THE RETURNS OF PRIVATE INVESTMENTS IN THE GREEK TERTIARY TECHNOLOGICAL EDUCATION BY GENDER

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Abstract

In the new global knowledge economy the meaning of decisions for investments in education is crucial for individuals as well for the society as a whole. This paper estimates the returns of investment in the Greek Tertiary Technological Education by gender. The study uses earnings data from a stratified sample. The method used for the estimation of the rates of return is the Mincerian. More specifically we used both the actual experience from the sample and the potential experience. The main conclusions are: a. The private investment in the tertiary technological education is an efficient one both for males and females. b. The estimated private rate of return by using the actual experience is smaller than that from the potential experience; the difference is bigger for females than for males. c. There is no statistically significant difference between the rates of return of the two sexes.

1. Introduction

Higher education in Greece consists of the *university education (UNIVE)* and the *tertiary technological education* (TTE). Presently, there are 18 Public Universities (UNIV), 8 of which are located in the Athens-Piraeus metropolitan area and 14 Public Technological Educational Institutions (TEI), 2 of which are in the Athens-Piraeus area. The number of entries, varies from year to year and is determined by the Ministry of Education MoE (in academic year 2001-2002 the entries are: 38,670 for UNIV and 40,700 for TEI). In academic year 2000-2001, the UNIV had 148,772 students (87,322 women) and the TEI had 87,797 students (47,043 women). The higher education institutions act under the supervision of the State, which finances their operation and determines their status by virtue of the enacted laws. The duration of the university programs is between four to six years, while that of tertiary technological education is three-and-a-half to four years. *Universi-*

ties (UNIV) are geared towards academic programs; whereas *Technological Educational Institutions* (TEI) are more professionally applied and vocationally oriented. Each TEI consists of at least two faculties or schools which are sub-divided into departments. The department is the main academic unit, offering studies in a specific scientific or technological field leading to a degree. The faculties of the TEI focus on applied technology, management and administration, agricultural technology, health care professions, food and nutrition technology, graphic arts, and graphic design. Greece is characterized by a "high" demand for third level education. It has an almost world record of students in higher education studying abroad, particularly in light of its relatively small size of population [see Psacharopoulos (1990)]. There is an increasing social demand for studies in tertiary education despite the enlargement of the system by the State. The increase has been observed not only in the number of students and graduates who get employed, but also in the portion of those who remain unemployed. Equally important, the number of tertiary technological education students who do not eventually graduate is also significant-almost one third of the aggregate figures [see Tsamadias (2000)].

There have been many studies on the returns in education in developed, less developed and developing countries, which cover the period from 1960 to the present.

Recent empirical papers estimating the rate of returns of the investment in education include, *inter alia*, those of Enaohwo and Osakwe (1986), Knapp and Knapp (1990), Fiszbein and Psacharopoulos (1993), Ryoo, Nam and Carnoy (1993), Beve (1993), Tansel (1994), Psacharopoulos, Velez and Patrinos (1994), Weisberg (1995), Ramirez and Segundo (1995), Gomez-Castellanos and Psacharopoulos (1990), Tannen (1991), Psacharopoulos and Alam (1991), Grootaert (1990), McMahon et al (1992), et al.

In Greece, some empirical studies have been made [see: Leibenstein (1967), Psacharopoulos (1982), Lambropoulos and Psacharopoulos (1992), Psacharopoulos (1994, 1999), Tsamadias (2000, 2001a, b, 2002), Chilas (2002)].

The purpose of this study is, by concentrating on the TTE, to address whether or not investing in tertiary technological education produces the same rates of return for males and females.

The structure of this paper is structured as follows: In Section 2, we present the methodology and the model we use for the estimation of the returns of investment in TTE for males females. In Section 3, we present the sources of our collected data. In Section 4, we calculate these rates in TTE by implementing the Mincerian method. We apply the basic Mincerian method, using the actual experience (from the sample) and the potential experience (the traditional way), and we compare their results. Finally, in Section 5, we summarize the main findings of this paper.

2. Models and Methodology

The theory of human capital recognises education as the principal institutional mechanism through which people can improve their abilities and skills. There are several ways to estimate the private and social returns of investment in education [see Psacharopoulos and Mattson (1998) and Psacharopoulos (1999)]. In this study, we use the Mincerian method to estimate the rates of return of private investment in the Greek tertiary technological education by gender. The method is also known as the "Earnings Functions Method" [see Mincer (1974), Psacharopoulos and Layard (1979)]. There are two versions of that method: the basic and the extended.

The basic version of the Mincerian method involves the fitting of a function and is specified as:

$$LnW_i = a + b.S_i + c.EX_i + d.EX_i^2 + U_i \qquad (1)$$

where LnW_i is the natural logarithm of annual net earnings (earnings after taxes) rate of the individual i, EX_i is the number of years of work experience of the individual i, and EX_i^2 accounts for the concavity of the earnings-experience profiles. S_i is the years of schooling of the individual i, a is a constant, b and d are regression coefficients, and ui is the disturbance term. The b is a regression coefficient. It can be interpreted as the average private rate of return to one additional year of education (according to the Becker-Mincer interpretation)].

The estimation of the model (1) is based on the actual experience [from the sample] and the potential experience [from the use of the equation EX_i = Age – Years of Schooling – 6 (the traditional Mincerian way)].

The statistical significance of coefficient b for males and females and of constant a between males and females is assesed by estimating function (2).

$$LnW_i = a + b.S_i + c.EX_i + d.EX_i^2 + e.Y + f.S.Y \qquad (2)$$

where Y is a dummy variable (1=males, 0=females)

3. Data

The aim of our survey was to collect annual earnings from the hired labour of the TTE and SE graduates and data relating to both private and public cost in TTE education. Accordingly, we collected gross and net earnings data from a stratified survey based on questionnaires. We derived of the cost data from the Ministry of Na-

tional Education and Religious Affairs and TEI. We collected these questionnaires from TTE and SE graduates who did not have any additional education and full time work in the private or public sector. The productivity bonuses are included in the annual earnings. Earnings from overtime and additional education or training are not included. The TTE and SE graduates who had their own work are not included, since it is difficult to separate the part of income that comes from their personal employment from that arising from other factors which are used in the production process. The part time employees are also not included.

We apply a cross sectional econometric analysis for the year 1997. The population is comprised of two sub-populations: sub-population I, which includes the TTE graduates who have full-time dependent employment in the private or public sector; and sub population II, which includes the SE graduates who work as full time employees in the private or the public sector in Greece. According to the labour force survey of the National Statistical Service of Greece (NSSG), the size of the two sub-populations for 1997 is $N_I = 82,063$ individuals and $N_{II} = 686,147$ individuals, respectively.

Based on the structure and the categorisation of the two sub-populations, these are diverted in six sub-groups (strata) according to the sector of production (primary, secondary, tertiary) and to the sector of employment (public, private). The stratified sampling not only gives increased accuracy, but also provides separate estimates for each stratum [see Zairis (1991)]. We determine the minimum size of the sample which we take from each stratum according to the formula

$$n_{oh} = \frac{Z^2_{a/2} \cdot S_h^2}{d_o^2 + \dfrac{Z^2_{a/2} \cdot S_h^2}{N_h}} \tag{3}$$

where, Z is the statistic of the standard normal distribution; a is the level of significance; S_h^2 is the real variance of stratum h (it is subsituted from pilot estimation) and N_h is the size of stratum h. The random sample, which is extracted from each stratum of the two sub-populations, has been determined so that the estimation of mean $\bar{Y}_h$ to have maximum sampling error:

$$d_o = |\bar{y}_h - \bar{Y}_h| = Z_{a/2} \cdot S.E(\bar{y}_h) = 200,000 \text{ drs.} \tag{4}$$

where $\bar{y}_h$ and $\bar{Y}_h$ are the average value of stratum h and the sample, respectively. The $\bar{y}_h$ in practice is substituted with the value which arises from the pilot survey.

Table 1 shows the structure of the sample more analytically.

Table 1: Structure of Sample by Level of Education and Gender [Year 1997]

Educational Level	Males	Females	Total
S.E. Graduates	706	561	1,267
TTE Graduates	631	428	1,059
Total	1,337	989	2,326

Source: Sample data derived from the author's research

4. Empirical Analysis and Results

In this section, we first examine the descriptive statistics of earnings and, subsequently, we estimate the Mincerian earnings functions on the basis of the regression analysis. We further estimate the private rates of return of investment in TTE by gender with the Mincerian method.

The descriptive statistics for the earnings variable are presented in Tables 2 and 3.

Table 2: Mean Annual Earnings by Level of Education and Gender [Drs]

	Males			Females		
	Mean	CV(%)	N	Mean	CV(%)	N
S.E.	4,515,643	38.55	706	3,913,427	35.20	561
TTE	5,272,629	40.60	631	4,442,518	28.18	428
Entire Sample	4,872,904	40.54	1,337	4,142,397	32.58	989

Notes: N number of observations.

Table 2 shows the mean earnings by the level of education and gender. It is worth noting that the mean gross earnings of the TTE male graduates is 16.76% higher than those of SE graduates. For females the difference is 13.51%. These results are in accordance with the human capital theory and the findings of empirical work which have been carried out in Greece and abroad. They help explain why there is a high social demand for tertiary education. Simultaneously, it is worth mentioning that the TTE male graduates earn 18.68% higher than females of the same educational level (for the SE level the difference is 15.38%).

Table 3: Mean Annual Earnings of Tertiary Technological Education Graduates by Faculty and Gender [Drs].

Faculties	Total		Males		Females	
	Mean	N	Mean	N	Mean	N
Applied Technology	5,430,522	402	5,652,985	329	4,427,915	73
Agricultural Technology	4,315,680	92	4,451,936	71	3,855,005	21
Health Care Professions	4,880,661	185	4,842,928	30	4,887,964	155
Graphic Arts Graphic Design	4,811,793	32	5,357,754	19	4,021,158	13
Management Administration	4,480,769	287	4,909,510	148	4,024,268	139
Food Nutrition Technology	5,007,119	61	5,220,943	34	4,737,859	27
Total *	4,937,136	1,059	5,272,679	631	4,442,518	428

Notes: N number of observations

Table 3, cited above, summarizes the mean gross earnings of the TTE graduates by faculty and gender. It is clear that TTE male graduates take also higher average income than females, with the only exception for the graduates of the health care professions. Interestingly, the mean earnings of the applied technology graduates is the highest and that of the agricultural technology graduates is the lowest. It must be noted that the level of annual earnings is expected to move upwards during the period 1997-2006 [see Thanos (2001)].

4.1. Mincerian Method

In this section we estimate the basic Mincerian function (1) with potential and actual experience. The function is estimated for the males and females. The results are presented in Table 4.

Table 4: Basic Mincerian Earnings Function with Actual and Potential Experience by Gender

Independent Variables	Gender			
	Males		Females	
	Dependent Variable (LnW)			
	Actual Experience	Potential Experience	Actual Experience	Potential Experience
EX²	-0.00071	-0.00079	-0.00073	-0.00059
	-7.060	-9.881	-7.084	-7.142
	***	***	***	***
EX *	0.048	0.049	0.047	0.042
14.782	16.506	14.930	12.967	
***	***	***	***	
S	0.0467	0.0598	0.0156	0.0663
11.975	14.383	12.308	15.541	
***	***	***	***	
Constant	14.079	13.824	13.998	13.649
239.525	212.184	251.855	194.140	
***	***	***	***	
R²	40.56	35.69	46.96	36.59
Adj. R2	40.43	35.54	46.80	36.40
F 303.187	246.575	290.676	189.447	
Signif	***	***	***	***
N	1,337		989	

Notes: ***, *significant at 1% level of significance, t- values are given with Italics.*

The findings are summarised as follows: The value of the F-statistic ($p < 0.001$) suggests a statistically significant relationship between the dependent and all independent variables together. In terms of overall explanation (R^2), the human capital model fits better to males than females. The explanatory power of the model (R^2 - adjusted) is fluctuated from 36% - 47% and is consistent with previous research. The R^2 - adjusted values are considered to be also satisfactory, given the fact that the data are cross-sectional. The t-statistic is particularly satisfactory. The signs of the co-efficients conform with the human capital theory. Education has positive and statistically significant ($a = 0.01$) linear impact on earnings for both male and female

employees (human capital theory). Labour market experience (actual/potential) has statistically significant ($a = 0.01$) linear and quadratic impact on earnings for both male and female employees with expected signs (human capital theory). The impact is stronger for male than for female employees. An additional year of actual experience increases earnings by 4.8% for males and by 4.7% for females. When we use the actual experience, the coefficient b for the sub-samples concerning males and females is smaller than when we employ the potential experience.

* Although on average, females earn less than males, the returns from investing in TTE for females are 0.65% higher than for males when we use the potential experience. This result is typical in most countries. When we use the actual experience, the private return for males is $0.11 - 0.12\%$ higher than for females.

Table 5 presents the results of our regression analysis of the equation (2).

Table 5: Results of Regression Analysis of Equation [2].

Independent Variables	Dependent Variable (LnW_N)
EX^2	-0.000717
	-9.817
	***
EX	0.04721
	20.667
	***
S	0.04584
	10.882
	***
Y	0.09649
	1.252
	P = 0.211
SY	0.0007011
	0.127
	P=0.899
Constant	13.989
	231.197
	***
R^2	45.1
Adj. R^2 *	44.9
F	380.522
Signif	***
N	2,326

Notes: ***, significant at 1% level of significance. t- values are given with Italics.

The coefficients of variables Y and SY are not statistically significant. This means that both the constant and the coefficient of variable S are not statistically significant between males and females. Therefore the return of investments in TTE is of the same level for males and females.

5. Concluding Remarks

In this paper, we have presented estimates for the returns of investment in the Greek tertiary technological education by gender. We have provided empirical results regarding the relationship of the tertiary technological education graduates and the labour market, as well the income stemming from employment. In the examined sample the level of earnings is higher for the TTE graduates compared to the SE graduates. Additionally, male graduates of the TTE have a higher average earnings compared to females of the same level of education.

The private rates of return, of investments in the TTE have been estimated according to basic mincerian method. The private rates of return for males are approximately equal to that of females (actual experience). The private rates of return for the duration of four-year studies have been calculated within 4.56% - 6.63% on the basis of actual-potential experience. For the economic valuation of private investments in the system of the tertiary technological education, the alternative real interest rate during 1997 has also been estimated. For the private investments, the real interest rate was 3.73% [the average deposit rate of commercial banks was 9.23% and the inflation rate was 5.5% (Ministry of National Economy-1997)]. The private rates of return are low compared with those measured on a unified basis for tertiary education in other countries [see Psacharopoulos (1999)]. The returns are higher compared to the returns of alternative investments.

Note that the rates of return have been underestimated [see Haveman and Wolfe (1984), Psacharopoulos (1999)]. However, TTE can provide benefits that are not captured by this calculation. Beyond the increase of the private rate of return that has been estimated, the following factors must be considered: (a) the six months period of practical experience of the students is associated with their reward; (b) the time period someone has to wait for his entrance in the labor market is smaller for TTE graduates than for the SE graduates [see Tsamadias (2000)]; (c) the time of unemployment during the life-cycle is shorter for the TTE graduates than that for the SE graduates [see Tsamadias (2000)]; and (d) the TTE graduates who become pensioners after the age of sixty-five enjoy higher pension funds than the SE graduates. In addition, compared to the SE graduates, the TTE graduates have the potential to exercise independent professional activity related to the specialisation they have acquired during

their education. The "psychic income" and the "social prestige" of the TTE graduates are higher than for SE graduates. This is especially true when one considers that the social prestige is directly and positively correlated with the level of education.

The evidence of our research enhances the general conclusion that the investment in TTE constitutes a great investment for individuals which are educated within it and accumulate "human capital". Indeed, in a country like Greece, where natural resources are very scarce, development of human capital is undoubtedly essential for economic development. Thus, there is private concern for TTE education. From the perspective of the private interest, as educational attainments increase, the worker's financial and non-financial returns get higher.

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