developed to study the relationship between human capital and economic development in a different perspective. The aim of this thesis is to examine the relationship between output composition and composition of education expenditure. Output composition is represented by the share of high value added sectors in total value added and composition of education expenditure is represented by share of higher education expenditure in total education expenditure. In this context, two hypotheses based on the possible positive relationship between the share of high value added production and share of tertiary education are established and the relationship examined for 20 OECD countries from 1995 to 2005 through cross section regression analyses. In contrast with our expectations we reject the existence of a possible positive relationship and our results suggest that the relationship between output composition and composition of education expenditure is negative and mainly depends on the structure of labor market and composition of population.

Key Words: Human Capital, Education Expenditure, Tertiary Education.

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1. INTRODUCTION

This research paper aims to examine the relationship between human capital accumulation and economic development from a different perspective. This relationship has been investigated several times by scholars for various types of countries and various time periods with results pointing out to human capital accumulation having positive effects on economic growth. In this study we create a new theoretical framework from a perspective based on possible different outcomes of human capital accumulation on economic development and do not focus on the relationship between economic growth and human capital accumulation. More specifically, the main purpose is to analyze the different aspects of human capital and sources of the demand for these aspects through investigating the possible relationship between output composition and composition of education expenditure.

Quality aspects of the labor force emerged as one of the most important determinants of the economic growth after growth accountants such as Fabricant (1954), Abramovitz (1956), Kendrick (1956) and Solow (1957) observed that economic growth could not be explained solely through conventional measures of labor and capital (Griliches, 1957). In these early works changing quality of the labor force was seen as a possible explanation for the unexplained part of the growth residual or total factor productivity (TFP). At this point, an important clarification was provided by Kendrick (1956) who compared 33 industries and 80 manufacturing firms in the U.S. with respect to relative efficiency of factors from 1899 to 1953 and human capital accumulation defined as "cultural" capital. Increase in productivity over time and productivity differences among industries and firms were explained with a missing factor or immaterial capital. "*This "cultural" capital is largely the technical knowledge of individuals, accumulated by investment in education and research, and its services are manifested through the application of technical know-how by individuals directly in productive activity, or through the instruments of production."* (Kendrick, 1956: 250) Thus, this early framework regarded human capital as the source of technical improvement and as the most important part of the TFP.

After the emergence of the endogenous growth theory, focus on human capital as an important determinant of the economic development increased. The role of continuous accumulation of knowledge as the key element of technological development and sustained economic growth was defined by Kuznets (1973) which can be seen as an important contribution to the new framework. Beginning with the mid-1980s Lucas (1988), Romer (1990) and Mankiw, Romer and Weil (1992) modeled human capital in growth regressions. In this new framework, the role of human capital in economic growth is defined in two ways. The first aspect of the human capital is determined as the source of qualified labor force in

ongoing production process and second aspect of the human capital is determined as the source of technological improvement. These two fundamental functions of human capital in economic development is one of the most important distinctions with respect to the earlier framework.

Rosenberg (1982, 1994) defined the relationship between technological change and economic development as a black box because of the complex structure of the mechanism from accumulation of knowledge to technological improvement (Ljungberg and Smits, 2004). In the earlier framework, technological improvements were defined exogenously through immaterial capital accumulation or as a missing factor. However, after the emergence of endogenous growth models the role of human capital took a more definite form and a distinction emerges between two fundamental functions of human capital accumulation. Romer (1990a) underlines the existence of a minimum threshold in human capital accumulation to stimulate an innovative process. Although the emergence of endogenous growth models clarifies the functions of human capital accumulation, the mechanism from accumulation of knowledge to technological improvement is still not explicitly resolved. This situation was described by Mokyr (2002) as exploring a new "black box".

Education is seen as the fundamental source of human capital and most studies of educational attainment set education expenditure or average years of schooling a proxy of human capital or as a representative of quality aspects of labor force. Additionally, some studies such as Judson (2002) modify the human capital index to include other sources of human capital such as on the job training and work experience. At this point, Romer (1990b) and later Gemmell (1996) underline the different aspects of human capital acquired from different levels of education. Especially, Gemmell (1996) emphasizes on the distinction between stock and flow of human capital and introduces a re-classificaion of human capital accumulation with respect to level of education.

As stated above, acquisition of knowledge through education is the fundamental source of human capital accumulation and it is not reasonable to expect the same kind of knowledge with the same purpose acquired through primary, secondary, vocational or tertiary education. In the same perspective, Mokyr (2000 and 2002) provides us with a useful tool in order to make a distinction between two aspects of knowledge by categorizing knowledge as propositional knowledge and prescriptive knowledge. Propositional knowledge deals with natural phenomena and regularities while propositional knowledge deals with techniques. In other words, prescriptive knowledge is a function of propositional knowledge. Although

Mokyr (2002) concentrates on useful knowledge and this definition is not directly related with the distinction of the roles of stock and flow of human capital, it is still useful.

Aggregate human capital stock is the fundamental determinant of the production capabilities of economic development and human capital represents the quality aspects of existing labor force. The theoretical framework for this research paper could be summarized as follows: Human capital accumulation promotes economic growth in two ways; (1) by increasing productivity of labor force and (2) by providing technological improvements. In relation with these two functions of human capital accumulation we determine two threshold levels. First threshold is the minimum required knowledge for an individual to utilize existing production technology and contribute to the production process. Human capital accumulation above this threshold would be basically defined as an increase in the proportion of labor force with minimum required human capital. The first threshold's definition is based on Mitch (1990) and can be seen as an important justification behind compulsory education which underlines a minimum level and some clear standards. The second threshold is based on Romer (1990a) who argues that a minimum threshold of human capital accumulation is necessary to promote technological improvements. Human capital accumulation above this threshold would basically be defined as an increase in the proportion of high skilled labor force donated with capabilities of creating new and better production technology or improving existing technology. Accumulation of human capital above this second threshold, which can be named the scientific knowledge threshold, is closely related with Kuznet's (1973) definition of continuous flow of additional knowledge to sustain economic growth in the long run. Similar with propositional knowledge and prescriptive knowledge, knowledge between the first and second threshold is a function of the knowledge above the second threshold. In other words, when an improvement occurs in production technology and enters into the common set of production technology, it started to spill over and becomes a part of minimum required knowledge.

Since education is the fundamental source of human capital accumulation in this framework, the composition of education expenditure represents the composition of current interests in human capital accumulation. In developed countries which we implicitly assume that the sustainable growth process achieved through investments above the second threshold which would be greater and related with the high value added production. Demand for high skilled or highly educated individuals would be greater and this demand would be derived from output composition. In this study, the relationship between output composition and

composition of education expenditure is examined for 20 developed countries in the time framework 1995 -2005.

The research question of this thesis is "Does output composition as an indicator of the interests of economy represent or determine the composition of education expenditure as an indicator of the demand for stock or flow of human capital?" The plan of the paper is as follows: Section 2 provides theoretical justification and introduces hypotheses. Section 3 connects theoretical justification and empirical analysis through providing a broad picture of educational attainment, financial returns to education for public and private investors, social returns to education and composition education expenditure respectively. Section 4 firstly introduces the data sources and variables and then explains the research methodology and secondly presents the results of empirical analyses and interpretations of these results. Finally, Section 5 concludes with an overall evaluation of the investigation.

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2. THEORETICAL JUSTIFICATION

Human capital is basically defined as the stock of competences, knowledge and skills embodied in the ability to perform in the production of economic value. Although focus on human capital increased after the emergence of endogenous growth theory, concept of the human capital defined by Adam Smith[1] (1776) and importance of this concept underlined. Smith did not use the term human capital but use the term *useful abilities* or *talents* which obtained through education or training and defined it as a capital because it is fixed and realized similar with a machine which facilitates and abridged labor. Similar with Smith's definition, *human capital* introduced as a term in the modern economic literature by Jacob Mincer (1958) and Gary Becker (1964).

Scholars generally concentrate on the relationship between human capital development and economic growth. In this approach, level of output growth is seen as a function of the stock of human capital. Uzawa (1965) and Lucas (1988) defined human capital stock as an input in production function and employ measure of educational attainment variables. In other words, human capital closely related with knowledge and existing knowledge seen as an input. According to Lucas (1988), human capital is a qualitative aspect of labor which is required to facilitate existing and new technologies. This approach is similar with Smith (1776), Mincer (1958) and Becker (1964) in which human capital seen as a physical means of production and acquired through education or training and the more investment made on human capital the more productive labor force obtained.

On the one hand, human capital is fixed and represents the existing knowledge and as this knowledge spills over, productivity of labor force increased which in turn leads to an increase in total production. On the other hand, Romer (1990a) underlines the assumption that human capital is the key input in the production of new ideas and continuous accumulation of the human capital rather than existing stock of human capital is the key element of economic development. In other words, technological improvements and innovations are the key elements of long term economic growth and human capital accumulation is the fundamental source of technological improvements or innovations. Temple (2001) underlines the difference between the approaches of Lucas and Romer as "*In contrast with the Uzawa-Lucas framework, this opens up the possibility that even a one-off increase in the stock of human capital will raise the growth rate indefinitely. Indeed, in many endogenous growth models,*

[1] Smith, Adam: *An Inquiry into the Nature And Causes of the Wealth of Nations Book 2 - Of the Nature, Accumulation, and Employment of Stock*; Published 1776.

human capital must be above a threshold level for any innovation to take place at all"(2001: 4)

By underlining the difference between stock and flow of human capital, Romer (1990a) made an important contribution to human capital literature after Kuznets (1973), because this distinction enable us to distinguish human capital investments in a theoretical way. In practice a distinction exists between investments on research and development and expenditure on the job training programs funded by firms. Similarly, a distinction exists between tertiary education expenditure and education expenditure below tertiary level. Expenditure below this threshold level is related with providing qualified labor force to ongoing production process, but expenditure above threshold is related with providing skilled labor force to sustain technologic improvements. At this point, defining educational threshold is important which is introduced by Mitch (1990) as "*the basic principle of an educational threshold, in this view, is that some standard of educational attainment must spread throughout a population if an economy is to progress, in terms of one or another measure of economic development income per capita, the proportion of labor force in manufacturing, and so on.*"

In addition to underlining existence of a threshold level in human capital accumulation, in another study Romer (1990b) made a distinction between post secondary and secondary education which could be seen as a complementary definition with Mitch's (1990) educational threshold definition. Romer (1990b) defines three types of skills for each individuals and these are: (1) Physical skills such as eye-hand coordination and strength, (2) Educational skills acquired in primary and secondary school and (3) Scientific talent acquired in post-secondary education. In this context, difference between acquired skills through different level of education is underlined which is the main argument behind the distinction between the roles stock and flow of human capital. Gemmel (1996) stressed the same point that there is a necessity to construct an alternative human capital measure which is capable of distinguishing between stock and flow of human capital. Therefore, in the examination of the relationship between economic growth both initial stock and growth of human capital employed from 1960 to 1980 for 98 countries Gemmel (1996) introduced skills obtained through education in a hierarchy but this time divided into three levels as primary, secondary and tertiary. In both stock and flow of human capital empirical evidences indicate a positive and statistically significant influence in income growth. Additionally, as a result of distinguishing between primary, secondary and tertiary level computation of human capital index was provided in a more detailed way. According to their results primary and secondary

education have the most prominent effect on growth while tertiary education has greater influence in less developed countries.

Recently, an important study in this context was presented by Leeuwen and Foldvari (2008), which examine the relationship between human capital and economic growth for the countries Japan, India and Indonesia from 1890 to 1940 and 1950 to 2000. In order to examine the long term relationship between human capital and economic growth they used cointegration analysis. In their analysis, they first create a human capital stock index by using cost based method similar with Judson (2002) and then take the logarithm and first difference of these series to obtain human capital growth. In the second step, they employed Johansen (1991, 1995) procedure to test for the presence of cointegration which investigates the long run relationship. In Johansen cointegration analysis variables should be stationary at the same level to be cointegrated and a series is said to be "integrated of order d" if one can obtain a stationary series by "differencing" the series d times.

In this context, in order to test for Lucas' (1988) approach they examine the relationship between human capital growth and economic growth through employing first difference of the original index and to test Romer's (1990a) approach the relationship between change in human capital growth and economic growth through employing second difference of the index is examined. In the first part of their analysis in which both of the series are in the same integrated order that they are both I(1). If economic growth and human capital growth cointegrated in the same order, relationship between economic growth and human capital is confirms Lucas' (1988) approach. Otherwise, if economic growth is I (1) and human capital is I (2), they are cointegrated at different order, in this case relationship between economic growth and human capital confirms Romer's (1990a) approach. This is the methodological explanation of the threshold underlined by Romer (1990a).

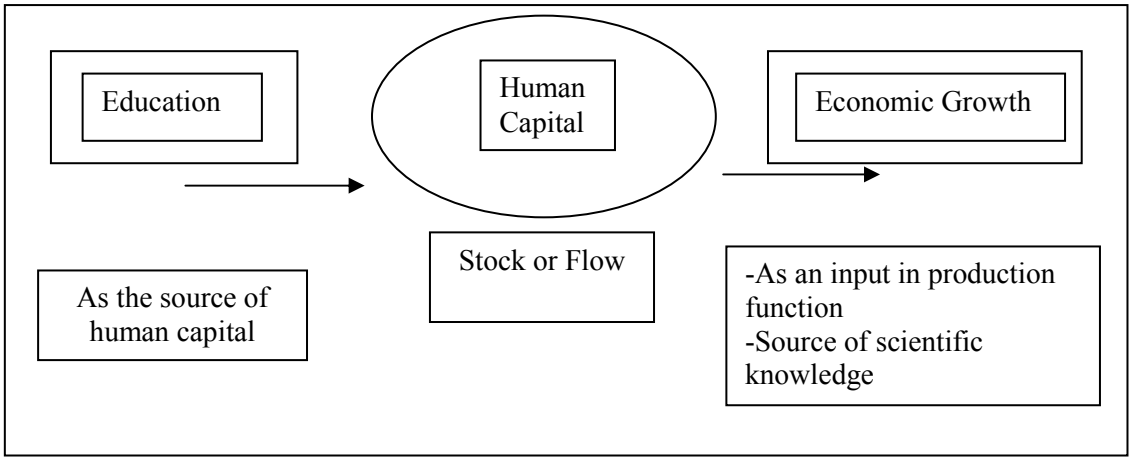
According to their results, in both of the periods from 1890 to 1940 and 1950 to 2000 dominant relationship between human capital and economic growth is corresponding with Lucas model (1988) that in less developed economies human capital incorporated into growth models as a factor of production. In the Japanese case for the first period from 1890 to 1940 Lucas model (1988) is again dominant while in the second period from 1950 to 2000 Romer's approach (1990a) is dominant that human capital does not enter the production function directly but defined as the source of technological improvement. This study provides valuable information about different effects of human capital on economic growth through different stages of economic development and economies. They explain the differences of human capital on economic activity among countries through two major views on the role of

human capital in economic development by Lucas (1988) and Romer (1990a). In its simple definition "*Lucasian approach considers human capital to be a qualitative aspect of labor that is required, for example, to operate existing and new technologies. When a country is close to the technological frontier and cannot import technology, the importance of the Romerian aspect of human capital should become dominant. More and more labor is employed to extend the technological frontier"* (Leeuwen and Foldvari, 2008: 232).

Here the basic difference between these two approaches is based on the differences between stock of human capital and flow of human capital. In the early, stages of development, it is possible to increase existing productivity and output level through transferring existing knowledge to labor. In other words, by increasing the proportion of the skilled labor force in total. However, as the economy develops a minimum level of knowledge diffused through the society and additional knowledge accumulation required to improve existing human capital and stimulate growth. The same phenomenon explained by Kuznets as follows; "*The high rate of growth is sustained by the interplay between mass applications of technological innovations based on additions to the stock of knowledge and further additions to that stock*" (1973: 257).

In this theoretical perspective human capital is seen as the source of economic growth both as an input of the production function and as the fundamental determinant of the technological improvement. Gemmell (1996) summarizes rationale of the inclusion of human capital in growth equations under four topics. First, standard form of Cobb-Douglas aggregate production function can be extended to include human capital. Second, as it is presented by Mankiw, Romer and Weil (1992) an augmented Solow model can be formed through extending with human capital growth as well as physical capital growth. Third, human capital growth as the source of scientific knowledge and technologic improvements in production would take an important role in endogenous growth process, as it is modeled by Romer (1990b). Fourth, Baumol (1986) and Barro (1991) again define the role of human capital in an indirect way in economic growth. Human capital serve as a facilitating factor in technology transfer and in this approach as the stock of educated labor force increase technology transfer would be facilitated. In this concept, relationship between education and economic growth is summarized in the following figure.

Figure 1 Relationship between education and economic growth



In this figure, education is the fundamental source of the human capital and in most of the studies educational attainment, schooling, enrolment rates at different level of education or educational expenditure employed as the indicator of human capital accumulation. Human capital stimulates economic growth in two ways both as an input in production function or as the qualification of the labor force and as the source of technological improvements or innovations. As it is summarized above, the most important and typical examples of this approach is estimating GDP growth as a function of education. Björklund and Lindahl (2005) state that the most important advantage of this approach is that includes all possible positive effects of education into the analyses. Education as it is stated before is the fundamental source of human capital and increase in the productivity of the labor force. However, education has possible positive contribution to social welfare through increasing social cohesion, interpersonal trust, healthcare and political interest. At this point, it is important to state that finding positive externalities of education is possible and we can extend and add other possible positive outcomes of education rather than increase in labor productivity.

One of the influential study in this framework presented by Mankiw, Romer and Weil (1992) that in this study they employ augmented Solow model to examine the cross country differences and employ percentage of the working age population in secondary school as a proxy of human capital. They create three sub samples and one of them is the OECD sample which includes 22 countries. For the OECD sample regression results indicate a positive relationship between output growth and human capital investments.

Another important study in this framework is presented by Barro and Lee (1993) which is again one of the influential studies of the human capital literature. Educational attainment at four different levels; no schooling, primary, secondary and higher over five year periods from 1960 to 1985 for 129 countries used as a proxy of human capital. Their results indicate that both male and female attainment has positive and significant influence. One of the recent studies of Barro (2001) suggests valuable results on different issues on the relation between human capital and economic growth. This is a panel study that includes 100 countries from 1965 to 1995 and employs primary and secondary school enrolment as a proxy of education. In the analysis, male-female participation, primary and secondary education attainment, and quality differences were examined. The results indicate that male attainment is statistically significant and an additional year of schooling raises the growth rate on impact by 0.44 percent per year. On the other hand, female attainments both in secondary and primary schools are statistically insignificant. The most important finding of the study is probably, the external effect of primary school enrolment of females that when fertility is not held constant, the estimated coefficient on female primary schooling becomes significantly positive. As a result, female primary education effects economic growth only indirectly through lower fertility. These findings of the study is also indicates a structural determinant, that if female labor force participation is low, we can not observe an increase in productivity.

Another important finding of the study is that quality of education is more important than quantity. Comparison in quality quantity based on scores on internationally comparable examinations in science, mathematics, and reading. "*The estimated coefficient on the science scores, 0.13 (SE = 0.02), implies that a one-standard- deviation increase in scores (by 0.08) would raise the growth rate on impact by 1.0 percent per year. In contrast, the estimated coefficient for the school attainment variable, 0.002 (SE = 0.001), implies that a one-standard-deviation rise in attainment would increase the growth rate on impact by only 0.2 percent per year. Thus, the results suggest that the quality and quantity of schooling both matter for growth but that quality is much more important."* (Barro, 2001: 15). Additionally, Hanushek and Kimko (2000) use the test results of mathematics and science as control variable and then effect of an additional year of education decreased from 0.55 to 0.10.

To sum up, providing evidence for the positive relationship between human capital and economic growth is possible. However, examining all the literature on human capital and economic growth based on growth regression is out of scope of this section. Most influential and prominent studies in relation with our interest are presented above and it is possible to find more in the existing literature for different samples, econometric methodology and

approach. In this theoretical framework investments made on education by both government and private sector assumed as given or basically assumed that government or private sectors invest on education with a purpose providing human capital.

In this study, we want to focus on this relationship from a different perspective. The main hypothesis is as the share of high value added sectors in total value added increase, demand for high skilled labor force increased and both households, government and private sectors' spending on education increased. High value added production requires intensive use of technology and sustainability of this pattern requires investment in human capital. In other words, current production composition is the determinant of current labor force composition or demand for high skilled labor force. For instance, we do not expect an intense demand for tertiary education from an agrarian society or intense demand for technical vocational education in a small country which specialized on service sector such as tourism or banking. Composition of output and labor force basically indicates what kind of specialization exists in production and what kind of investments should made by government or private sector to stimulate this production or increase the efficiency of the production.

Education expenditures have basically two components current expenditures and investment expenditures. The most important determinant of the current expenditures on education is the demographic structure such as the number of students. As a result, it would be problematic to focus just on total education expenditures and make cross country analysis without checking demographic differences or number of students. Since, we focus on the relationship between output composition and education expenditures and we will concentrate on investment part of the education expenditure and its distribution among below and above tertiary level. From this point of view our expectations concentrated on tertiary education because of following reasons. First, in all of the developed countries and most of the developing countries primary and secondary education is mandatory. Additionally, when we examine the United Nations education systems database[2] duration of compulsory education varies between 5 to 12 years and in most of the developed countries compulsory education is between 9 and 12 years, on the average compulsory education is around 11 years for our sample.

Second, as it is stated by Romer (1990b) and Gemmell (1996) human capital acquired from education should be distinguished to investigate the true effect of human capital on economic growth. Human capital acquired in primary and secondary education

[2] Duration of compulsory education for sample countries is provided in appendix.

would not make the same contribution to labor productivity and allocation of education expenditure among different levels of education depends on the demand for education on different levels. At this point, educational threshold would be a useful tool to distinguish human capital stock and flow. Fundamental, difference between stock and flow of human capital is closely related with two aspects of human capital. First, human capital as an input in production function similar with physical capital and for an individual to contribute to the current production process a minimum amount of knowledge is required. This minimum amount of required knowledge is the reasoning behind compulsory education and one aspect of the educational threshold. Second, human capital also serves as the source of scientific knowledge and technologic development and as Romer (1990a) underlined human capital must be above a threshold to stimulate new ideas and innovation which is the other aspect of the threshold.

Based on these two aspects of educational threshold, in this study we determine the threshold level as the upper secondary and post-secondary non- tertiary education as the minimum required knowledge threshold and tertiary education as the scientific knowledge threshold. In addition to theoretical explanations, in the last decade from 1998 to 2007 the proportion of the adult population with below upper secondary education has fallen to 30%, the proportion with tertiary attainment has risen to 27%, while the proportion of the population with upper secondary and post-secondary non-tertiary education has remained unchanged at 43% (OECD, 2009: 31). At this point it is important to state that our choice of thresholds are mainly arbitrary and depended on data availability.

In this study we concentrate on the second threshold for the following reasons. First and the most important one is that scientific knowledge threshold defines the distinction between stock and flow of the human capital. Second, almost all of the countries in our sample are developed countries and Findings of Leeuwen and Foldvari (2008) are also support this expectation that in the early stages of development stock of human capital and its spill over in order to provide a standard level of educational attainment must spread throughout a population. However, as the economy and society develops investments above the threshold required to extend technology frontier. In other words, in developed countries composition of education expenditure expected to be different and expenditure on tertiary education expected to be higher than other levels of education. Third, data restriction is also an important reason which is examined in a detailed way in the following sections.

To sum up, under the presented theoretical framework the relationship between output composition and composition of education expenditure is examined through scientific

knowledge threshold. In this study, we have two fundamental arguments and two main hypotheses based on the defined possible relationship. First, increase in the share of high value added sectors in total value added leads to an increase in the share of education expenditure above scientific knowledge threshold or an increase in share of tertiary education expenditure. Second, increase in the share of high value added sectors in total value added leads to increase education expenditure per student above scientific knowledge threshold.

3. A REVIEW OF EDUCATION IN SAMPLE COUNTRIES

Defining educational threshold is one of the leading elements of our hypotheses and one of the other leading elements is the concept of sustainable economic growth through continuous flow of human capital. In this part of the thesis we provide a review of last ten years of educational development and incentives of investment in education with respect to increasing demand for education, economic and social incentives to invest on education and change in composition of education expenditure.

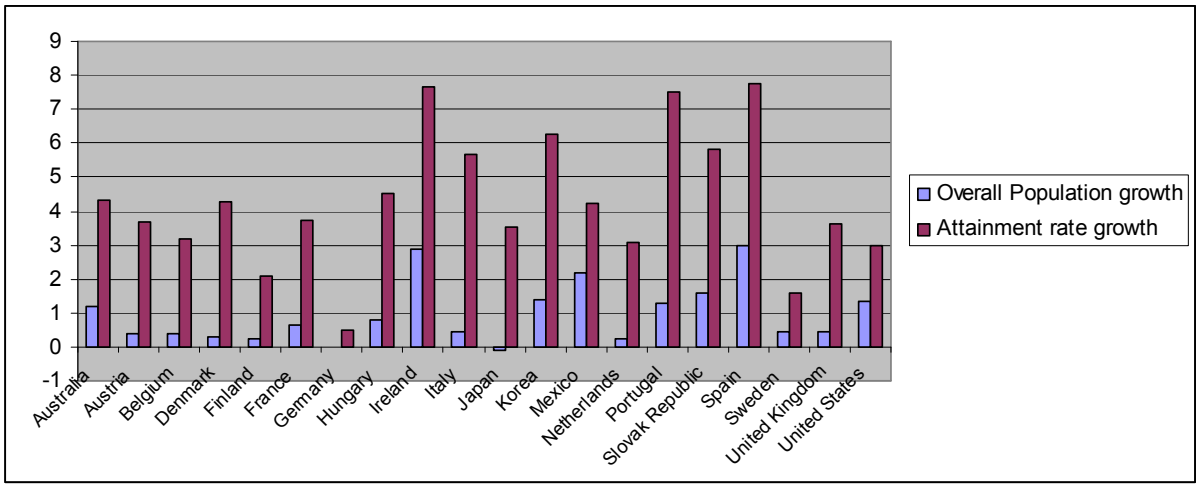
Government policies concentrated on two important issues related with labor market and economic development. First one is the continuous supply of well educated individuals to labor market. Second one is preparing the workforce for labor market with necessary skills during the downturn. Otherwise, individuals face with a great threatens of structural unemployment. Government policies concentrate both on stimulating economic growth through investing more on human capital accumulation and providing continuous flow of labor force at market expectations.

In relation with our hypotheses, composition of education expenditure also shaped with market expectations. In high value added sectors both in manufacturing and service sectors demand for high skilled labor force would be high and countries in which proportion of high value added sectors have greater share in total value added production would have greater demand for high skilled labor force. We also expect that in these countries households and private sector also invest more on education as well as government sector. From the perspective of households or individuals return to education increased as the supply of high skill jobs increased and it is less risky to be employed if they at least satisfied the minimum requirements. From the perspective of private sector both to continue the production and innovative process increase their incentive to invest on education. As a result, different sectors have different expectations to invest on education and current output and labor market composition have influence on future composition of education expenditure. Output composition in terms of share of high value added production, labor market demands and government policies determine composition of education expenditure through participation of households, private and government sectors. As a result, the purpose of this review section is connecting theoretical justification and empirical analysis of the relationship through providing a broad picture of educational attainment, financial returns to education for public and private investors, social returns to education and composition education expenditure respectively.

3.1 Demands for Education

Structure of population and demand for education are important determinants of education expenditure. Population growth increases the proportion of younger cohorts which means an increase in the number of students and as the number of students increased education expenditure increased. However, since our sample compromised by developed countries and population growth in developed countries stable and low, change in population structure is not an important determinant. On the other hand, increase in demand for education is an important determinant of the composition of education expenditure. In the entire OECD countries, growth in attainment rate at tertiary level is higher than population growth. Average annual growth rates between 1998 and 2006 of overall population and educational attainment for Italy, Denmark, Poland, Austria and United Kingdom overall population growth is below 1% while attainment rate growth is around 5 %. For Japan overall population growth is negative while attainment rate growth is about 4%. Although in some OECD countries such as Spain, Ireland and Mexico overall population growth rate is relatively higher, fundamental reason behind the increase in the number of students in total is not just because of population growth but also because of increasing demand for education. Before examining the attainment rate growth in a more detailed way in upper secondary and tertiary level, a comparison of overall population growth and attainment rate growth presented in Figure 1.

Figure 2 Average annual growth in the population with tertiary education (1998-2006)



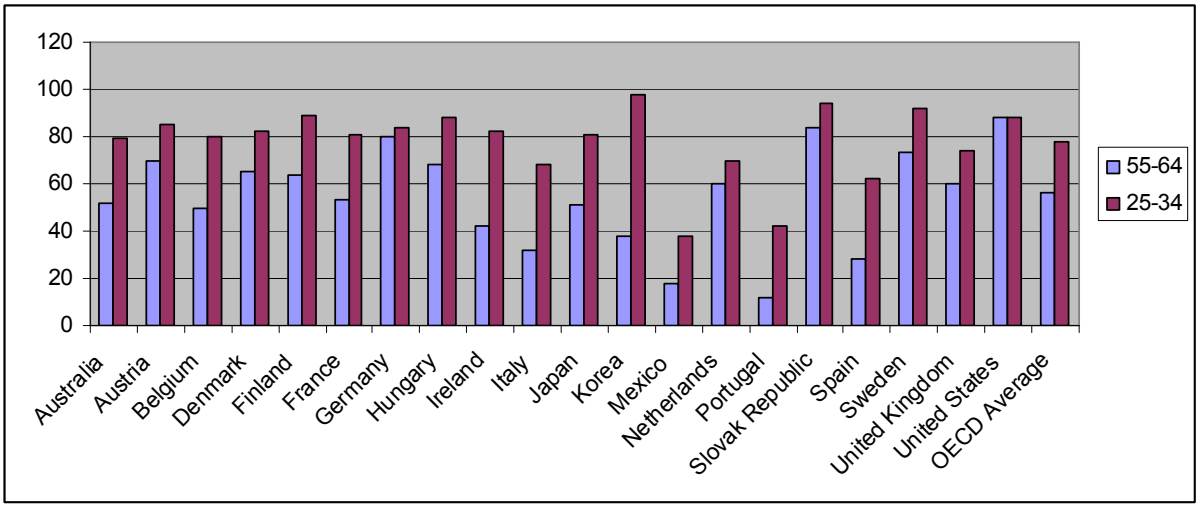
Source: OECD. Table A1.4 and Table A1.5. Education at A Glance 2009

Attainment rate growth alone is an important indicator of existence of an educational threshold since, as it is stated before upper secondary and post-secondary education is determined as minimum required knowledge threshold and tertiary education as the scientific

knowledge threshold. In the following, relationship between education and employment analyzed with respect to educational attainment. An important detail in examining market expectations and educational attainment is the age cohorts, because in most of the countries such as France, Ireland, Japan and Korea, the difference between oldest and youngest age cohorts is about 25 percentage points. Especially when we take into account educational threshold, difference between 25-34 years olds and 55-64 year olds cohorts in upper secondary education attainment on OECD average which is about 22 percentage points indicates an important change in demand for education. The difference between age cohorts varies among countries but generally we observe an important difference in the last decade that both in upper secondary and tertiary education attainment a considerable difference exists which in turn indicates a change in demand for education. In the following figures educational attainment differences between age cohorts are presented.

In upper secondary school attainment in 23 out of 29 OECD countries around 60 % of the population aged between 25 and 65 completed upper secondary education. Although the difference between age cohorts is not as sharp as in all countries, a considerable increase in upper secondary attainment observed in all countries except United States. Especially in Belgium, Ireland, Italy, Korea, Portugal and Spain difference is above OECD average of 22 percentage points.

Figure 3 Population that has attained at least upper secondary education (2007)

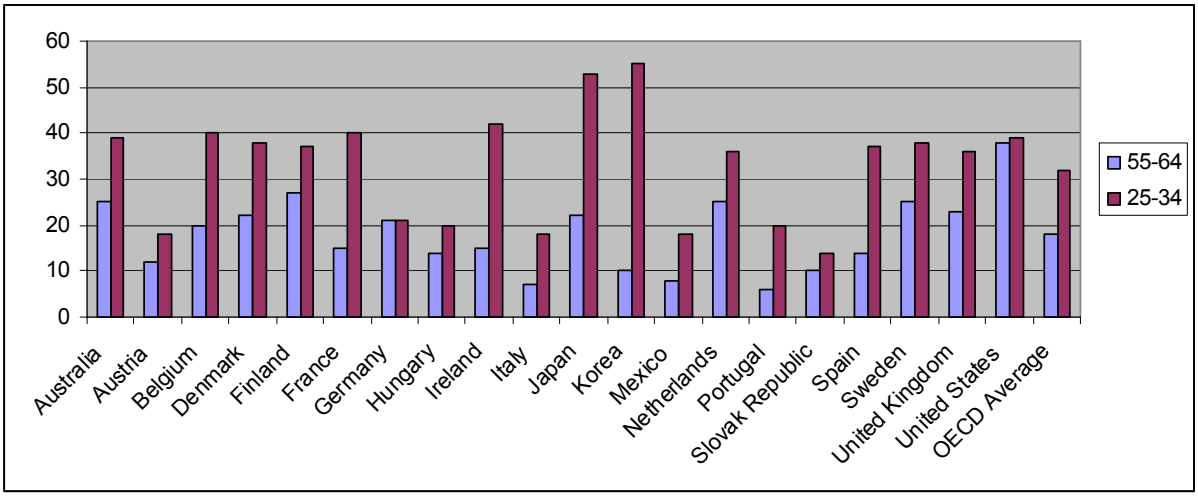


Source: OECD. Table A1.2a Education at A Glance 2009.

On the other hand, in some countries upper secondary attainment quite stable that in Germany and United States that we do not observe an important difference but the difference is about 59 percentage points in Korea OECD (2009). Tertiary attainment also exhibits the same pattern with secondary attainment that on OECD average difference between 25-34

year-olds and of 25-64 year-olds cohorts is about 14 %. The rapid expansion of tertiary attainment can be observed in all countries except United States and Germany. A summary of this change presented in the following figure.

Figure 4 Population that has attained at least tertiary education (2007)



Source: OECD. Table A1.3a Education at A Glance 2009.

Expansion of educational attainment, both in upper secondary and tertiary education, exhibits a very similar pattern. The difference between age cohorts in Germany and United States is close to zero or too small. On the other hand, for Korea, Japan, France, Ireland and Spain it is quite high and they are under OECD average in older cohorts while above in the younger cohorts. Figures 3 and 4 indicate that educational attainment or demand for education increased in all levels and market expectations or marginal contribution of education increased from one generation to the other.

According to the OECD (2009) records in the last decade composition of educational attainment changed in favor of tertiary education while upper secondary and post secondary non-tertiary education not changed. In 1997, educational attainment of 37 % of the adult population below upper secondary education and 43 % of population completed upper secondary and post-secondary non-tertiary education while 20 % of them completed tertiary education. In 2007, proportion of the population below upper secondary school education level degreased to 30 % and share of tertiary education increased to 27 % while the share of upper secondary and post-secondary non-tertiary education stays the same around 43 %.

These figures indicate that in the last decade proportion of adult population which completed at least upper secondary education increased 7 % on the OECD average. In the previous section of this study we define educational threshold and determine it as the upper

secondary and post-secondary non- tertiary education because of expansion of compulsory education. Additionally, previous statistics indicate that on the OECD average only 30 % of adult population below upper secondary education and 70 % of population completed at least upper secondary and post-tertiary education.

3.2 Incentives to Invest on Education

Education is the fundamental source of human capital accumulation and minimum required human capital to find a skilled job or just finding a job is not constant but changing over time. Difference in demand for education between age cohorts is the most important indicator of this situation. If we just focus on the economic return of education, individuals' demand for education is depended on economic return of education and supply of high skilled jobs in the market. One of the most important indicators of the match between educational attainment and labor market is the International Standard Classification of Occupations (ISCO) statistics. According to ISCO classification; (1) Legislators, senior officials and managers, (2) Professionals, (3) Technician and associate professionals are defined as skilled occupations. On the OECD (2009) average 79 % of the skilled jobs performed by tertiary educated adults in 25-34 year olds cohort between 1998 and 2006. From another point of view, unemployment ratios for below upper secondary educated and tertiary educated individuals are also beneficial to understand increasing demand for education. On the OECD (2009) average between 1997 and 2007 the unemployment rate for individuals below upper secondary education is about 6 % while for tertiary educated individuals it is slightly over 2 %. Although unemployment rates and the difference with regard to education level vary among countries, tertiary educated people face the risk of being unemployed less than others. Additionally, in the last ten years unemployment level exhibit an increasing trend and unemployment rate increase about 0.8 percentage points for tertiary educated individuals while for upper secondary graduates its over 1 percentage points.

Apart from finding a job, earning differentials between individuals with different education level is another important motivation behind increasing demand for education. On the OECD (2009) average earning differentials between tertiary educated individual and upper secondary educated individual is around 5 percentage points and in some countries such as Germany, Hungary and Italy difference is over 20 percentage points between 1997 and 2007, for the 25-64 year olds age cohorts. On the other hand, if we take into account change between generations through comparing different age groups an important point emerges. Between 55 and 64 earning differentials are greater than younger cohorts and between males

and females which means tertiary education increase earning differentials increase over time. Second, earnings differentials between males and females with the same educational attainment remain substantial. Increase in earning differentials is not only a motivation to invest on education or a reason of increasing demand for education, but also an indicator of supply of and demand for high skilled labor force. Since earning differentials increase over the last ten years, demand for tertiary educated labor force increasing or supply of tertiary educated labor force is below demand.

3.3 Financial Return on Education

Earning differentials alone provide information on one side that gives information on wage differentials or money benefits of education. On the other hand, from another point of view education is an investment and decision making on investment basically depend on the cost benefit analysis. It is only reasonable for a decision maker to invest which can be an individual, government or private sector, if benefits of investment are greater than costs. Statistics provided by OECD (2009) are based on Net Present Value (NPV) approach. Here, all the costs and benefits in different periods transferred into present time through discounting with a pre-determined interest rate. In OECD analysis discount rate is chosen as 5 %. Although magnitude of the NPV is also very important, basically, if net present value takes positive values, investment decision is reasonable.

A financial returns to education is an important topic in itself. However, examining this topic in a detailed way through defining each components and how these components take part in computation of NPV of investment on education is out of scope of this study. In relation with our hypotheses it would be useful to know return on upper secondary or post secondary non-tertiary education and tertiary education separately in order to examine with regard to educational threshold framework. Additionally, from one point of view education expenditure can be decomposed into public and private investment which is again related with our research scope. As a result, in this part we provide statistics for upper secondary or post secondary non-tertiary education and tertiary education through public and private returns respectively. In calculation of private return to education framework of costs and benefits are defined by OECD (2009) as fallows. Costs; transfer effects, social contribution effect, income tax effect, foregone earnings and direct cost. Gross earning benefits and unemployment effect

compromises benefit side. Private returns on education in terms of NPV in U.S[3] dollar values are presented for males and females in the following table.

Table 1 Private Returns on Education

	Upper Secondary, post-tertiary		Tertiary	
	Male	Female	Male	Female
Australia	49482	25782	48714	61374
Austria	62805	33435	60519	42915
Belgium	13659	37145	63414	60792
Denmark	22587	2828	7342	11983
Finland	10432	-2020	66664	26392
France	5284	8081	40260	-1908
Germany	19134	32039	48024	10450
Hungary	15046	19029	127961	43432
Ireland	31618	35058	104410	78158
Italy	21487	30415	173889	25806
Korea	50950	-12011	85586	129516
Portugal	62570	50158	186307	123357
Spain	37604	43136	55695	73495
Sweden	43505	23900	18802	5097
United States	112929	81889	169945	75492
OECD Average	39849	28223	82007	51986

Source: OECD. Table A8.1 and Table A8.2. Education at A Glance 2009.

On the OECD average the return for males is higher than for females both in upper secondary and tertiary education and the return on tertiary education is higher than on upper secondary education. In some countries such as Finland and Korea return on upper secondary education is negative for females. However, in Belgium, Germany, Hungary, Italy, France and Spain the private return on upper secondary education for females is higher than for males. In general, return on tertiary education is greater than return in upper secondary or post secondary non-tertiary education but in Austria, Australia, Denmark and Sweden males and in United States, Italy and France females the private return on tertiary education is less than on upper secondary or post secondary non-tertiary education. Only in Australia, Denmark, Korea and Spain is the return on tertiary education for females greater than for males.

Public return on education is an important part of the analysis of financial return on education because in most of the countries governments are the main investors on education. In NPV calculations direct costs on education such as payments for educational employees, public-private transfers such as scholarships and subsidies and loss of income tax because of foregone earnings of students. Benefits are defined as income taxes on higher wages, social

[3] in equivalent USD converted using PPPs

insurance payments or lower social transfers (OECD, 2009). In the following table public return on upper secondary or post secondary non-tertiary education as well as for tertiary education males and females are presented.

Table 2 Public Return on Education

	Upper Secondary or Post-tertiary		Tertiary	
	Male	Female	Male	Female
Australia	11755	18426	47368	31357
Austria	30613	7911	37586	25911
Belgium	12314	22626	96186	81858
Denmark	35524	22063	14236	-22702
Finland	18058	11944	55612	24003
France	-271	2811	36730	40903
Germany	13959	42176	63604	13554
Hungary	5065	2483	94804	63921
Ireland	12474	5796	74219	46027
Italy	5325	-1637	63756	32887
Korea	-4272	-7516	21280	13752
Portugal	23857	6928	50271	66975
Spain	9652	7130	19752	21012
Sweden	26768	24685	17197	-10923
United States	32257	14976	100119	43469
OECD Average	14056	10566	51954	27280

Source: OECD. Table A8.3 and Table A8.4. Education at A Glance 2009.

On the OECD average return on tertiary education is greater than upper secondary or post secondary non-tertiary education for both males and females and return on education is greater for males in most of the countries. In some countries, such as Korea and Italy, return on upper secondary education is negative for females, in Korea it is negative also for males. For Australia, Belgium, France and Germany the return on upper secondary education is higher for females than for males. In the case of tertiary education for the countries France and Portugal return on education is greater for females but in Denmark and Sweden return on education takes negative values for females. In the comparison of public and private return on education two important points emerge. First, return on tertiary education is greater than upper secondary or post-secondary non-tertiary education and private return on investment greater than public return in almost all countries. Second, on average return on male education is greater than female education, but in a considerable proportion of countries this difference is moderate or returns on female education is greater.

3.4 Social Return On education

Social return on education is as important as financial return and the existing literature on education and human capital accumulation underlines social outcomes of education as externalities. Björklund and Lindahl (2005) define these externalities as effects of education on health and life expectancy, spill-over effects of knowledge, effects of education on crime rate and political involvement. OECD (2009) provides statistics related with health and cohesiveness of society in terms of social return of education.

Education as it is stated before is the fundamental source of human capital which in turn determines the quality of labor. On the other hand, education has also possible positive effects on individual's social cohesiveness and life standards. Education makes people more aware of their health directly or indirectly through higher income level which permits them to increase their life standards. In addition, education tends to make people more sensitive, more active and motivated to participate directly in social issues or educated people probably have better access to social and political power. Education has possible positive effect on personal trust through direct and indirect ways. Educated people expected to be more respectful to social and moral values which directly affect interpersonal trust. Indirectly, education raise interpersonal trust through social interactions that people with higher level of education live, work and interact in the same environment in which crime and anti-social behavior are expected to be lower OECD (2009). In the following table marginal effects of education on health, political involvement and interpersonal trust are presented for some of the sample countries.

Table 3 Marginal Effects of Education on Health, Political Involvement and Interpersonal Trust

	Marginal effects of education on self-reported health		Marginal effects of education on political interest		Marginal effects of education on interpersonal trust	
	Difference from below upper secondary to upper secondary	Difference from below upper secondary to tertiary	Difference from below upper secondary to upper secondary	Difference from below upper secondary to tertiary	Difference from below upper secondary to upper secondary	Difference from below upper secondary to tertiary
Belgium	0.15	0.08	0.05	0.25	0.06	0.15
Denmark	0.09	0.06	0.19	0.17	0.05	0.11
Finland	0.18	0.14	0.02	0.15	0.02	0.10
Germany	0.10	0.07	0.26	0.23	0.04	0.11
Ireland	0.06	0.02	0.18	0.08	0.04	0.09
Italy	0.13	0.03	0.13	0.19	0.07	0.01
Korea	0.15	0.06	-0.00	0.07	0.03	0.01
Portugal	0.23	0.00	0.24	0.09	0.07	0.07
Slovak Rep.	0.30	0.08	0.03	0.17	0.01	0.07
Spain	0.13	0.06	0.13	0.10	0.13	0.03
Sweden	0.10	0.03	-0.00	0.21	0.04	0.16
United States	0.18	0.09	0.19	0.13	0.16	0.17
Country Avr.	0.15	0.07	0.11	0.16	0.07	0.08

Source: OECD. Table A8.3 and Table A9.1., A9.2., A9.3. and A9.4. Education at A Glance, 2009.

Marginal effects of education except self reported health increase as the level of education increased. These statistics indicate positive effect of education on society that as the level of education increased political interest and interpersonal trust increasing. Governments support education not only to provide human capital or skilled labor force but also increase social welfare through creating a healthier, politically involved and peaceful society.

3.5 Composition of Education Expenditure

In relation with empirical part of this study, examining the change in composition of education expenditure is an important part of this review. We examined the composition of education expenditure from two different points of view. First, we examine distribution of expenditures among upper secondary or post secondary non- tertiary education and tertiary education and how it changes in last ten years. Second, we examine the financial source of education and how it is distributed and change among households, private and public sectors.

In the beginning of the section we examined the change in demand for education and statistics indicate that demand for education increased in the last ten years. One of the important possible results of this increase in demand for education is increase in education expenditure in total at least in current expenditures in order to compensate for the increasing number of students. There are two possible reasons behind an increase in total education expenditure. First policy makers increase education expenditure to compensate for the

increase in number of students and second they increase education expenditure to increase quality. One possible way of distinguishing this increase is comparing increase in number of students, increase in total expenditure and increase in education expenditure per student. In the following tables this comparison presented for from primary to tertiary education and for tertiary education.

Table 4 Primary, Secondary and Post-Secondary Non-Tertiary Education: Change in Total Expenditure, Change in the Number of Students, Change in Expenditure Per Student

	Change in Total Expenditure (%)		Change in the Number of Students (%)		Change in Expenditure per Student (%)	
	1995 to 2000	2000 to 2005	1995 to 2000	2000 to 2005	1995 to 2000	2000 to 2005
Australia	35	16	6	5	27	11
Denmark	19	19	4	6	15	12
Finland	12	25	8	5	4	19
Germany	6	0	3	-3	3	4
Hungary	0	51	-5	-9	5	67
Italy	-1	12	-2	2	1	10
Japan	2	1	-12	-9	16	12
Mexico	23	25	8	7	15	17
Netherlands	22	21	3	4	19	16
Portugal	32	-1	-5	-11	39	12
Slovak Republic	3	40	-5	-11	9	57
Spain	1	12	-16	-6	19	19
Sweden	23	14	16	1	6	14
United Kingdom	16	34	15	-11	1	50
United States	25	17	5	3	20	14
OECD	14	21	0	-2	12	24

Source: OECD. Table B1.5. Education at a Glance, 2009.

On the OECD average total expenditure below tertiary (primary, secondary and post secondary non tertiary education) education increases 14 % and 21 % from 1995 to 2000 and from 2000 to 2005 respectively. In those ten years, education expenditure in total increased while the number of students below tertiary level. In developed countries we expect population growth rate to be low and the change in number of students also illustrate this phenomena. On the OECD average changes in number of students were 0 % and -2 % for the period 1995 to 2000 and 2000 to 2005 respectively. The change in expenditure per student is an important indicator of the increasing quality of education or at least an incentive to increase quality of education. On the OECD average expenditure per student increased 12 % and 24 % below tertiary education for the period 1995 to 2000 and 2000 to 2005 respectively.

Table 5 Tertiary Education: Change in Total Expenditure, Change in the Number of Students, Change in Expenditure Per Student

	Change in expenditure		Change in the number of students (2000=100)		Change in expenditure per student (2000=100)	
	1995 to 2000	2000 to 2005	1995 to 2000	2000 to 2005	1995 to 2000	2000 to 2005
Australia	10	30	20	11	-9	17
Denmark	10	17	4	1	5	16
Finland	11	19	12	6	-1	12
Germany	5	7	-4	8	10	-1
Hungary	35	33	72	52	-22	-12
Italy	27	16	1	12	25	4
Japan	14	14	1	2	14	12
Mexico	30	37	30	24	-1	11
Netherlands	5	17	4	20	1	-2
Portugal	37	46	30	8	4	35
Slovak Republic	23	71	39	58	-12	8
Spain	39	19	0	-6	39	27
Sweden	23	18	20	18	2	0
United Kingdom	3	49	12	7	-8	39
United States	43	22	9	18	30	3
OECD	20	30	19	18	1	11

Source: OECD. Table B1.5. Education at a Glance 2009.

At the tertiary level, the OECD average total expenditure increased 20 % and 30 % for the periods 1995 to 2000 and 2000 to 2005 respectively. The number of students in tertiary education is increased by around 20 % for both periods. Increase in demand for tertiary education is quite high but the increase in education expenditure is relatively low when we compare with primary, secondary and post-secondary non-tertiary education. In those ten years the number of students in tertiary education has increased by about 40% which was an important increase and keeping quality in the same level at tertiary education is not an easy task when increase in the number of students is taken into account. In this framework, comparing education expenditure in total and per student could be informative about the efforts of increasing quality of education or incentives to invest more on education.

It is also possible to do it through examining current and capital proportion of the education expenditure, however in that case some of the direct and indirect quality increase would be ignored. For instance, salaries of teachers counted in current expenditures, but increase in the number of teachers increase the quality of education directly and indirectly when teachers paid well they would be more motivated in their profession. As a result, statistics indicate that number of students increasing in tertiary education while decreasing in all other levels of education below tertiary level. Expenditure per student increase below

tertiary level more than tertiary level which can also be interpreted as investment on education dominated by primary, secondary and post-secondary non-tertiary education. However, considerable increase in the number of students in tertiary should be taken into account.

In its basic definition financial source of education classified under two topics public and private. On the other hand, if we define financial sources of education with respect to decision makers, we could divide private financial sources into two parts namely households and other private sources. The reason behind this classification is providing information for both of the decision makers because households represent individual investment with respect to individual expectations on return on education while private sectors other than households represent firms or organizations with different expectations. For instance, an individual invest money on education to obtain greater income but a firm invest on the job training to improve current labor productivity. Another important reason is that underlining system differences among countries because some countries especially below tertiary education provide free education while others do not. The following tables show the share of households, other private sector and public sector in education expenditure for primary, secondary and post-secondary non-tertiary education and tertiary education which we will call it as below tertiary education in the following part of this study.

Table 6 Primary, Secondary and Post-Secondary Non-Tertiary Education: Composition of Education Expenditure

	1995			2000			2006		
	Public	Households	Private	Public	Households	Private	Public	Households	Private
Australia	85,5	10,5	4	83,9	13,2	2,9	82,8	14,3	2,9
Austria	96,2	1,9	1,9	96,0	1,9	2,1	94,3	3,0	2,7
Denmark	93,7	3	3,3			0,0	88,7	4,0	7,3
France	92,5	6,2	1,3	93,0	5,5	1,5	92,5	6,2	1,3
Germany	80,9		19,1	81,7		18,3	87,0		13
Hungary	91,7	4,4	3,9	93,8	3,3	2,9	94,7		5,3
Ireland	96,5		3,5	96,5		3,5	96,9		3,1
Italy	91,7	7,4	0,9	91,7	7,4	0,9	89,9	7,6	2,5
Mexico	83,8	16,2	0	83,1	16,8	0,1	82,7	17,2	0,1
Netherlands	93,9	5,1	1	94,1	4,1	1,8	86,9	5,1	8,0
Spain	86,6	12,5	0,9	93,5		6,5	93,7	6,3	0,0
Sweden	99,9	0,2	0	99,9	0,1	0,0	99,9	0,1	0,0
United Kingdom	88,5	11,5	0	86,5	13,5	0,0	76,8	13,7	9,5
United States	93,4		6,6	91,6	8,4	0,0	91,5	8,5	0,0
Country Average	91,0	7,1	3,3	91,1	7,4	2,9	89,9	7,8	3,9

Source: OECD. Table B3.1b. Education at A Glance 2005 and 2009.

Related statistics are not available for all countries but we have enough statistics to make inference for the last ten years for below tertiary education. Where the composition of education expenditure is quite stable. The public share of education expenditure is around 90% and remaining part financed by private sector. In general we expect governments to support education below tertiary education, not primarily because of providing labor force but providing minimum level of education to provide social welfare, especially in primary education. Additionally, as it is stated before in most of the countries compulsory education is around 12 years and this level is naturally provided by government through public sources which is also an important argument of our educational threshold interpretation.

Table 7 Tertiary Education: Composition of Education Expenditure

	1995			2000			2006		
	Public	Households	Private	Public	Households	Private	Public	Households	Private
Australia	64,8	20,0	15,2	48,7	33,7	17,6	47,6	35,8	16,6
Austria	96,1	1,9	2,0	91,6	6,8	1,6	84,5	5,4	10,1
Denmark	99,4	0,6	0,0	97,9	2,1	0,0	96,4	3,6	0,0
France	84,3	11,8	3,9	85,7	10,1	4,2	83,7	10,1	6,2
Germany	92,9		7,1	91,6		8,4			15,0
Hungary	80,3	4,8	14,9	78,7	5,4	15,9	77,9		22,1
Ireland	69,7	28,3	2,0	85,8	12,9	1,3	85,1	13,2	1,7
Italy	82,9	12,7	4,4	78,6	15,7	5,7	73,0	19,3	7,7
Mexico	77,4	22,6	0,0	71,0	28,5	0,5	67,9	31,6	0,5
Netherlands	80,6	10,1	9,3	78,1	11,4	10,5	73,4	15,5	11,1
Spain	74,4	19,4	6,2	76,3	20,2	3,5	78,2	17,6	4,2
Sweden			0,0	90,0		10,0	89,1		10,9
United Kingdom	80,0		20	72,0	16,6	11,4	64,8	26,6	8,6
United States			0,0	45,1	38,9	16,0	34,0	36,3	29,7
Coubtry Average	81,9	13,2	6,0	77,9	16,8	7,6	71,6	19,5	10,3

Source: OECD. Table B3.2b. Education at A Glance 2005 and 2009.

In contrast with below tertiary education, a change in the composition of education expenditure at tertiary level can be observed. Public share in education decreased from over 80 % to around 71 % where as the share of household increase by about 7 percentage points and other public investments increased by around 4 percentage points. In the previous sub-section we observe an important increase the number of students which is probably the main reason behind the slowdown in expenditure per student in tertiary education. Combining this information with the increasing share of the private sector in tertiary education, it is reasonable to say that increase in number of students was compensated by the private sector rather than the public sector.

3.6 Summary

Demand for education both below tertiary and at the tertiary level increased relatively more than increase in population. Moreover, increase in demand for tertiary education increased dramatically about 20 % on average in the last ten years. Comparing different age cohorts indicates increasing demand for education and for the year 2007, 70 % of the adult population is at least upper secondary graduate on the OECD average. Increasing demand for education is analyzed through employment and earning differentials in the first hand. Evaluation with respect to employment opportunities indicates that 79 % of the skilled jobs were performed by university graduates in the OECD average in 2007. Additionally, statistics indicate that in last decade employment rate slightly increased but with increasing exposure to risk of being unemployed is decreased.

Earning differentials is also another important incentive in micro level that on the OECD average earning differentials between tertiary educated and upper secondary educated is increased by about 5 percentage points from 1997 to 2007 which seems quite low at the first glance (OECD, 2009). However, statistics indicate that earning differentials increased in the older cohorts and education increase the chance of being employed in a position that an individual has the opportunity of paid well in the future. Another important outcome of the increase in earning differentials in the last decade underlines the increasing demand for skilled labor.

Education as an investment seems quite reasonable since both private and public returns on education are considerably high. Private return on education both in tertiary and other levels is higher than public return and return on education in tertiary level is greater both in public and private investment. Social return to education was examined through self reported health, personal trust and political involvement. Marginal effects of education except self reported health increase as the level of education increased.

Number of students, total expenditure and expenditure per student compared and educational expenditure was analyzed in order to distinguish the efforts of increasing quality of education or incentives to invest more on education. Below tertiary education the number of students was more or less stable because of demographic structure and expenditure per student below tertiary level increased 15 % in the last decade. On the other hand, an increasing demand for tertiary education dominate over the slowdown in population growth and because of dramatic increase in number of students in tertiary education expenditure per student increase only by 1 % and 11 % for the periods 1995 to 2000 and 2000 to 2005 respectively.

Finally, composition of education expenditure with respect to financial sources was examined through change in shares of public and private sources. In order to distinguish individual investments and other private investments on education, private investments were divided into households and other private investors. Below tertiary education composition of education expenditure in the last decade is quite stable with above 90 % of the expenditure financed by public sources. On the other hand, in tertiary education share of private sources increased from 20 % to 30 % in the last ten years and share of households increased around 7 percentage points while other private sources increased around 4 percentage points. This change in the composition of education expenditure indicates a very important issue in finance of tertiary education. Increase in costs of tertiary education because of considerable increase in the number of students in tertiary education, has to some extent been compensated by private sources and especially by households.

4. EMPIRICAL ANALYSIS

In the previous sections, we define the theoretical framework of the relationship between output composition and composition of education expenditure through providing theoretical connections with educational thresholds, stock and accumulation of human capital and sustainable economic growth. In addition to providing theoretical connections, review of education in the last decade for sample countries is provided in order to underline the change in the composition of education expenditure and support the idea of educational threshold with related statistics. As the last step of our study we test our hypothesis by using cross-section regression analysis. Before presenting the results of empirical analyses and interpretation of these results, it would be useful to introduce the data set and methodology.

4.1 Data and Methodology

In this study we examined the possible relationship between output composition and composition of education expenditure for the first time. Therefore, defining the reasoning behind variable selection is important. In the previous sections we first define possible theoretical connections based on educational thresholds through minimum required human capital at two different levels and sustainable economic growth through continuous flow of human capital above this threshold.

In order to examine the relationship between output composition and composition of education expenditure, we first determine the variables in relation with our hypothesis. Output composition is a very broad concept and can possibly be defined in different ways. However, in our analysis the main purpose is to distinguish the demand for high skilled labor force of high value added sectors. At this point, we have two assumptions in determining the variables. First, we assume that in high value added sectors proportion of high skilled individuals is relatively higher. Second, high skilled jobs are performed by high skilled individuals. Our assumptions are not so unrealistic when we take into account the statistics provided in the previous section that around 80 % of the skilled jobs performed by tertiary educated individuals. At this point we need variables to represent composition of education expenditure and output composition.

As dependent variables we determine the following: Change in share of tertiary education, Change in education expenditure per student in tertiary level and Change in education expenditure per student below tertiary level. These variables represent composition of education expenditure and change in composition of education expenditure respectively.

In the right hand side of the equation, employed variables represent the output composition and market demand for high skilled labor force; share of high and medium high value added manufactures in total value added, share of finance, insurance, real estate and business services value added in total value added, employment share in high value added production and employment share of finance, insurance, real estate and business services. As a result, in our analyses we examine the relationship through the effect of a change in share of high value added production and employment level over change in composition of education expenditure.

We use secondary data sources and collect education, production and labor force statistics from OECD statistical databases for 20 OECD countries[4] from 1995 to 2005. Education statistics are obtained from the OECD Education at a Glance databases and various publication of the same database. Value added and labor force statistics are obtained from the OECD STAN (Structural Analysis) Industry database. The STAN Industry database provides production and labor force statistics in accordance with ISIC (International Standard Industrial Classification) classification system. Definition of high and medium-high technology sectors and finance, insurance, real estate and business services sectors are based on this classification and more detailed information is provided in appendix.

Structure and availability of the data is the fundamental determinant of the chosen sample and period. In order to examine the relationship between output composition and composition of education expenditure we strictly need detailed data on education and production. One of the most important data source for educational statistics is the OECD Education at a Glance databases, but they do not provide education statistics in a detailed way before 1990s as time series and also after 1990s for most of the countries and for many years provided data is not complete. However, educational statistics are provided in a detailed way for the years 1995, 2000 and 2005. The same situation exists for production and labor force statistics where we need high and medium high production in manufacturing and finance, insurance, real estate and business services statistics in order to observe the demand for high skilled labor force. These statistics are not available as uninterrupted time series and for most of the years most of the data are missing. As a result data limitation is not only fundamental determinants of the sample and period choice, but also affect econometric methodology in hypotheses testing.

[4] List of the countries presented in the appendix

In this study, cross section regression analysis is used in order to investigate the possible relationship between output composition and composition of education expenditure. As it is stated above structure and availability of the data restrict time dimension of our analysis and econometric analysis of this study is limited with the variation among countries because of the nature of the simple linear regression analysis. However, time dimension of the relationship is also as important as the cross section variation. As a result, in order to strengthen the time dimension of the empirical analysis we take the differences between periods of 2005-2000 and 2000-1995 of the variables and estimate the relationship between change in output composition and change in composition of education expenditure which is based on the comparison of the periods rather than a given point in time. As a result, our data set give a longitudinal dimension to our analyses and results.

The purpose of the regression analyses is testing following hypotheses;

1) H_o : **An increase in the share of high value added sectors (in relation to total value added) leads to an increase in *the share* of education expenditure above scientific knowledge threshold (i.e. tertiary education expenditure).**

2) H_o : **An increase in the share of high value added sectors in total value added leads to increase in education expenditure *per student* above the scientific knowledge threshold.**

In the first hypothesis we test the validity of the argument that as the share of high value added sectors in total value added increased, demand for skilled labor force increased and share of tertiary education expenditure increased in total expenditure of education. In other words investment above threshold increased more than below threshold. In the second hypothesis we test the relationship between output composition and composition of education expenditure in a different perspective and take into account the possible change in the number of students. Change in the composition of the education expenditure in the aggregate level do not take into account the change in the composition of education expenditure in micro level per student. Therefore, in the second hypothesis we test the relationship in micro perspective and analyze the change in the composition of education expenditure per student.

For the first hypothesis following regression equations used;

$$\Delta in\ share\ of\ TERT_{2000-2005} = c + \beta_1\ \Delta PHigh_{1995-2000} + \beta_2\ \Delta LHigh_{1995-2000} + \beta_3\ \Delta Pfri_{1995-2000} + \beta_3\ \Delta Lfri_{1995-2000} + \varepsilon \quad (1)$$

$$\Delta in\ share\ of\ TERT_{2000-2005} = c + \beta_1\ \Delta PHigh_{1995-2000} + \beta_2\ \Delta LHigh_{1995-2000} + \varepsilon \quad (2)$$

$$\Delta in\ share\ of\ TERT_{2000-2005} = c + \beta_1\ \Delta PHigh_{1995-2000} + \varepsilon \quad (3)$$

$$\Delta in\ share\ of\ TERT_{2000-2005} = c + \beta_1\ \Delta PHigh_{1995-2000} + \beta_3\ \Delta Pfri_{1995-2000} + \varepsilon \quad (4)$$

In all of the regression equations, dependent variable is the change in share of tertiary education from 2000 to 2005 and different combination of explanatory variables are used in four different equations. Theoretically and in practice there should be a lag between change in output and labor force composition and change in the composition of education expenditure. Therefore, in the explanatory variables we use the change in share of high value added sectors and change in employment share of these sectors from 1995 to 2000. At this point, it is important to underline two important facts. First, we do not expect a change both in output composition and in the composition of education expenditure from one year to other and examining the relationship based on five years change is neither a disadvantage nor a limitation. Second, theoretically we expect that change in output composition create incentives to change the composition of education expenditure and in our model there has to be a lag.

In the equations *Phigh* represents the share of the high and medium high production in total value added. *Lhigh* represents the share employment in high and medium high production. *Pfri* represents the share of value added in finance, insurance, real estate and business services sectors in total value added. *Lfri* represents the share of value employment in finance, insurance, real estate and business services sectors respectively.

For the second hypothesis we use two different dependent variables to test the relationship. First dependent variable is for the change in tertiary education and the second dependent variable is to test for below tertiary education. As a result we test the relationship between output composition and composition of the education expenditure for both below and above scientific knowledge threshold. Following regression equations used for the second hypothesis;

$$\Delta perTERT_{2000-2005} = c + \beta_1 \Delta PHigh_{1995-2000} + \beta_2 \Delta LHigh_{1995-2000} + \beta_3 \Delta Pfri_{1995-2000} + \beta_3 \Delta Lfri_{1995-2000} + \varepsilon \quad (5)$$

$$\Delta perTERT_{2000-2005} = c + \beta_1 \Delta PHigh_{1995-2000} + \beta_2 \Delta LHigh_{1995-2000} + \varepsilon \quad (6)$$

$$\Delta perTERT_{2000-2005} = c + \beta_1 \Delta PHigh_{1995-2000} + \varepsilon \quad (7)$$

$$\Delta perTERT_{2000-2005} = c + \beta_1 \Delta PHigh_{1995-2000} + \beta_3 \Delta Pfri_{1995-2000} + \varepsilon \quad (8)$$

$$\Delta perOther_{2000-2005} = c + \beta_1 \Delta PHigh_{1995-2000} + \beta_2 \Delta LHigh_{1995-2000} + \beta_3 \Delta Pfri_{1995-2000} + \beta_3 \Delta Lfri_{1995-2000} + \varepsilon \quad (9)$$

$$\Delta perOther_{2000-2005} = c + \beta_1 \Delta PHigh_{1995-2000} + \beta_2 \Delta LHigh_{1995-2000} + \varepsilon \quad (10)$$

$$\Delta perOther_{2000-2005} = c + \beta_1 \Delta PHigh_{1995-2000} + \varepsilon \quad (11)$$

$$\Delta perOther_{2000-2005} = c + \beta_1 \Delta PHigh_{1995-2000} + \beta_3 \Delta Pfri_{1995-2000} + \varepsilon \quad (12)$$

In all of the equations above we employ the same explanatory variables used for the first hypothesis and for dependent variable *perTERT* and *perOther* represent expenditure per student in tertiary education and expenditure per student below tertiary education, respectively. In hypotheses testing if β_1 and β_3 have positive signs and statistically significant we do not reject H_o for both of the hypotheses in all of the equations otherwise we reject H_o. If we do not reject H_o in the first hypothesis, it means that increase in the share of high value added sectors in total value added leads to an increase in the share of education expenditure above scientific knowledge threshold. If we do not reject H_o in the second hypothesis, it means that increase in the share of high value added sectors in total value added leads to an increase in education expenditure per student above threshold.

4.2 Empirical Results

In this study the relationship between output composition and composition of education expenditure is estimated based on two hypotheses and for each hypothesis different equations are estimated. The first hypothesis is that an increase in the share of high value added sectors in total value added leads to an increase in the share of education expenditure

above scientific knowledge threshold. Regression results of the first four equations are presented in the following table.

Table 8 Regression Results for the equations 1-4

Dependent Variable: Change in Share of Tertiary Education in Total Education Expenditure				
Equation	(1)	(2)	(3)	(4)
Constant	3.99 (0.00)	1.95 (0.00)	1.96 (0.00)	3.72 (0.00)
$\Delta PHigh$	-0.53 (0.02)	-0.45 (0.06)	-0.53 (0.00)	-0.55 (0.00)
$\Delta LHigh$	-0.05 (0.88)	-0.16 (0.69)		
$\Delta Pfri$	-0.57 (0.29)			-0.83 (0.02)
$\Delta Lfri$	-0.48 (0.53)			
Adjusted R-squared	0.55	0.51	0.46	0.49

Values in parentheses represent p-values.

In the first equation four independent variables are employed, $\Delta PHigh$ and $\Delta LHigh$ represent change in value added and employment share of high and medium technology production from 1995 to 2000, respectively. $\Delta Pfri$ and $\Delta Lfri$ represent the change in value added and employment share of finance, insurance, real estate and business services sectors for the same period, respectively. Dependent variable for all of the equations is the change in share of tertiary education in total education expenditure from 2000 to 2005. All of the coefficients have negative signs which indicate a negative relationship between the changes in value added share of high value added sectors and employment shares in these sectors. Additionally, only the coefficient of the change in value added share of high and medium high technology production is statistically significant at 5 % significance level. Since, signs of the coefficients are negative for all variables and only change in value added share of high and medium high technology production is statistically significant we reject the null hypothesis. In the second equation two independent variables are used, $\Delta PHigh$ and $\Delta LHigh$, and again the signs of the coefficients of the variables are negative and the only the coefficient of change in value added share of high and medium high technology production is statistically significant at 10 % significance level. In the third equation only one independent variable is used,

$\Delta PHigh$ and it is statistically significant in all significance level but its coefficient has negative sign. Finally, in the fourth equation $\Delta PHigh$ and $\Delta Pfri$ used as independent variable and both of their coefficients are statistically significant at the 5 % significance level and have negative signs. Thus, we reject the null hypothesis for last three equations which means we do not have enough statistical evidence to infer that an increase in the share of high value added sectors in total value added leads to an increase in the share of tertiary education expenditure. Moreover, our results indicate a negative relationship for both high and medium high technology production and finance, insurance, real estate and business services sectors.

In the following table regression results for the eight different equations are presented in order to test second hypothesis. Our second hypothesis is that an increase in the share of high value added sectors in total value added leads to an increase education expenditure per student above scientific knowledge threshold.

Table 9 Regression Results for the equations 5-12

Dependent Variable: Change in Education Expenditure Per Student								
	Tertiary				Primary, secondary and post-secondary			
Equation	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Constant	25.20 (0.00)	16.58 (0.00)	15.97 (0.00)	23.15 (0.00)	10.65 (0.33)	15.00 (0.02)	14.79 (0.01)	4.40 (0.64)
$\Delta PHigh$	-3.98 (0.02)	-3.67 (0.03)	-1.20 (0.19)	-1.28 (0.16)	1.85 (0.41)	1.78 (0.43)	2.63 (0.03)	2.76 (0.02)
$\Delta LHigh$	5.61 (0.06)	5.16 (0.08)			1.70 (0.66)	1.79 (0.65)		
$\Delta Pfri$	-3.75 (0.35)			-3.40 (0.25)	9.68 (0.08)			4.92 (0.19)
$\Delta Lfri$	-0.39 (0.94)				-9.55 (0.22)			
Adjusted R-squared	0.33	0.14	0.039	0.16	0.20	0,14	0.18	0.21

Values in parentheses represent p-values.

In the second group of equations we used two different dependent variables and those are *perTERT* and *perOther* which represent education expenditure per student in tertiary level and below tertiary level respectively. On the one hand, we do not need an additional dependent variable to test the second hypothesis because our hypothesis based on the change in tertiary education expenditure per student. On the other, analyzing the relationship for the

change in below tertiary education expenditure per student strengthen our analysis through providing information below threshold.

In the first four equations for the second hypothesis, change in tertiary education expenditure per student used as dependent variable and in the first equation four independent variables used, $\Delta PHigh$, $\Delta LHigh$, $\Delta Pfri$ and $\Delta Lfri$. All of the coefficients have negative signs except $\Delta LHigh$ and variables for finance, insurance, real estate and business services sectors, $\Delta Pfri$ and $\Delta Lfri$, are not statistically significant while coefficients of $\Delta PHigh$ and $\Delta LHigh$ are statistically significant at 5 % and 10 %, respectively. In the second equation two independent variables used, $\Delta PHigh$ and $\Delta LHigh$, both of their coefficients are statistically significant at 5% and 10%, respectively. Sign of the coefficient for $\Delta PHigh$ is negative while for $\Delta LHigh$ sign of the coefficient is positive which indicates negative relationship between change in the share of high and medium high production value added and education expenditure while a negative relationship exist for the change in employment share in the same sector. In the third equation only one independent variable used, $\Delta PHigh$, it is not statistically significant and its coefficient has negative sign. Finally, in the fourth equation only variables for the change in value added in high value added sectors used and both of them have negative signs and statistically insignificant. As a result, in all of the equations we reject the null hypothesis. According to results, we can only infer that there is a positive relationship between education expenditure and employment share in finance, insurance, real estate and business services sectors. Although, coefficients for other variables are generally statistically insignificant, their signs indicate an important point that in contrast with our expectations existing relationship between change in the share of high value added sectors and change in expenditure per student in tertiary education is negative rather than positive.

As it is stated before, change in education expenditure as a dependent variable is also used to examine the relationship in a different perspective. All the regressions estimated again with the same explanatory variables in the same order. In the first equation four independent variables used, $\Delta PHigh$, $\Delta LHigh$, $\Delta Pfri$ and $\Delta Lfri$. All the coefficients of these variables are not statistically significant except $\Delta Pfri$ and have positive signs except $\Delta Lfri$. In the second equation two independent variables are used, $\Delta PHigh$ and $\Delta LHigh$, both of their coefficients have positive signs and statistically insignificant. In the third equation only one independent variable used, $\Delta PHigh$, it is statistically significant and has positive sign. Finally, in the fourth equation $\Delta PHigh$ and $\Delta Pfri$ used as independent

variable, both of their coefficients have positive sign and coefficient of $\Delta PHigh$ is statistically significant while coefficient of $\Delta Pfri$ is not statistically significant.

To sum up, according to empirical results we reject both of the hypotheses. In the first hypothesis we argue that an increase in the share of high value added sectors in total value added leads to an increase in the share of education expenditure above scientific knowledge threshold or leads to an increase in the share of tertiary education expenditure. However, results of the regression analyses based on four different equations indicate that we do not have enough statistical evidence to infer that there is a positive relationship between changes in the share of high value added sectors in total value added and share of tertiary education expenditure. Moreover, in most of the equations even coefficients of $\Delta PHigh$ and $\Delta Pfri$ are not statistically significant, they have negative signs which indicates a possible negative relationship rather than a positive one.

In the analyses of the second hypothesis, equations are estimated for change in education expenditure per student both at tertiary and below tertiary levels of education. In the second hypothesis we argue that an increase in the share of high value added sectors in total value added leads to increase education expenditure per student above scientific knowledge threshold or in tertiary level. According to results of the regression analysis, again we reject the null hypothesis that there is a positive relationship between share of high value added sectors in total value added and expenditure per student at tertiary level. Additionally, results of the analysis below tertiary education indicate a possible positive relationship between shares of high value added sectors in total value added and expenditure per student below tertiary level. In equation (11) and (12) coefficients of $\Delta PHigh$ have positive sign and they are statistically significant while in equation (9) coefficient of $\Delta Pfri$ is statistically significant and has positive signs.

As a result, we reject the existence of a positive relationship both in share of tertiary education in total education expenditure and change education expenditure at tertiary level with shares of high value added sectors in total value added and our results indicate a possible negative relationship.

4.3 Evaluation of the Empirical Results

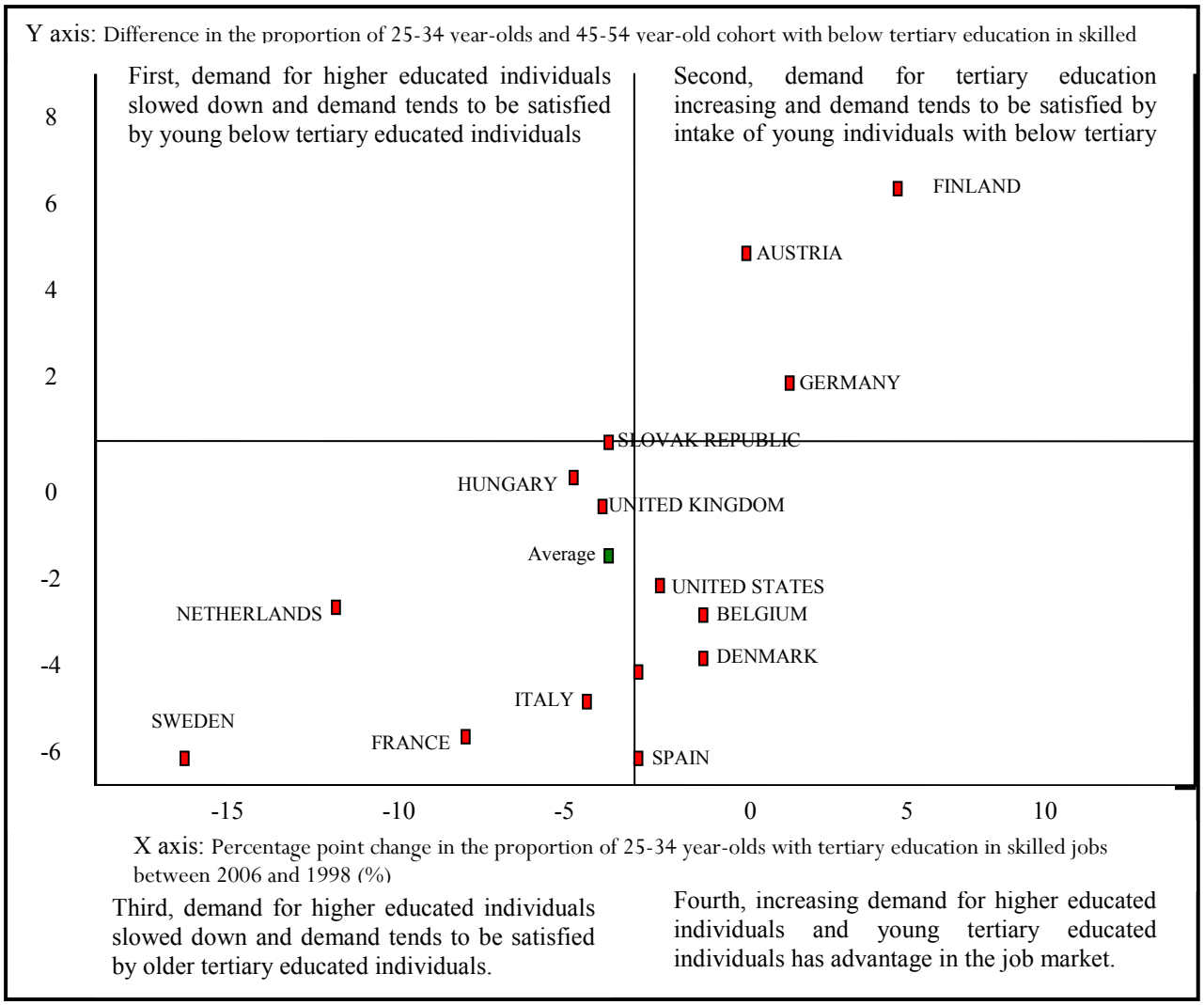
Theoretically, we expected the coefficients of the variables for *Phigh, Pfri, Lhigh* and *Lfri* to have positive signs. However, when we take into account the population and the labor market structure, an increase in the share of employment in high value added sectors could have different effects.

The composition of the labor market and the structure of the population have two possible effects on the relationship between the increase in the share of employment in high value added sectors and the demand for skilled labor force. First, current composition of the labor force is important because both public and private sectors have to solve their human resource problem in the short run with the existing labor force. If both the population and labor market proportion of young individuals with required skills is not sufficient, decision makers such as government or private sector has to substitute their investments on tertiary education with additional investments on job training or post secondary non-tertiary education in order to compensate for the shortage in the supply of skilled labor force. Secondly, aging population is a common feature of developed countries in which supply of skilled labor force is below demand because of a working age population. In addition to the composition of labor market and structure of the population, rapid change in the expectations of the labor market also effect the relationship between the shares of employment in high value added sectors and demand for skilled labor force.

The possible effect of the composition of the labor market on the signs of the coefficients can be examined through supply of and demand for young individuals to skilled jobs. It is possible to analyze the expected sign by comparing the difference between the change in the proportion of young (25-34) and old (45-54) cohorts with education below tertiary level in skilled jobs and the change in the proportion of young individuals with tertiary education in skilled jobs. In the following figure[5] supply of and demand for young individuals to skilled jobs are presented for the sample countries.

[5] Adopted from Education at A Glance (2009:35)

Figure 5 Supply of and demand for young individuals (25-34 year-olds) to skilled jobs (ISCO 1-3), 1998-2006



Source: OECD. Table A1.6. Education at A Glance 2009

Four possible situations exist depending on the supply of and demand for young individuals to skilled jobs. First, demand for higher educated individuals slowed down and demand tends to be satisfied by young below tertiary educated individuals. Second, demand for tertiary education increasing and demand tends to be satisfied by intake of young individuals with below tertiary education. Third, demand for higher educated individuals slowed down and demand tends to be satisfied by older tertiary educated individuals. Fourth, increasing demand for higher educated individuals and young tertiary educated individuals has advantage in the job market.

On average our sample falls in the fouth quarter, which means that the demand for higher educated individuals slowed down and demand tends to be satisfied by older tertiary educated individuals. This situation can also be interpreted as a result of population structure

that if labor market is not provided by fresh and skilled labor force because of aging population, demand for skilled labor force can change direction from tertiary educated young individuals to experienced current labor force and investment on education change direction from tertiary education to on the job training and post secondary non-tertiary education in order to compensate the gap between the demand for and supply of skilled labor force.

Empirical results of the tests for the first and second hypotheses indicate that the increase in the share of high value added sectors in total value added and in the employment shares in these sectors neither lead to an increase in the share of tertiary education expenditure in total education expenditure nor an increase in the expenditure per student at tertiary level. In addition to rejecting a possible positive relationship, regression results indicate a negative relationship. The composition of the population and labor force provide possible explanations for this situation and our analysis for below tertiary education complete this explanation. Under the limitation of time because firms and government have to solve their human resource problems in the short run and limitations of current labor market composition because of a shortage in supply of fresh tertiary educated individuals or aging population, investment on education shift from tertiary level to below tertiary level.

Consequently, in contrast with our expectations demand for skilled labor force does not create an incentive to invest more above the scientific threshold. The composition of population and labor force dominate and change the expected relationship because of the presented reasons above. Increase in the share of high value added sectors (in total value added) and increase in employment shares in these sectors create incentives to invest below scientific knowledge threshold rather than promoting investments above the threshold.

5. CONCLUSION

In this study the relationship between human capital and economic development is examined in a different perspective and we focus on another possible aspect of this relationship. The main purpose of this study is to examine the relationship between output composition and composition of education expenditure For this purpose, following the findings of Romer (1990a), Mitch (1990) and Gemmell (1996), two educational thresholds are determined: (1) the minimum required knowledge threshold and (2) the scientific knowledge threshold. The most important argument behind defining these thresholds is the different aspects of the acquired human capital through different levels of education. The role of human capital in economic development can be summarized under two main topics, the former regarding human capital as a factor of production and the latter as source of technologic development. In the first threshold the minimum required knowledge for an individual to contribute to a production process or to manage the existing production tools is defined as the fundamental which is based on Mitch's (1990) threshold. In the second threshold the minimum required knowledge for an individual to contribute to technologic improvement or to manage high skilled production process is defined as the fundamental which is based on Romer's (1990a) which underlines a threshold level in human capital accumulation to create technological improvements. In this framework our analyses concentrated on the scientific knowledge threshold because: (1) two different aspect of human capital are defined at this level, (2) our sample compromised from developed countries, which increases the importance of distinction at this level and (3) limitations regarding the data did not enable further analysis.

In order to examine the educational development in sample countries for the last decade a broad review of educational attainment, return on education and changes in composition of education expenditure are provided for both tertiary and below tertiary level. In this respect, our findings indicate some important changes in the last ten years. First of all, *demand for tertiary education* increased dramatically from 1995 to 2005 that the number of students increased about 20 % on average. The increase in number of students in tertiary level is greater than population growth in almost all of the sample countries. Additionally, if we compare old (55-64) and young cohorts (25-34) in terms of tertiary attainment level in 2007, a considerable increase can be observed, around 14 % which in turn again indicates an increasing demand for tertiary education in the last decade. Second, demand for high skilled labor force is increasing and this situation is indicated by the return to education at individual level, where earning differentials increased by 5% on average in the last decade. Another

possible indicator of increasing demand for tertiary educated labor is that around 80% of the skilled jobs are performed by tertiary educated individuals. Third, education is examined as an investment through NPV analyses both for public and private sectors at tertiary and below tertiary level. Financial return on education indicates that for both public and private sectors investing on education is reasonable especially at tertiary level. Public return on tertiary education for males and females are 51914 and 27280 U.S. dollar on average, respectively. Private return on tertiary education average for males and females are 82007 and 51986 U.S. dollar, respectively. As a result, private return on education is greater than public return on education and the same situation also exists for below tertiary education.

Finally, composition of education expenditure was examined from two different points of view. First a comparison was made for the change in number of students, change in total expenditure and change in expenditure per student examined in both tertiary and below tertiary level. The number of students below the tertiary education did not increase or increased very moderately but expenditure per student increased by 15% on average in the last ten years. At the tertiary level an increasing demand for tertiary education dominated over the slowdown in population increase and expenditure per student increased by 1 % and 11 % for the periods 1995 to 2000 and 2000 to 2005 respectively. Second, the composition of education expenditure was examined with respect to the source of finance for public, households and private sector. Below the tertiary education level the composition of education expenditure with respect to source of finance is quite stable and 90% of the total expenditure financed by government. One of the most important outcomes of this examination is related to the change in the composition of expenditure at tertiary level. In tertiary education share of private sources increased from 20 % to 30 % in the last ten years and the share of households increased around 7 percentage points while other private sources increased around 4 percentage points. This change indicates a very important point that the burden of the 20% increase in the number of students at tertiary level was compensated by private sources and especially by households.

In the empirical part of the study, two hypotheses were tested based on scientific knowledge threshold while estimating the possible relationship between output composition and composition of education expenditure. In the first hypothesis, the main argument is that the share of tertiary education is expected to increase as the share of high value added sectors in total value added increased . In contrast with our expectations we reject the existence of a possible positive relationship between shares of high value added sectors and share of tertiary education. Moreover, our results indicate a negative relationship rather than a positive one. In

the second hypothesis, the main argument is that the education expenditure per student at tertiary level is expected to increase as the share of high value added sectors in total value added increased. Again in contrast with our expectations we reject the existence of a possible positive relationship between shares of high value added sectors and change in education expenditure per student at tertiary level. Additionally, for the second hypothesis we employ a number of regression equations to examine the other part of the relationship by using change in education expenditure per student below tertiary education as the dependent variable. The results for these additional regressions indicate a positive relationship while regression analysis for tertiary education indicates a negative relationship.

At the first glance, empirical results seem quite interesting and unexpected with respect to our assumptions and theoretical expectations. However, when we take into account structure of labor market and demographic trends, it is possible to justify the negative relationship. If we examine the structure of labor market through comparing supply of and demand for young individuals to skilled jobs and proportion of young (25-34) and old (45-54) cohorts with education below tertiary level in skilled jobs. On the average for the sample countries, demand for higher educated individuals slowed down and demand tends to be satisfied by older tertiary educated individuals. At this point two possible explanations emerge, first if demand for high skilled individuals cannot be compensated with fresh and skilled labor force because of current structure of labor market, then investing on tertiary education has to be substituted with investing on the job training or post secondary non-tertiary education in order to compensate shortage in supply of skilled labor force. Second, aging population is a common feature of developed countries in which supply of skilled labor force is below the demand for skilled labor force because of a decrease in the share of working age population and decision makers have to compensate this gap by providing human capital accumulation in an alternative way to solve their human resource problems in the short run. In addition to labor market structure and population composition, one other possible explanation is the rapid change in labor market expectations: If the minimum required skills to find a place in the labor market change rapidly, the composition of education expenditure would change in favor of below tertiary education in order to prevent a possible structural employment problem and enable continuous flow of labor force at market expectations.

Consequently, our analyses indicate that the relationship between output composition and composition of education expenditure mainly depends on the structure of labor market and composition of population. One other important possible outcome is in developed

countries as in our sample, we expect an increasing demand for high skilled labor force which in turn is a possible justification behind brain drain.

REFERENCES

Abramovitz, M., "Resource and Output Trends in the U.S. since 1870"*, American Economic Review*, Vol. 46, pp. 12-17, 1956

Barro, R. J., "Economic growth in a cross-section of countries", *Quarterly Journal of Economics,* Vol. 106, pp. 407-43, 1991

Barro, R, J. and Lee, J. W., "International comparisons of educational attainment", *Journal of Monetary Economics,* Vol. 32, pp. 363-94, 1993

Barro R. J., "Human Capital: Growth, History, and Policy", *American Economic Review*, Vol. 91, No. 2, pp. 12-17, 2001

Baumol, W. J., "Productivity growth convergence and welfare: what the long-run data show"*, American Economic Review*, Vol. 76, pp. 1072-85, 1986

Becker, G. S., *"Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education, Chicago,* University of Chicago Press*",*1964,1993,3rd ed.

Björklund, A. and Lindahl M., "*Education and economic development: what does empirical research show about causal relationships?*"
http://www.sweden.gov.se/content/1/c6/05/53/87/2cab64cd.pdf, 2005

Fabricant, S., "Economic Progress and Economic Change", Cambridge, MA*: National Bureau of Economic Research,* 1954

Gemmell, N., "Evaluating the impacts of human capital stocks and accumulation on economic growth: some new evidence", *Oxford Bulletin of Economics and Statistics*, 58(1), 9-28, 1996

Hanushek, E. A. and Kimko D. D., "Schooling, Labor-Force Quality, and the Growth of Nations", *American Economic Review*, Vol. 90, No. 5, pp. 1184-1208, 2000

Johansen, S., "Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models", *Econometrica*, 59, pp. 1551–80, 1991.

Johansen, S., "*Likelihood-based inference in cointegrated vector autoregressive models,* Oxford University Press*",* Oxford, 1995.

Judson, R., *"*Measuring human capital like physical capital: What does it tell us?" *Bulletin of Economic Research,* 54, pp. 209–31, 2002

Kendrick, J. W., *"Productivity Trends: Capital and labor",* New York: National Bureau of Economic Research, 1956

Kuznets S., "Modern Economic Growth: Findings and Reflections", *The American Economic Review,* Vol. 63 No. 3, 1973

Leeuwen B. van and Foldvari P., "Human Capital and Economic Growth in Asia 1890–2000: A Time-series Analysis", *Asian Economic Journal*, Vol. 22 No. 3, 225–240, 2008

Lucas Jr., R.E., *"On the mechanics of economic development"*, Journal of Monetary Economics 22, 3–42., 1988

Ljungberg J. and Smits J. P., *"Technology and Human Capital in Historical Perspective, Basingstoke: Palgrave Macmillan"*, 2004

Mankiw, N. G., Romer, D. and Weil, D., *"A contribution to the empirics of economic growth",* Quarterly Journal of Economics, 107, 407-437, 1992

Mincer, J., *"Investment in Human Capital and Personal Income Distribution",* The Journal of Political Economy, Vol. 66, No. 4, 281-302, 1958

Mitch, D., "*Education and economic growth: Another axiom of indispensability? From human capital to human capabilities"*, Tortella, G (ed.), Education and Economic Development since the Industrial Revolution, Generalitat Valenciana, Valencia, 1990

Mokyr, J., *"Knowledge, Technology, and Economic Growth during the Industrial Revolution"*, in B. van Ark, S.K. Kuipers and G.H. Kuper, *Productivity, Technology and Economic Growth* (Dordrecht: Kluwer Academic Publishers), 2000

Mokyr, J., "*The Gifts of Athena. Historical Origins of the Knowledge Economy*, Princeton: Princeton University Press", 2002

OECD, "*Education at a Glance – OECD Indicators"*, OECD, Paris, 2005

OECD, "*Education at a Glance – OECD Indicators"*, OECD, Paris, 2009

Romer, P., "Endogenous technological change", *Journal of Political Economy,* 98, part 2, pp. 71–102., 1990a

Romer, P. M., "Human capital and growth: theory and evidence", *Carnegie- Rochester Conference Series on Public Policy*, Vol. 32, pp. 251-86., 1990b

Rosenberg, N., *"Inside the Black Box: Technology and Economics, Cambridge:* Cambridge University Press*",* 1982

Rosenberg, N., *"Exploring the Black Box: Technology, Economics, and History,* Cambridge: Cambridge University Press", 1994

Solow, R. M., "Technical Change and Aggregate Production Function", *Review of Economics and Statistics*, Vol. 39, pp. 312-320, 1957

Smith, Adam: *An Inquiry into the Nature And Causes of the Wealth of Nations Book 2 - Of the Nature, Accumulation, and Employment of Stock*; Published 1776.

Temple, J., "*Growth Effects of Education and Social Capital in the OECD Countries.",* In John F. Helliwell ed. The Contribution of Human and Social Capital to Sustained Economic Growth and Well-Being (Ottawa: HDRC,)(Proceedings of an OECD/HRDC conference, Quebec, March 19-21, 2000)., 2001

United Nations, “International Standard Industrial Classification of All Economic Activities.” 4th rev. ed. *Statistical Papers Series* M, no. 4, rev. 4, 1990

Uzawa, H., *“*Optimal technical change in an aggregative model of economic growth”, *International Economic Review*, 6, 18-31., 1965

APPENDIX

1. List of Countries

Australia
Austria
Belgium
Denmark
Finland
France
Germany
Hungary
Ireland
Italy
Japan
Korea
Mexico
Netherlands
Portugal
Slovak Republic
Spain
Sweden
United Kingdom
United States

2. International Standard Industrial Classification of All Economic Activities, Rev.4

2.1 High and Medium-High Technology Manufacturers

24 - Manufacture of chemicals and chemical products

29 - Manufacture of machinery and equipment n.e.c.

30 - Manufacture of office, accounting and computing machinery

31 - Manufacture of electrical machinery and apparatus n.e.c.

32 - Manufacture of radio, television and communication equipment and apparatus

33 - Manufacture of medical, precision and optical instruments, watches and clocks

34 - Manufacture of motor vehicles, trailers and semi-trailers

35 - Manufacture of other transport equipment

351 - Building and repairing of ships and boats

2.2 Finance, Insurance, Real Estate and Business Services

65 - Financial intermediation, except insurance and pension funding

66 - Insurance and pension funding, except compulsory social security

67 - Activities auxiliary to financial intermediation

70 - Real estate activities

71 - Renting of machinery and equipment without operator and of personal and household goods

72 - Computer and related activities

73 - Research and development

74 - Other business activities

3. Compulsory Education

Country	Duration of Compulsory Education In Years
Australia	11
Austria	9
Belgium	13
Denmark	10
Finland	10
France	11
Germany	13
Hungary	10
Ireland	10
Italy	9
Japan	10
Korea	9
Mexico	10
Netherlands	13
Portugal	9
Slovak Republic	19
Spain	11
Sweden	10
United Kingdom	12
United States	12
OECD Average	11,05

Source: United Nations education systems database
http://stats.uis.unesco.org/unesco/TableViewer/tableView.aspx?ReportId=163