

# Εκπαίδευση, Δια Βίου Μάθηση, Έρευνα και Τεχνολογική Ανάπτυξη, Καινοτομία και Οικονομία

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## Human Capital and Economic Growth: A Case Study of Greece before Economic Crisis

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## Περίληψη

Αυτό το άρθρο μελετά τη συμβολή της εκπαίδευσης στην οικονομική μεγέθυνση της Ελλάδας κατά τη διάρκεια της περιόδου 1960-2006. Η μέθοδος εκτίμησης βασίζεται στο θεωρητικό υπόδειγμα του E. Denison που περιγράφει την «ποιοτική εργασία» (qualitative labor). Σύμφωνα με το θεωρητικό αυτό υπόδειγμα εκτιμάται η συμβολή του εκπαιδευμένου, ανά βαθμίδα εκπαίδευσης, εργατικού δυναμικού στην οικονομική μεγέθυνση της Ελλάδας.

Αυτή η μελέτη έχει χρησιμοποιήσει στοιχεία από τους Εθνικούς Λογαριασμούς, την έρευνα εργατικού δυναμικού και τους οικογενειακούς προϋπολογισμούς της ΕΣΥΕ.

Τα αποτελέσματα τεκμηριώνουν τη συνεχή συμβολή των γυναικών εργαζομένων στην Οικονομική μεγέθυνση της Ελλάδας. Επιπλέον τα στοιχεία δείχνουν μία αυξητική τάση της συμβολής των εκπαιδευμένων γυναικών που έχουν τελειώσει τριτοβάθμια εκπαίδευση στην οικονομική μεγέθυνση της Ελλάδας την περίοδο 1960-1990.

**Λέξεις κλειδιά:** εκπαίδευση, «ποιοτική» εργασία, οικονομική μεγέθυνση.

## Abstract

This paper investigates the contribution of education to the economic growth of Greece during the period 1960-2006, before the 2008 crisis. The method is based on “qualitative labor” approach of E. Denison. It estimates the contribution of different levels skills to the economic growth of Greece.

The study utilizes data from the National Accounts, the Labor Force Surveys and the Household Budget Surveys of the National Statistical Service of Greece.

The results suggest that the relative contribution of secondary and higher education to economic growth has risen. The findings also indicate that the increased number of women with higher education and their subsequent participation in the labor force have contributed significantly to the growth process.

**Keywords:** education, quality labor, economic growth

## 1. Introduction

The impact of education on economic growth has been dealt with in numerous works over the last fifty years. In their classic contributions, Schultz (1961) and Denison (1962) have strived to explain the rate of technological change by assigning qualitative attributes to the traditional factors of production and adjusting accordingly both the capital and labour inputs.

Lucas (1990) explains that physical capital fails to flow to poor countries because of their poor endowments of complementary human capital. This point is confirmed from an aggregate cross-country empirical analysis by Benhabib and Spiegel (1994). At this point, two stylized facts are of interest: (a) Economies with a larger stock of human capital experience faster growth (Romer 1990); and (b) Investing in schooling is a prerequisite to the creation of

human capital which, in turn, generates ideas and is capable of developing new products (Romer 1993).

Besides health, education is the most important investment activity in human capital theory (Romer 1993), for it enhances human abilities in several ways. The most obvious effect of formal schooling is the development of vocational skills which are useful in the future labour market (Choi 1993). Formal schooling, in conjunction with general and liberal arts education, can also increase the efficiency with which new skills are acquired in the labour market (Blau 1996 and the literature cited therein). The presumption is that an educated labour force, relative to a non-educated one, has a comparative advantage with respect to learning, creating, implementing, and adopting new technologies, thereby generating growth (Benhabib and Spiegel 1994).

Ceteris paribus, higher levels of education may permit workers to accomplish more with the resources at hand (the marginal product of education is higher than otherwise); to accumulate more human capital on the job than less educated workers; and to enhance their 'entrepreneurial' ability (Welch 1970, Choi 1993). However, investment in education implies foregone labour earnings on the part of the persons involved. And foregone earnings vary with the level of human capital invested. That is, a worker with little (much) human capital foregoes a lower (higher) wage in order to accumulate more human capital (Mankiw et al. 1992). In terms of measurement, and regardless of shortcomings, the average number of years in school of the labour force has been used as a good proxy for human capital in the new growth literature (Mankiw et al 1992, Mulligan and Sala-i-Martin 1995).

The positive impact of education on economic growth has been confirmed in several empirical studies. Among the most interesting contributions are Winter-Ebmer (1992) for Israel; the World Bank (1993) for Hong-Kong, Indonesia, Japan, Korea, Malaysia, Taiwan, Singapore and Thailand; Juoro (1993) for Malaysia; and Chatterji (1998).

Almost all of the empirical theories refer to comparative outcomes from different countries and face serious problems of availability of data. Generally, the problem that arises from these models is the difficulty in empirical testing.

The conclusions that can be drawn from the empirical studies are: There is a (highly) positive correlation between education and economic growth. It is impossible to accurately estimate the contribution of education to economic growth using the contemporary theories of endogenous economic growth.

So, the main reason for the success of the "traditional" models based on the classic theory of economic growth is their capability of organising data. It should be noted that the endogenous growth models cannot be described in a clear empirical framework. Therefore, the models which are most effective in estimating the contribution of education to economic growth are those compatible with Denison's approach.

In this paper we estimate the contribution of education to the economic growth of Greece in the 1961-2006 period according to the Denison's approach of 'qualitative labor'.

## 2. Methodology

As already mentioned, the methodology we use is compatible to the Denison's approach which refers to *quality labor*. Basic element of the aforementioned approach is the distinction between three levels of education of the workforce, particularly of the employed. Thus, the production function is the following:

$$Y^* = f(K, L_1, L_E) \quad (1)$$

where  $L_1$  stands for the number of employed who have completed compulsory education and  $L_E$  stands for the number of employed who have completed secondary or higher education. Thus:

$$L_E = \sum_{i=2}^3 L_i .$$

Based on the above, it becomes evident that the total of employed is:

$$L = \sum_{i=2}^3 L_i + L_1$$

Therefore, the economic growth equation becomes:

$$\frac{\partial Y^*}{\partial t} = \frac{\partial K}{\partial t} f_K + \frac{\partial L_1}{\partial t} f_{L_1} + \frac{\partial L_E}{\partial t} f_{L_E} + R \quad (2)$$

Given the fact that the marginal product of a certain level of education is equal to the difference in the average salary from the previous level due to the extra education, equation (2) becomes:

$$\frac{\partial Y^*}{\partial t} = \frac{\partial K}{\partial t} f_K + \frac{\partial L_1}{\partial t} f_{L_1} + \sum_{i=2}^3 \frac{\partial L_i}{\partial t} (\bar{W}_i - \bar{W}_{i-1}) + R \quad (3)$$

From equation (3) and taking into account that everybody is obliged by law to complete compulsory education, it can be concluded that the employed who have completed secondary or higher education, that is post-compulsory education, contribute to the production of *quality labor*.

Within the framework of this analysis, and assuming that there will be no changes in those employed having completed compulsory education, the contribution of educated employed becomes as follows:

$$\sum_{i=2}^3 \frac{1}{L} \frac{\partial L_i}{\partial t} (\bar{W}_i - \bar{W}_{i-1}) \frac{L}{Y^*} = \sum_{i=2}^3 \frac{\partial L_i}{\partial t} \frac{(\bar{W}_i - \bar{W}_{i-1})}{Y^*} \quad (4)$$

In other words, the contribution of education to economic growth is equal to the increase in the extra educated employed (in each level of education) times the difference in average salary from the previous level due to the extra education.

Hence, the equation of the rate of economic growth becomes:

$$g_{Y^*} = \frac{1}{Y^*} \frac{\partial K}{\partial t} f_K + \frac{1}{Y^*} \frac{1}{L} \frac{\partial L_1}{\partial t} \frac{\partial f}{\partial L_1} \frac{L}{1} + \sum_{i=2}^3 \frac{\partial L_i}{\partial t} \frac{1}{L} \frac{(\bar{W}_i - \bar{W}_{i-1})L}{Y^*} + R \quad (5)$$

Or, to put it more simply:

$$g_{Y^*} = \frac{1}{Y^*} \frac{\partial K}{\partial t} f_K + (g_{L_1} s_{L_1}) + \sum_{i=2}^3 g_{L_i} s_{L_i} + R \quad (5a)$$

Therefore, the contribution of education to the growth rate of GDP, according to the methodology used, is equal to the product of the growth rate of employment of of secondary and higher education graduates times their corresponding income share in GDP.

### 3. Empirical Evidence

As mentioned before, the purpose of this study is to investigate the contribution of education to economic growth of Greece the period before global financial crisis. So that the following table describes the employment by level of education and sex up to 2006.

The global financial crisis of 2007-2008 had a severe impact on Greece which changed completely the data of Greek employment. The youth unemployment, especially among the highly skilled have tremendous increased after 2006 ( Labrianides & Sykas, 2015).

Table 1: Employment (15 years and over) by education level and sex (In thousands)

GREECE, TOTAL	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
<b>Males</b>	<b>2.373,52</b>	<b>2.365,62</b>	<b>2.371,92</b>	<b>2.342,22</b>	<b>2.443,52</b>	<b>2.535,72</b>	<b>2.558,32</b>	<b>2.566,52</b>	<b>2.608,72</b>	<b>2.652,62</b>	<b>2.668,52</b>	<b>2.695,72</b>	<b>2.715,7</b>
Higher Education	374,1	380,0	408,1	410,4	451,8	607,4	630,8	628,9	644,9	680,6	799,0	782,3	813,9
Secondary Education	633,9	643,3	654,6	665,7	730,9	756,6	764,7	782,5	839,4	862,5	856,3	899,7	927,0
Primary Education	1.365,5	1.342,2	1.309,2	1.266,1	1.260,8	1.171,7	1.162,8	1.155,1	1.124,4	1.109,5	1.013,2	1.013,6	974,7
<b>Females</b>	<b>1.279,61</b>	<b>1.302,91</b>	<b>1.314,41</b>	<b>1.330,01</b>	<b>1.352,81</b>	<b>1.465,51</b>	<b>1.498,21</b>	<b>1.504,81</b>	<b>1.550,61</b>	<b>1.604,51</b>	<b>1.638,11</b>	<b>1.667,01</b>	<b>1.718,4</b>
Higher Education	249,8	260,5	276,2	290,6	329,8	481,4	505,3	507,2	528,6	575,4	644,1	662,3	718,1
Secondary Education	348,8	373,8	370,4	387,3	403,7	410,2	429,1	445,5	464,1	480,7	500,3	509,7	519,0
Primary Education	681,1	668,5	667,7	652,1	619,3	573,9	563,8	552,1	557,9	548,5	493,7	494,9	481,2

Source:ESYE.

Categorization of education level in table 1 was based on the following:

Our Categorization	ESYE categorization for the years 1994-2001 (according table 2)
Higher education	Category 1 (University degree or post graduate degree)
Secondary education	Category 2 (Completed secondary education)
Primary education	Category 3 (None – completed 3 years of the 6 years secondary education)

This categorization of data in table 1 was chosen in order to be compatible with the one used by ESYE in table 2. Table 2 indicates the change, by level of education, of labour force of Greece in period 1994-2006.

Table 2: Annual Change in Employment (15 years and over) by education level and sex (In thousands)

GREECE, TOTAL	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
<b>Males</b>												
Higher Education	6,0	28,1	2,3	41,4	155,6	23,4	-1,9	16,0	35,7	118,4	-16,7	31,6
Secondary Education	9,4	11,3	11,1	65,1	25,7	8,1	17,8	56,9	23,1	-6,2	43,4	27,3
Primary Education	-23,3	-33,0	-43,2	-5,2	-89,1	-8,9	-7,7	-30,7	-14,9	-96,3	0,4	-38,9
<b>Females</b>												
Higher Education	10,8	15,7	14,4	39,2	151,6	23,9	1,9	21,4	46,8	68,7	18,2	55,8
Secondary Education	25,1	-3,4	16,9	16,4	6,5	18,9	16,4	18,6	16,6	19,6	9,4	9,3
Primary Education	-12,5	-0,8	-15,6	-32,8	-45,4	-10,1	-11,7	5,8	-9,4	-54,8	1,2	-13,7

Source ESYE.

Table 3: Annual Salary by level of education and sex in Euro (2005 prices)

GREECE, TOTAL	1994	1995	1996	1997	1998	1999	2000	2001	2003	2004	2005	2006
<b>Males</b>												
Higher Education	8.409,40	8.390,42	8.546,13	9.563,44	9.769,23	9.651,28	9.838,57	10.123,4	10.652,4	10.813,7	11.076,2	11.164,2
Secondary Education	4.814,35	5.030,51	4.890,13	5.233,28	4.875,14	4.709,62	5.006,98	5.366,61	5.513,64	6.021,03	6.011,97	5.994,72
Primary Education	2.477,74	2.450,39	2.280,80	2.401,39	2.422,72	2.437,17	2.350,17	2.284,68	2.686,11	2.866,57	2.936,12	2.877,48
<b>Females</b>												
Higher Education	5.088,97	5.013,35	5.270,04	6.092,54	6.851,25	6.961,64	7.045,13	7.398,38	8.624,70	8.728,26	8.905,07	8.903,77
Secondary Education	1.976,00	2.017,29	1.984,65	2.188,10	2.513,20	2.243,99	2.386,21	2.560,30	3.046,98	3.160,42	3.114,89	3.069,14
Primary Education	646,41	706,21	624,11	612,58	657,06	567,27	613,07	625,02	731,68	756,59	773,20	782,94

Source Labor Force Surveys, ESYE

According to these findings, the number of labour force with education until primary education has declined.

It is mentioning that, National Statistics Services of Greece (ESYE) uses for first time in 1999, a new system for data classification and because of this it is noted higher change of labour force.

It is noted that the annual salary by level of education and sex is used as estimation for the marginal product by level of education and sex.

From the data of the above table it becomes obvious that mean wages of labour force of women of the every level of education are lower from the mean wages of corresponding level of education of men.

Table 4: Difference in Annual Salary between level of education in Euro (2005 prices)

GREECE, TOTAL	1994	1995	1996	1997	1998	1999	2000	2001	2003	2004	2005	2006
Higher-Secondary	3.595,04	3.359,90	3.656,00	4.330,17	4.894,09	4.941,66	4.831,59	4.756,85	5.138,76	4.792,69	5.064,27	5.169,50
Secondary-Primary	2.336,61	2.580,13	2.609,34	2.831,89	2.452,42	2.272,45	2.656,81	3.081,92	2.827,53	3.154,46	3.075,85	3.117,25
Females												
Higher-Secondary	3.112,97	2.996,06	3.285,39	3.904,44	4.338,04	4.717,65	4.658,92	4.838,07	5.577,72	5.567,84	5.790,18	5.834,63
Secondary-Primary	1.329,59	1.311,08	1.360,54	1.575,52	1.856,14	1.676,71	1.773,14	1.935,28	2.315,30	2.403,83	2.341,69	2.286,20

Source: Labor Force Surveys, ESYE

The rising through time wage differentiation among workers with different educational background has inevitably contributed to the rising role of secondary and higher education to the economic growth of Greece.

Table 5: GDP factor prices in 2005 prices (In million Euro)

GREECE, TOTAL	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
GDP, 2005 prices	111.420,98	113.887,36	116.207,00	119.210,54	122.546,22	125.559,26	142.255,1	147.169,81	153.604,56	162.591,31	171.651,84	178.017,00	184.210,72
dGDP (Annual Change)		2.466,4	2.319,6	3.003,5	3.335,7	3.013,0	16.695,8	4.914,7	6.434,7	8.986,8	9.060,5	6.365,2	6.193,7
% Change		2,21%	2,04%	2,58%	2,80%	2,46%	13,3%	3,45%	4,37%	5,85%	5,57%	3,71%	3,48%

Source ESYE, Gross Domestic Product in factor prices in 2005 prices.

Calculation of Gross Domestic Product in factor prices in 2005 prices is based on Gross Domestic Product in factor prices in current prices (ESYE) and the Consumer Price Index (ESYE). For the years 2000-2007, Gross Domestic Product in factor prices in current prices are estimated values by ESYE.

The following table describes the contribution of education by sex or regardless sex during the decades 1961-1971, 1971-1981 and 1981-1991. It is noted that g means GDP growth rate.

Table 6.a. Contribution of education to economic growth by sex (period 1961-1991)

periods	g	total	regardless of sex			Males				Females			
			1ary	2ary	higher	total	1ary	2ary	higher	total	1ary	2ary	higher
1961-71	8.00	0.16	0.06	0.06	0.04	0.12	0.05	0.04	0.03	0.04	0.01	0.02	0.012
1971-81	3.40	1.03	0.53	0.26	0.24	0.52	0.24	0.15	0.14	0.51	0.29	0.12	0.10
1981-91	0.80	2.25	0.11	1.38	0.76	1.25	-0.01	0.88	0.38	1.00	0.12	0.50	0.38

Source: Th. Magoula (1998), Th. Magoula and K. Prodromidis (1999)

According to the data of the above table, the role of primary education has declined in the 1980s relative to that of secondary education, which has contributed the most to economic growth of Greece. The results concerning the insignificant contribution of education to Greece's economic growth in the sixties is comparable to the respective findings of earlier studies by Leibenstein (1967), Bowles (1967). Because of the rising participation of women in the labour force their contribution per education level in the growth process has become



more comparable to that of men, since the seventies. In the eighties, women of higher education have contributed about as much as men in economic growth.

The following table 6.b describes the calculation of contribution to economic growth by level of education and sex from 1994 to 2007 (except 2002, 2007 where there is no data available).

Table 6.b: contribution to economic growth by level of education and sex (period 1994-2006)

GREECE, TOTAL	1995	1996	1997	1998	1999	2000	2001	2003	2004	2005	2006
<b>Males</b>											
Higher Education	0,01756	0,08828	0,00831	0,16532	0,61246	0,07948	-0,00614	0,11268	0,33072	-0,04749	0,08875
Secondary Education	0,02125	0,02541	0,02640	0,13034	0,04660	0,01513	0,03728	0,04018	-0,01140	0,07502	0,04620
Subtotal	0,03881	0,11368	0,03471	0,29567	0,65907	0,09460	0,03113	0,15286	0,31932	0,02754	0,13495
<b>Females</b>											
Higher Education	0,02831	0,04443	0,04711	0,13867	0,56963	0,07827	0,00625	0,16048	0,22290	0,05924	0,17669
Secondary Education	0,02885	-0,00401	0,02233	0,02486	0,00866	0,02356	0,02157	0,02359	0,02749	0,01242	0,01152
subtotal	0,05716	0,04042	0,06944	0,16353	0,57829	0,10183	0,02781	0,18407	0,25040	0,07165	0,18822
Grand total (Males & Females)	0,09597	0,15411	0,10415	0,45920	1,23735	0,19644	0,05895	0,33693	0,56972	0,09919	0,32317

Source:ESYE.

According to the results of the table 6.b the contribution of higher and secondary education as total (of men and women) to economic growth has increased from 0,09597 ( which analyses in: 0,03881 of men and 0,05716 of women) in 1995 to 0,32317 (that analyses in: 0,13495 of men and 0,18822 of women) in 2006.

It is worth noting that during the same period (1995-2006) women's higher education contribution to the economic growth is higher than the representative of men.

## 4. Conclusions

The results suggest that the relative contribution of secondary and higher education of men and women to economic growth of Greece has risen during the period 1960-2006, the period before crisis. The findings also indicate that the increased tendency for higher education of women and their consequent rising participation in the labor force have contributed a great deal to the growth process after nineties.

It also worth noted that the empirical evidence of this study is compatible to the corresponding of previous studies. According to these the contribution of higher education is higher when the economic growth rate is also higher and generally the contribution of education is related to the economic growth.

Because of the basic purpose of educational policy that is the increase of higher (mainly) and secondary education's contribution to the economic growth of Greece; it is necessary to investigate in a further study: the parameters which maximize the external efficiency of higher and secondary (especially vocational) education in Greece the period after the global economic crisis of 2008.

Finally by taking into account the Greek exodus of generation G during the same period, after the global crisis of 2008; it is necessary to investigate in a further study: the effectiveness of



educational development policy tools such as the HFRI<sup>1</sup> (Hellenic Foundation of Research and Innovation) which is planned to contribute to the reduction of the tremendous “brain drain” by investing in high quality in research of education.

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<sup>1</sup> HFRI is based on a dynamic mix of local Universities, Research Organizations and private companies, together with mixed public-private funding schemes and technology transfer support services. This growth model is planned to connect geographically and thematically different R&I strengths of the country into a cohesive network.

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