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Private Rates of Return of Investment in Upper General and Vocational Secondary Education in Greece

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Abstract

The paper examines whether the investment of individuals in the Upper Secondary Education system is efficiency. It estimates the private return on investment in upper secondary education, overall and comparatively in general and vocational upper secondary education. It also estimates private rate of return, comparatively, by gender and type of education. The estimation is performed using the Mincer method and the short-cut method. The income data used came from a primary survey, which was conducted throughout the Greek economy with stratified sampling. Research has shown that investing in the upper secondary education system is efficiency. In particular, the investment of individuals in Upper Secondary General Education (in total and by gender) is more efficient than the investment of individuals in Upper Secondary Vocational Education. Females' investment in Upper Secondary Education (overall but also by type, general and vocational) is more efficient than that of males.

JEL Classification: I21, I25, J24
Keywords: Upper secondary education, general and vocational, human capital

1. Introduction

Smith (1776) made a major shift in the field of economic thought. It highlighted the investment character of education and the economic value that arises through it in the long-term, both for the individual who invests in education and for society as a whole. He was the first to realize the important contribution of knowledge, skills and competences in promoting productivity (Tsamadias, 2020). Over time, Schultz (1960, 1961, 1962, 1963, 1968, 1971) and Mincer (1958, 1974) pointed out the important function of knowledge and skills in increasing productivity, while at the same time identifying the influence of human capital in determinating individual incomes. Mincer (1974) argued that workers' wages are inextricably linked to education level and work experience. Becker (1964) noted that education can be seen as a form of investment, similar to investment in physical capital such as machinery and equipment. A person's decision to obtain an education is based on an estimate of the expected financial results and possible future benefits that will result from this investment (increase in income, improvement in professional prospects, personal improvement and development, etc.) and if the anticipated returns from the education exceed its cost (in terms of time, money, etc.), then they will choose to invest in it.

Educational system designers, policy makers, and citizens of all countries have long been concerned with the question: At the level of upper secondary education, general or vocational education is the most efficiency investment for the individual. It is noted that upper secondary vocational education programs across countries differ in the emphasis placed on general knowledge and skills or specific knowledge, and skills and apprenticeship. In Greece, it leans towards general knowledge and skills.

The purpose of this paper is to examine whether the investment of individuals in the system of Upper Secondary Education is efficient. To this end, the private rate of return of investments in upper secondary education as a whole and in particular comparatively in upper general and vocational secondary education is estimated. Private efficiency is also estimated, by gender and type of education. The estimation is carried out by the Mincer method (it is the most popular estimation method in the literature) and the short-cut method (it is the fastest method of estimating private efficiency with limited data). The research innovates, because it estimates private efficiency using data from primary research, which was done throughout the Greek economy with stratified sampling. During the application of the Mincer method, both actual and potential (indirectly) experience are taken.

The rest of the work is organized as follows. Section 2 presents the secondary education system in Greece. Section 3 presents a review of estimating methods. Section 4 presents a brief review of the literature on the private return on investment in education in different countries and in different years and places more emphasis on Greece. Section 5 presents the empirical analysis and Section 6 presents the conclusions of the research.

2. The Greek secondary educational system

Secondary Education plays a key role in the development of the individual's personality and contributes significantly to his professional development, while at the same time it contributes substantially to the well-being and development of society as a whole. Secondary Education in Greece operates in a specific context and is divided into two cycles. The first cycle is the Lower Secondary Education and includes the Gymnasium, in which attendance is compulsory and the second cycle is the Upper Secondary Education and includes Lyceum, in which attendance is non-compulsory. The «National Qualifications Framework» classifies Upper Secondary Education at level 4. Table 1 presents the structure of the Greek formal Secondary Educational System.

Table 1. The structure of the Greek formal Secondary Educational System (2020-21)

Secondary Education	Duration of studies (years)	Age	ISCED	Compulsory or non-compulsory
Lower Secondary Education	3	12-15	Level 2	Compulsory
Upper Secondary Education (Lyceum)	3	15-18	Level 4	Non-compulsory
Upper General Secondary Education (GEL)	3	15-18	Level 4	Non-compulsory
Upper Vocational Secondary Education (EPAL)	3	15-18	Level 4	Non-compulsory

Source: EOPPEP responsible for the development of the National Qualifications Framework (NQF) and its correlation with the European Qualifications Framework (EQF)[1]

[1] https://www.eoppep.gr/index.php/el/qualification-certificate/national-qualification-framework

Gymnasium offers basic knowledge and general education courses in a daily or evening program and is aimed at students who have completed Primary Education. Students enroll in the Gymnasium ex officio and attend for three years until they reach the age of 16. The aim of the Gymnasium is for students to develop their skills, their critical thinking and to cultivate their skills and interests. After completing Gymnasium, students can continue their studies at the Lyceum by choosing between the General or Vocational Upper Secondary School.

At General Upper Secondary School (GEL), attendance is three years, students acquire high-level general education knowledge and are encouraged to develop their critical thinking and skills. They also shape their personality and prepare for their active participation and contribution to society. In the last year they have the opportunity to choose one of the following four scientific fields to study: i. Humanities, Law and Social Sciences, ii. Science and Technology, iii. Health and Life Sciences and iv. Science of Economics and Informatics and to be admitted to higher educational institutions and schools after their successful participation in Panhellenic entrance examinations.

At Vocational Upper Secondary School (EPAL), attendance is three years and students acquire knowledge of general education as well as technical and professional knowledge. Students have the opportunity to choose one of the following nine areas of study of EPAL: i. Agriculture, Food, and Environment, ii. Management and Economics, iii. Construction, Built Environment, and Architectural Design, iv. Applied Arts, v. Electrical Engineering, Electronics, and Automation, vi. Engineering, vii. Maritime Professions, viii. Informatics and ix. Health Welfare and Wellness. During their studies, students study areas related to their chosen specialty and acquire technical and professional knowledge in order to acquire the appropriate skills for the exercise of specific professions. In addition, they can optionally attend the post-secondary course, the Apprenticeship class for one year. This gives them the opportunity to gain work experience and training in a professional environment. Graduates of Vocational Upper Secondary Schools have the opportunity to be admitted to higher educational institutions and schools. Thus, they have the opportunity to continue their studies in more specialized fields and gain higher educational prospects for their future. Secondary education in Greece is supervised by the Ministry of Education and is provided in both public and private schools. The funding of public secondary education is covered by the state budget.

3. Review of Estimating Methods

According to theory of human capital, education, training and lifelong learning are a valuable factor contributing to the improvement of one’s abilities and talents. Education is an investment undertaken by the individual (private investment) or society (social investment), from which they expect to bring additional benefits and returns. There are several methods that value private and social efficiency in education [(Psacharopoulos and Mattson, 1998) and (Psacharopoulos, 1999)]. In this study, the efficiency of private investments in Upper Secondary Education is estimated with the basic Mincer function (Mincer, 1974) and with the Short-cut method (Psacharopoulos and Mattson, 1998).

3.1 Basic Mincer function

Basic Mincer function calculates the private return on investment in education using the experience-earning function. The variable of years of experience is calculated in two ways:

a. Actually

b. Potentially [Potential experience = Age - Years of Education - 6 (age of initial school), Mincer (1974)]

Type (1) presents the basic function of the Mincer method:

$$LnY_i = \alpha + b \cdot S_i + c \cdot EX_i + d \cdot EX_i^2 + u_i \quad (1)$$

Y_i is the earning of the i person, LnY_i is the logarithm of earning, S_i is the duration of studies in years of the i person, EX_i are the years of experience that i person acquires from the work, u_i is the disruptive term (error term).

The formula [1] is applied by using the empirical evidence of the variables Y_i, S_i and the variable EX_i with actual or potential values. The variable EX_i^2 is included in order to adapt the model to the parabolic form of experience- earning profiles. It is assumed that the remaining variables are constant. Deriving the relation (1) with respect to S results the relation (2):

$$\frac{d\mathrm{LnY}}{\mathrm{dS}} = b = \mathrm{r} \quad (2)$$

In this way, the average private rate of return **r** of education of an additional formal year of education is estimated and is equal to the coefficient b of the variable S, referring to the years of education of the individual. The coefficients α, b, c and d of the semilogarithmic function are estimated by regression from statistics.

The use of the Mincer method has the advantage that it is not necessary to discount and normalize earning-age profiles due to regression. However, it has the disadvantage that cost is not included in the data, for the calculation of efficiency and that it is proposed to take a large sample size for more accurate results.

When estimating private efficiency with the Mincer method and potential experience, private efficiency is usually overestimated due to the disregard of other factors such as periods of unemployment, part-time work or temporary absence from work (Tsamadias, 2020).

The Mincer income function has been a subject of discussion and debate in the literature (Psacharopoulos and Layard, 1979; Heckman et al., 2006). One issue arising from estimating the returns to education using the Mincer method is the omission of significant variables. This omission is primarily associated with unobserved or unmeasurable variables related to education and income. When estimating income functions, the "ability" factor of workers is omitted. Another problem concerns measurement errors in the education variable. Both of these omissions introduce bias into the estimation of the rate of return to education. Griliches (1977) analyzed these issues many years ago, concluding that bias is small. Recently, Patrinos (2016) pointed out that adding more variables to the equation will not remedy the problem, but may introduce other forms of bias (Tsamadias, 2020).

3.2 Short-cut Method

The Short-cut method estimates the private rate of return on investment in education. It is a simplified version of the elaborate method and is applied when only the average net incomes of graduates of education levels h-1 and h are available (Psacharopoulos, 1994).

The Short-cut method estimates the efficiency of private investments using the average net earnings of employees per education level by applying the type (3).

$$r_h = \frac{\bar{E}_{N,h} - \bar{E}_{N,h-1}}{S_h \cdot APrC_h} \quad (3)$$

r_h is the private return on investment in the level of education h,

$\bar{E}_{N,h}$, $\bar{E}_{N,h-1}$ is the average net earnings from salaried work of its graduates h και h-1 level of education respectively,

S_h is the duration of studies in years at the level of education h,

$APrC$ is the average annual total private cost of education which is equal to the sum of Average Direct Private Cost (A.D.Pr.C) and Average Indirect Private Cost (A.IND.Pr.C) in Education.

$$APrC = \text{A.D.Pr.C} + \text{A.IND.Pr.C} \quad (4)$$

The application of the Short-cut Method entails two assumptions. First, that the difference in the earnings of wage earners, graduates at education levels h, h-1, is constant during the working life and second, that the annual average cost can be summed over the years of study without compounding or discounting (Psacharopoulos, 1994).

4. Review of Empirical Studies

Over the last six decades, numerous studies have been conducted both internationally and, on a country, -by-country basis in order to assess the rates of return on private investment in education (Psacharopoulos, 1973, 1985, 1994). There are two dominant approaches used to estimate private investment and policies in education. The first approach is based on the basic and extended-earnings function methods Mincer (Psacharopoulos and Patrinos, 2004) and the second approach is based on the cost-benefit analysis (Short-cut, Elaborate).

Internationally, literature review shows that education is a profitable investment. This suggests that the acquisition of educational skills and knowledge is an important factor for the development and economic well-being of an individual and a country in general. Psacharopoulos and Patrinos (2018) based on 705 estimates, over the years 1950 to 2014 indicated that the private rate of return to an additional year of schooling is 8.8 percent worldwide. López-Rodríguez et al. (2021) estimated the returns to education in Spain from 2014 to 2019 showed a decrease and reached 8.84% in 2019. A more detailed analysis by gender revealed that the efficiency of education was 9.12% for males and 10.33% females. According to Melianova et al. (2021), Russia is a country with a high level of education, and the returns peaked in the early 2000s, reaching around 10%, followed by a declining trend that brought returns to 5.6% by 2018. Horie & Iwasaki (2021) analyzed 848 estimates from 43 studies on the returns to education in European countries and revealed a decreasing trend over time in the returns from education in European emerging markets overall. Montenegro and Patrinos (2022) examined the efficiency of education in 28 countries in Europe and Central Asia using the Mincer method. As an illustration, estimates of returns in the private sector of work by country are presented with the reference year: Poland (2020) 6.01%, Georgia (2019) 9.91%, Germany (2018) 12.90%, Italy (2016) 9.46%, Greece (2016) 8.15%, Spain (2016) 9.53%, Estonia (2016) 8.01%, Finland (2016) 9%, Serbia (2016) 7.44%, Armenia (2016) 5.19%, Luxembourg (2013) 9.62%, etc.

Conclusions of studies estimating private rate of returns in secondary education and upper secondary education (overall, general and vocational) are presented below, first internationally and then for Greece.

In secondary education, Montenegro and Patrinos (2014) based on 819 observations from 139 economies between 1970 and 2013 estimated that the private rate of return is 7.2%. Psacharopoulos και Patrinos (2018) estimated private efficiency in secondary education after 2000 at 13.2% on average in high-income countries globally. Indicatively, some countries with the corresponding rates of private efficiency are listed: Austria (10.4%), Canada (11.2%), Czech Republic (14.2%), Denmark (14.4%), Estonia (21.9%), Finland (6.1%), France (9.4%), Great Britain (11%), Hungary (14.2%), Iceland (7.2%), Italy (8.1%), Korea, Rep. (3.7%), Luxembourg (10.2%), Netherlands (5.5%), Sweden (18.3%) etc.

In upper secondary education, Cholezas (2005) estimated the private efficiency for a group of 13 European Union countries. In 2000, the largest private return of upper secondary education was found in Portugal, followed in descending order by Luxembourg, Greece, Spain, Italy, the United Kingdom, Austria, Ireland, France, Germany, Denmark, Belgium and Finland. For males, the maximum private rate of return of upper secondary education is noted in Portugal and the minimum in Denmark. Greece is in third place in the ranking. In the majority of countries in upper secondary education males perform lower than females. The same conclusion is reflected in OECD (2020) for most OECD countries such as Finland, Germany, Ireland, Israel, Denmark, Italy etc. with the exception of Luxembourg, Norway, Slovakia and the United Kingdom. Recently, Cheung (2021) estimated the private return to education in Hong Kong (2016) using the Mincer method and found that the earnings of individuals with upper secondary education is 28.7% higher of them who have completed secondary education or below and Gashi and Adnett (2022) estimated the private and social efficiency of investments in education in Kosovo using the short-cut method and found that in public upper secondary education, the private efficiency of education is 6%.

By type of upper secondary education, Psacharopoulos (1994) concluded that on a global scale, private efficiency in general secondary education is 11.7% and is higher than the corresponding efficiency in the vocational direction which is 10.5%. The same conclusion has been drawn from Psacharopoulos and Patrinos (2004) for countries such as Argentina (with corresponding rates of private efficiency of 12.3% vs. 11%), Brazil (12% vs. 10%), Panama (15% vs. 9.9%), Mexico (12.4% vs. 12.3%), Peru (6% vs. 5.9%) while the reverse has been estimated in countries such as Bolivia (6.6% vs. 10.4%), Chile (9.4% vs. 13.1%), Honduras (19.8% vs. 28.1%), Uruguay (8.2% vs. 10.2%) and Venezuela (8.9% vs. 13.1%). Cox (2006) added that many (developing) countries are reducing traditional vocational education and directing most or all students to general secondary education. Patrinos and Psacharopoulos (2020) found that general secondary education is more profitable compared to vocational education. Additionally, the research indicated that in many countries, the wage returns to academic qualifications are significantly higher than those of vocational qualifications, government training programs, and adult skill training.

However, contrasting findings exist in studies like those conducted by Moenjak and Worswick (2003), as well as Almeida et al. (2015), which observe a positive impact of vocational education compared to general education in Thailand and Brazil, respectively. Similarly, results are observed in China by Yang (2017), Guo and Wang (2020), Chen & Pastore (2024), and in the Philippines by Vandenberg and Laranjo (2021). Patrinos et al. (2021) estimated the private and social returns to education investment in Turkey (2017) with the Mincer method and the discounting method. The analysis leads to the conclusion that the private returns for graduates of vocational secondary education are higher than those of the

general academic track. Additionally, the returns to education for females are higher than those for males. Seonkyung et al. (2023) studied how vocational upper-secondary education in Indonesia affects the labor market, with an emphasis on gender differences. They found that males who complete vocational upper-secondary education are more likely to work in jobs that meet the criteria of decent work (reflected in both wages and benefits) compared to those with lower-secondary or general upper-secondary education.

In Greece, a limited number of empirical studies have been carried out assessing the efficiency of private investment in education from the early 1960s until recently. Most are based on data from the Household Budget Survey of the Hellenic Statistical Authority (ELSTAT) and stratified sampling by independent researchers. Leibenstein (1967) first estimated the efficiency of education through a very small sample of individuals working in businesses and industry in the wider area of Athens, from which it emerged that the private efficiency in Secondary Education was 7.2% and in Tertiary Education was 14%. Social efficiency in Secondary Education was 6.3% and in Tertiary Education was 13.7%. By applying the Mincer method, the private efficiency of education was approximately 9% (Psacharopoulos, 1999).

Studies that estimated the efficiency of education in Greece are: Lambropoulos and Psacharopoulos, 1990; Psacharopoulos, 1994; Psacharopoulos and Tsamadias, 2001; Tsamadias, 2001; 2002; 2004, Kanellopoulos et al., 2003; Chanis and Tsamadias, 2013; Cholezas et al., 2013; Agiomirgianakis et al., 2018; etc. Review of empirical studies conducted by Psacharopoulos, 1994; Psacharopoulos and Patrinos, 2002; Mora, et al., 2007; Psacharopoulos and Patrinos, 2018.

In Greece, very few studies have been carried out and published on private rate of returns on secondary education [Psacharopoulos, 1982; Psacharopoulos and Kazamias, 1985; Magoula and Psacharopoulos, 1999] and on the upper secondary education system in Greece [Kanellopoulos, 1985; Magoula and Psacharopoulos, 1999; Tsakloglou and Cholezas, 2000-2001; Cholezas and Tsakloglou, 2006; Prodromidis and Prodromidis, 2008]. Private rate of returns of investment on secondary education has not been recently estimated.

More specifically, Kanellopoulos (1985) applying the Mincer method estimated the return on private investment in education on average at about 7-8%. Magoula and Psacharopoulos (1999) estimated that the return on private investment in education in General Lyceum is 6.7% and in Vocational/Technical Lyceum that it is 6.3%. The return on private investment in education is lower for males than for females. The same conclusion was reached by Tsakloglou and Cholezas (2000-2001) and also, pointed out that males' private performance in general education is higher than in technical education at comparable levels of the education system (upper secondary education), whereas in the case of females, this applies only to higher education. Cholezas and Tsakloglou (2006) estimated that private efficiency in upper secondary education is higher in the private work sector than in the public sector for both genders by using the standard Mincerian earnings function. In most cases, in the private sector the efficiency of private investment is higher in general than in vocational upper secondary education. Prodromidis and Prodromidis (2008) estimated the efficiency of private rates of return in education in Greece with the Mincer method. The research findings suggested that the efficiency of private investment in upper general secondary education is 5.7% and is higher than that of upper vocational secondary education which is 3.5%. Also, and that the rates of return of female upper general secondary education graduates is 8.2% and exceed those of male graduates which is 3.9%. In vocational upper secondary education, males have slightly higher rates of returns than females (3.7% and 3.5% respectively).

5. Empirical Analysis

The sampling and the sample are presented and then the efficiency of private investments in Upper Secondary Education is estimated overall and separately in Upper Secondary General and Vocational Education, as well as by gender, using the Mincer method and the short-cut method.

5.1 Sampling and sample

For the estimation of the efficiency of private investments in upper secondary education and separately in general and vocational secondary education, net annual income data were collected, using primary statistical research. The data related to the net annual income of employees from their paid employment in the private sector, their years of work experience, and other independent variables. They concerned graduates of upper secondary education, upper general and vocational secondary education and lower secondary education graduates, without additional education and working full-time in the private sector. Their annual income does not take into account extraordinary remuneration (e.g. overtime, remuneration in kind), nor remuneration from additional education. The research of income from wage labor was done using cross-sectional data of the year 2020 (reference period) from the three production sectors (primary, secondary, tertiary). Stratified sampling was done, because it offers greater accuracy in estimates (Zairis, 1991).

The total size of the sample and of the layers, n_0 determined by the type (5):

$$n_o = \frac{\sum W_h \cdot S_h^2}{\bar{Y}^2 \cdot CV^2(\bar{y})} \quad (5)$$

$W_h = \frac{N_h}{N}$ is the weight of each stratum in the population

N: population size,

N_h : the size of the h stratum,

S_h^2: the variance of stratum h, which was replaced by the value obtained based on the observations of the pilot sample.

CV: the coefficient of variation

$\bar{Y}$: the real average earning of Gymnasium, General Lyceum and EPAL graduates, which was replaced by the value obtained based on the observations of the pilot sample.

The sampling for the conduct of the survey was divided into two populations-categories and two subpopulations-subcategories as follows:

The first category includes graduates of Upper Secondary Education (Lyceum) who work as full-time employees in the private sector of the economy throughout Greece. According to the survey of the Hellenic Statistical Service (2020), the size of this category was 583,143 people.

This category was divided into two subcategories: The first subcategory includes graduates of upper general secondary education (General Lyceum-GEL). The size of this subcategory was 437,940 people. The second subcategory includes graduates of upper vocational secondary education (EPAL). The size of this subcategory was 145,203 people.

The second category includes graduates of lower secondary education (Gymnasium) who work as full-time employees in the private sector of the economy throughout Greece. The size of this category was 129,939 people.

The research did not take into account the graduates of secondary education, who work as freelancers or self-employed, because it is not possible to separate from their income the amount of money that resulted from their work and the amount of money that resulted in the production process from the other factors of production (natural resources, capital, entrepreneurship). Secondary school graduates working in the private sector were also not taken into account.

Table 2 presents the structure of the population and sample by level of education in the private employment sector in Greece.

Table 2.

Structure of the population and of the sample by level of education in private sector of employment in Greece, 2020

Educational levels	**Private Sector**			
	Population	**Sample**		
		All	**Males**	**Females**
Graduates of Gymnasium	129,939	347	176	171
Graduates of Lyceum	583,143	1,554	870	684
Total	713,082	1,901	1,046	855
	Population	**All**	**Males**	**Females**
Graduates of GEL	437,940	1,167	631	536
Graduates of EPAL	145,203	387	239	148
Total Graduates of Lyceum	583,143	1,554	870	684

Source: Hellenic Statistical Authority (2020) and sample data derived from the researcher

5.2 Private Rate of Return

The person who is educated in upper secondary education acquires human capital (knowledge, skills). It is important to estimate whether the return on investment made by the individual in this level of education is satisfactory. The economic evaluation of private investments is carried out using the Mincer and Sort-cut Method.

5.2.1 Mincer Method

The paper estimates the private rate of return on investment in Upper Secondary Education overall, by type of education (general, vocational) and by gender with Mincer method. Estimates are made with years:

a. of actual experience and
b. of potential experience

Table 3 and Table 4 presents the private rate of return of investment in Upper Secondary Education overall and by gender with actual and potential years of work experience respectively.

Table 3.

Private Rate of Return of investment in Upper Secondary Education overall and by gender (Actual years of work experience- Control group the graduates of Gymnasium)

Independent variables	**All**	**Male**	**Female**
α (constant)	8.3443** (319.91)	8.40762** (236.09)	8.29387** (223.26)
S	0.04825** (22.31)	0.044768** (15.34)	0.050412** (16.13)
EX	0.045878** (51.18)	0.04474** (38.96)	0.04702** (34.24)
EX^2	-0.0008033** (-33.99)	-0.0007686** (-25.90)	-0.000843** (-23.61)
Adj. R^2	0.7531	0.7608	0.7548
F	1,932.32	1,109.15	877.39
Significance	0.000	0.000	0.000
N	1,901	1,046	855

Note: ** Significance at the 5% level
Values in parentheses are the values of the t statistic

Table 4.

Private Rate of Return of investment in Upper Secondary Education overall and by gender (Potential years of work experience-Control group the graduates of Gymnasium)

Independent variables	**All**	**Male**	**Female**
α (constant)	7.898** (268.12)	7.967** (224.50)	7.831** (174.77)
S	0.0725** (31.70)	0.06762** (24.50)	0.07572** (21.79)
EX	0.04515** (43.09)	0.04723** (40.07)	0.04444** (25.51)
EX^2	-0.0006159** (-26.87)	-0.0006632** (-25.75)	-0.0005979** (-15.69)
Adj. R^2	0.7377	0.7979	0.7091
F	1,782.59	1,376.54	694.79
Significance	0.000	0.000	0.000
N	1,901	1,046	855

Note: ** Significance at the 5% level
Values in parentheses are the values of the t statistic

Figures in Table 3 present private rate of return in upper secondary education with Mincer method, with actual years of work experience and reveal that investing in Upper Vocational education is efficiency. The rate of private return on investment in upper secondary education is estimated at the level of 4.8%. In particular, efficiency is 4.5% for males and 5% for females. In upper secondary education males perform lower returns than females. The results are statistically significant and consistent with the findings of other studies (Tsakloglou and Cholezas, 2000-2001; Sakellariou, 2003; Cholezas, 2005; Cholezas and Tsakloglou, 2006; Prodromidis and Prodromidis, 2008; OECD, 2013; OECD, 2020; etc.).

Figures in Table 4 present private rate of return in upper secondary education with Mincer method, with potential years of work experience and reveal that the rate of private return is estimated at the level of 7.3%. In particular, efficiency is 6.8% for males and 7.6% for females. The results are quite close to the estimates of Magoula and Psacharopoulos (1999).

Overall, the results suggests that upper secondary education has a positive effect on the private rate of return on investment in education.

Table 5 and Table 6 presents private rate of return of investment in upper general secondary education overall and by gender with actual and potential years of work experience respectively.

Table 5.

Private Rate of Return of investment in Upper General Secondary Education overall and by gender (Actual years of work experience- Control group the graduates of Gymnasium)

Independent variables	**All**	**Male**	**Female**
α (constant)	8.30998** (312.14)	8.3729** (228.44)	8.2586** (220.03)
S	0.05145** (23.28)	0.04832** (16.16)	0.05360** (16.88)
EX	0.046207** (45.88)	0.044664** (33.86)	0.047602** (31.72)
EX^2	-0.0008021** (-31.00)	-0.0007579** (-22.65)	-0.0008485** (-21.71)
Adj. R^2	0.7555	0.7546	0.7662
F	1,559.70	827.31	772.22
Significance	0.000	0.000	0.000
N	1,514	807	707

Note: ** Significance at the 5% level
Values in parentheses are the values of the t statistic

Table 6.

Private Rate of Return of investment in Upper General Secondary Education overall and by gender (Potential years of work experience- Control group the graduates of Gymnasium)

Independent variables	**All**	**Male**	**Female**
α (constant)	7.871** (250.37)	7.939** (215.18)	7.797** (162.14)
S	0.0754** (31.32)	0.0709** (25.13)	0.0788** (21.36)
EX	0.04483** (36.99)	0.04669** (34.91)	0.04460** (225.26)
EX^2	-0.0006027** (-23.01)	-0.0006477** (-22.46)	-0.0005921** (-13.66)
Adj. R^2	0.7278	0.7965	0.6995
F	1,349.71	1,052.72	548.73
Significance	0.000	0.000	0.000
N	1,514	807	707

Note: ** Significance at the 5% level
Values in parentheses are the values of the t statistic

Figures in Table 5 present private rate of return in upper general secondary level with Mincer method, with actual years of work experience and reveal that investing in upper general secondary level is efficiency. The rate of private return on investment in upper general secondary Education is 5.1%. In particular, the efficiency for males is 4.8% and for females is 5.4%. Figures in Table 6 present private rate of return in upper general secondary level with Mincer method, with potential years of work experience and reveal that the rate of private efficiency in upper general secondary education is estimated at the level of 7.5%. In particular, the efficiency for males is 7.1% and for females is 7.9%. Estimates of efficiency rates are statistically significant at a significance level of 5% and are close to the estimates of Magoula and Psacharopoulos (1999).

Overall, the result suggests that investing in upper general secondary education has a positive economic return, and this applies to both males and females. The findings of the survey are consistent with the conclusions of other researchers (Prodromidis and Prodromidis, 2008).

Table 7 presents the private rate of return of investment in upper vocational secondary education overall and by gender with actual years of work experience.

Table 7.

Private Rate of Return of investment in Upper Vocational Secondary Education overall and by gender (Actual years of work experience- Control group the graduates of Gymnasium)

Independent variables	**All**	**Male**	**Female**
α (constant)	8.421** (246.02)	8.490784** (190.54)	8.39187** (161.84)
S	0.03936** (13.50)	0.03600** (9.76)	0.03880** (8.47)
EX	0.04513** (28.55)	0.04339** (22.50)	0.046386** (18.06)
EX^2	-0.0007601** (-18.41)	-0.0007209** (-14.34)	-0.0007927** (-11.83)
Adj. R^2	0.7486	0.7617	0.7383
F	728.72	442.06	300.02
Significance	0.000	0.000	0.000
N	734	415	319

Note: ** Significance at the 5% level
Values in parentheses are the values of the t statistic

Figures in Table 7 present private rate of return in upper vocational secondary education with Mincer method, with actual years of work experience and reveal that investing in upper vocational education is efficiency. The rate of private return in vocational upper Secondary Education is estimated at the level of 3.9%. In particular, the efficiency for males is 3.6% and for females is 3.9%. Estimates of rates of returns are statistically significant at the 5% significance level and they are consistent with the conclusions of other researchers (Prodromidis and Prodromidis, 2008).

Table 8 presents private rate of return of investment in upper vocational secondary education overall and by gender with potential years of work experience.

Table 8.

Private Rate of Return of investment in Upper Vocational Secondary Education overall and by gender (Potential years of work experience- Control group the graduates of Gymnasium)

Independent variables	**All**	**Male**	**Female**
α (constant)	7.935** (196.09)	8.033** (159.09)	7.879** (130.81)
S	0.0677** (21.98)	0.06116** (16.06)	0.06943** (14.88)
EX	0.04371** (25.82)	0.04471** (22,43)	0.04291** (15.87)
EX^2	-0.0005536** (-15.41)	-0.0005868** (-13.97)	-0.0005265** (-9.09)
Adj. R^2	0.7407	0.7673	0.7432
F	699.06	455.95	307.79
Significance	0.000	0.000	0.000
N	734	415	319

Note: ** Significance at the 5% level
Values in parentheses are the values of the t statistic

Figures in Table 8 present private rate of return in upper vocational secondary education with Mincer method, with potential years of work experience and reveal that the rate of private return is estimated at the level of 6.8%. Specifically, the efficiency for males is 6.1% and is less than the private efficiency for females which is 6.9%. Estimates of efficiency rates are statistically significant at the 5% significance level and are quite close to the estimates of Magoula and Psacharopoulos (1999).

Overall, the result suggests that investing in upper vocational education is efficiency and this applies to both males and females.

Table 9 summarizes the figures in Tables 3, 4, 5, 6, 7 and 8.

Table 9.

Private Rate of Return of investment in Upper Secondary Education and separately for Upper General and Vocational secondary education in Greece overall and by gender using actual and potential years of experience and net earnings

Private Rate of Return (%)						
Education	Actual Experience			Potential Experience		
	All	Male	Female	All	Male	Female
Lyceum	4.83	4.48	5.04	7.25	6.76	7.57
GEL	5.15	4.83	5.36	7.54	7.09	7.88
EPAL	3.94	3.6	3.88	6.77	6.12	6.94

Source: Edited by the researcher
Note: Using the basic Mincer function
** Significance at the 5% level

Table 9 reveals that the rate of private efficiency of Upper General Secondary Education is greater than that of Upper Vocational Secondary Education in the private employment sector. This finding is consistent with the conclusion of Magoula and Psacharopoulos (1999), Prodromidis and Prodromidis (2008) and contradicts the conclusions of other researchers [Moenjak and Worswick (2003); Almeida et al. (2015); Guo and Wang (2020); Chen and Pastore (2024); etc.]
The efficiency of male graduates of Upper General Secondary Education is greater than that of male graduates of Upper Vocational Secondary Education in the private sector of work. This finding is consistent with most findings of other research [Tsakloglou and Cholezas (2000-2001), Sakellariou (2003), Haidy et al. (2007) etc.], while contradicting Moenjak and Worswick (2003) conclusion. In addition, Table 9 reveals that the efficiency of female graduates of Upper General Secondary Education is greater than that of female graduates of Upper Vocational Secondary Education in the private sector of work.

5.2.2 Short-cut method

Initially, the average net income of Gymnasium, Lyceum, GEL and EPAL graduates in Greece, per classes of years of work experience, graphically presented in Figure 1.

Figure 1. Mean Annual Net Earnings (Y_N) of Gymnasium, Lyceum, GEL and EPAL graduates in Greece in classes based on years of work experience, in euros, for the year 2020

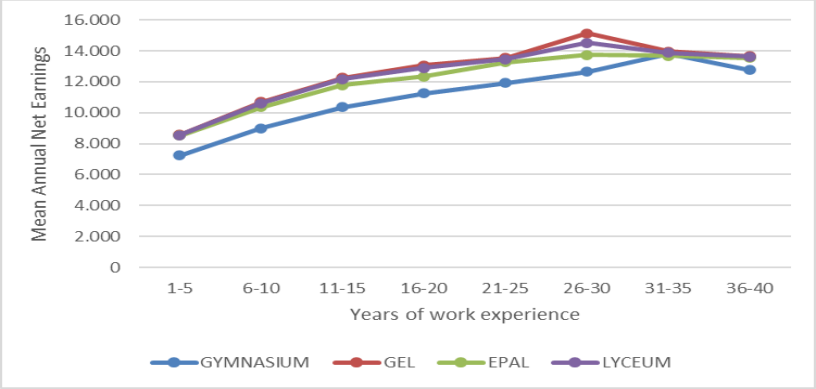

Figure 1 reveals that in all classes salaried graduates of Lyceum, GEL and EPAL receive a higher net income than salaried graduates of Gymnasium, thus confirming the theory of human capital. In addition, it reveals that in all classes, salaried graduates of GEL receive higher net income than salaried graduates of EPAL. According to the OECD (2020), among people with upper secondary or post-secondary non-tertiary education, people with general qualifications and people with vocational qualifications have similar relative earnings. The pay gap is at most 5% in about a third of OECD and partner countries. However, in Austria, Finland, Germany, France, and the United Kingdom, this difference ranges from 15-20% in favor of general education. There are countries such as Canada, Costa Rica, and the Czech Republic, where the pay gap is about 20% or more in favor of vocational qualifications.

The private efficiency of upper secondary education with short-cut method is estimated by Model [3]. The short-cut method estimates the private rate of return using the average net incomes of graduates of Upper Secondary Education, Upper Secondary General and Vocational Education and Lower Secondary Education (Gymnasium).

The Average Private Cost (APrC) of Upper Secondary Education (overall, general, vocational) is calculated by the type [4].

According to data from the Hellenic Statistical Authority (2021) and the researcher's calculations on household expenditure on public education, it emerged that a total of 713,300,000€ was spent in the year 2019 in Upper Secondary education. Of this, 603,600,000€ was spent in Upper General Secondary education and 109,700,000€ in Upper Secondary Vocational education.

In Greece, the average direct private cost is 2,127.81€ per student in Upper Secondary Education. More specifically, per type of upper secondary education, the average direct private cost is 2,583.61€ per student in General Education and 1,079.71€ per student in Vocational Education.

Average Indirect Private Cost (A.IND.Pr.C) includes the income foregone of graduates in Upper Secondary Education (overall, general, vocational) and is calculated 10,313.53€, equal to the average net income of Gymnasium graduates.

Table 10 shows the Average Private Cost (APrC) of Upper Secondary Education (overall, general, vocational) and the private rates of return of investment in Upper Secondary Education in Greece by the short-cut method.

Table 10.

Private Rates of Return of Investment in Upper Secondary Education in Greece by the short-cut method

Education	$\bar{E}_N$	AP_rC	Private Rate of Return (r%)
Graduates of Gymnasium	10,313.53		
Graduates of Lyceum	11,383.23	12,441.34	2.87
Graduates of GEL	11,478.87	12,897.14	3.01
Graduates of EPAL	11,094.85	11,393.24	2.29

Source: Edited by the researcher

Based on the calculations, the percentage of private efficiency of upper secondary education is estimated to be 2.87%. The percentage of private efficiency in upper secondary General Education is 3.01% and is higher than the corresponding percentage of upper secondary Vocational Education estimated to be 2.29%. Although the average private cost of vocational education is lower than that of general education, general education has a higher rate of private return, because the difference between the average net incomes of salaried Gymnasium graduates from GEL graduates is greater than that of Gymnasium graduates from EPAL graduates (Figure 1). Table 11 presents the overall results of the survey with Mincer and Sort-cut method.

Table 11.

Private Rate of Return of Investment in Upper Secondary Education with Mincer and Short-cut Method

Private Rates of Return (%)			
Education	**Basic Mincer** Actual Experience	**Basic Mincer** Potential Experience	**Short-cut Method**
Lyceum	4.83	7.25	2.87
GEL	5.15	7.54	3.01
EPAL	3.94	6.77	2.29

Source: Edited by the researcher

Table 11 shows that private investments in the system of Upper Secondary Education are more advantageous and profitable compared than other alternative investments, taking into account the fact that the interest rate of the ten-year bond for the year 2020 was 1.27%. This finding is consistent with the conclusion of Haidy et al (2007). In addition, upper general secondary education is more efficient than upper vocational secondary education. This finding is consistent with the conclusion of other researchers [Prodromidis and Prodromidis, (2008); Patrinos and Psacharopoulos, (2020)].

Private efficiency in Upper Secondary Education (overall, general, vocational) when estimated by the Mincer method shows higher values than when estimated by the Short-cut method. The Mincer method has the disadvantage of not including the cost of training in the calculation of private efficiency. A combination of techniques is certainly useful to better approach the private profitability of investing in education. In addition, it should be pointed out that investment in education is not limited to financial performance. These investments have wider implications associated with benefits to quality of life, social progress and the development of society.

6. Conclusions

This paper estimates the private rates of returns of Upper Secondary Education in Greece but also separately of Upper General and Vocational Secondary Education. The estimation was made using Mincer's basic experience-income function and the short-cut method. Empirical research innovates in that its data have emerged from primary research in the private sector of the economy, in which differences in productivity are most clearly reflected. Stratified data were collected from the three sectors of Greek economic activity (primary, secondary, tertiary) and actual work experience was used, as derived from the sampling of graduates' earnings as well as potential work experience. In addition, private efficiency was estimated by using the Mincer method and by gender.

The findings of the survey converge in the conclusion that the investment of individuals in Upper Secondary Education is profitable. Individuals who invest in this level of education have financially benefits from the knowledge and skills they acquire. In particular, investment of individuals in the system of Upper General Secondary Education is more efficient than the investment of individuals in the system of Upper Vocational Secondary Education overall and by gender. This finding is consistent with most other research findings. The private efficiency of female upper secondary education graduates is greater than that of males overall and by type of education (general and vocational). The private efficiency of Upper Secondary Education (overall and separately General and Vocational) when is estimated by using potential experience is greater than its corresponding value when is estimated by using actual experience.

It follows from the above that upper secondary education enhances the skills and knowledge of individuals and contributes to the improvement of the production process and economic growth, through the creation of human capital. Investing in upper secondary education is the responsibility of individuals and society. It is important to optimally design the structure of Upper Secondary Education. It is necessary to create educational programs that will be oriented to the needs of the labor market and society. Finally, upper secondary education, whether general or vocational, is necessary to provide skills and knowledge that will allow individuals to successfully integrate into the working environment, allowing them to face the challenges and take advantage of the opportunities of the future.

References

Agiomirgianakis, G., Lianos, T., & Tsounis, N. (2018). Returns to Investment in Higher Education: Is There a Difference between Distance Learning and Traditional Universities in the Fields of Physics, Mathematics, Social Studies, Computer Science and Economics? Creative Education, 9, 2920-2938.

Almeida, R., Anazawa, L., Filho, N. M., & Vasconcellos, L. (2015). Investing in Technical & Vocational Education and Training. Does It Yield Large Economic Returns in Brazil? World Bank Group. Education Global Practice Group. Police Research Working Paper.

Anchor, J. R., Fišerová, J., Maršíková, K., & Urbánek, V. (2011). Student expectations of the financial returns to higher education in the Czech Republic and England: Evidence from business schools. Economics of Education Review, 30 (4), 673-681.

Barouni, M., & Broecke, S. (2014). The Returns to Education in Africa: Some New Estimates. The Journal of Development Studies, 50 (12), 1593-1613. Retrieved from http://dx.doi.org/10.1080/00220388.2014.936394

Becker, G. (1964). Human Capital. New York: NBER.

Belli, P., Khan, Q., & Psacharopoulos, G. (1999). Assessing a higher education project: a Mauritius feasibility study. Applied Economics, 31, 27-35.

Bennett, R., Glennerster, H., & Nevison, D. (1995). Regional Rates of Return to Education and Trainingin in Britain. Regional Studies, 29 (3), 279-295.

Chanis, S. & Tsamadias, C. (2013). The Evaluation of Private Investments on the Greek Post-Secondary Initial Vocational Education and Training. International Journal of Economic Practices and Theories, 3 (4).

Chen, J., & Pastore, F. (2024). Dynamics of returns to vocational education in China: 2010–2017. Humanities and Social Sciences Communications, 118, (11).

Cheung, J. (2021). Estimating the return to education in Hong Kong: An econometric approach. Office of the Government Economist. Economic Letter 10.

Cholezas, I. (2005). Private returns to education in Greece and the European Union. Athens University of Economics and Business. Doctoral Thesis.

Cholezas, I., & Tsakloglou, P. (2006). Gender Earnings Differentials in the Greek Labour Market. Economic Policy Studies.

Cholezas, I., Kanellopoulos, N. C., Mitrakos, T., & Tsakloglou, P. (2013). The impact of current crisis on private returns to education in Greece. Economic Bulletin, 38, 33-63.

Cox, C. (2006). Policy Formation and Implementation in Secondary Education Reform: The Case of Chile at the Turn of the Century. The World Bank.

Gashi, A., & Adnett, N. J. (2022). Estimating the returns to education in a chronically depressed labour market: the case of Kosovo. International Journal of Development, 21 (3), 321-335.

Gjipali, A., & Kristo, S. (2011). Mincer rates of return to education in the emerging economy of Albania. Studies in Business and Economics, 6 (2), 27-36.

Griliches, Z. (1977). Estimating the Returns to Schooling: Some Econometric Problems. Econometrica. The Econometric Society, 45 (1), 1-22.

Guo, D., & Wang, A. (2020). Is vocational education a good alternative to low-performing students in China. International Journal of Educational Development. Elsevier.

Haidy, N., Pasay, A., & Quarina, Q. (2007). Rates of Returns to Vocational and General Upper Secondary Education, and to Experience in Addressing the Hollow Middle in Indonesia. Economics and Finance in Indonesia, 58 (3), 239 - 267.

Heckman, J. J., Lochner, J. L., & Todd, E. P. (2006). Earnings Functions, Rates of Return and Treatment Effects: The Mincer Equation and Beyond. Handbook of the Economics of Education 1, 307-458. Elsevier.

Hellenic Statistical Authority (2021). Public and Private Education Economics Survey.

Horie, N., & Iwasaki, I. (2021). Returns to Schooling in European Emerging Markets: A Meta-Analysis. Center for Economic Institutions. Working Paper Series. No. 2020-11.

Kanellopoulos, C. (1985). Individual Pay Differentials in Greece. Spoudai, 35 (1-2), 109-125.

Kanellopoulos, K. N., Mavromaras, K. G., & Mitrakos, T. M. (2003). Education and Labor Market. Studies No. 50, KEPE.

Lambropoulos, C., & Psacharopoulos, G. (1990). Socio-Economic Dimensions of Tertiary Education. Trends, Problems and Possible Solutions. Journal of Social Research, 77, 172-209.
López-Rodríguez, J., Faíña-Medín, A., & Villasenin-Ramos, M. H. (2021). Returns to schooling in Spain: 2008-2019. The Economic Research Guardian, 11, (2).
Magoula, T., & Psacharopoulos, G. (1999). Schooling and monetary rewards in Greece: an over-education false alarm? Applied Economics, 31 (12), 1589-1597.
Melianova, E., Parandekar, S., Patrinos, H. A., & Volgin, A. (2021). Returns to Education in the Russian Federation: Some New Estimate. 25 (3), 403–422. HSE Economic Journal.
Mincer, J. (1958). Investment in Human Capital and Personal Income Distribution. Journal of Political Economy, 66 (4), 281-302.
Mincer, J. (1974). Schooling, experience, and earnings. National Bureau of Economic Research.
Moenjak, T., & Worswick, C. (2003). Vocational education in Thailand: a study of choice and returns. Economics of Education Review, 22, 99–107.
Montenegro, C. E., & Patrinos, H. A. (2014). Comparable Estimates of Returns to Schooling Around the World. Policy Research Working Paper 7020. World Bank Group.
Montenegro, C. M., & Patrinos, H. A. (2022). Returns to Education in the Public and Private Sectors: Europe and Central Asia. Discussion Paper Series. IZA DP No. 15516.
Mora, J.-G., Vila, L., Psacharopoulos, G., Schmidt, E. K., Vossensteyn, H., & Villarreal, E. (2007). Rates of return and funding models in Europe. Final report to the Directorate-General for Education and Culture of the European Commission. CONTRACT Nº 2006-1665 / 001-001 SO2-81AWB, CEGES.
OECD. (2013). Education at a Glance 2013: OECD Indicators. OECD Publishing. Retrieved from http://dx.doi.org/10.1787/eag-2013-en
OECD. (2020). Education at a Glance 2020: OECD Indicators, OECD Publishing, Paris. Retrieved from https://doi.org/10.1787/69096873-en.
Patrinos, H. A. (2016). Estimating the return to schooling using the Mincer equation. World Bank and Georgetown University, USA.
Patrinos, H. A., & Psacharopoulos, G. (2020). Returns to education in developing countries. The Economics of Education. Second Edition. Elsevier Ltd.
Patrinos, H. A., Psacharopoulos, G., & Tansel, A. (2021). Private and Social Returns to Investment in Education: The Case of Turkey with Alternative Methods. Applied Economics, 53, (14), 1638–1658.
Prodromidis, K. P., & Prodromidis, P. I. (2008). Returns to education: the Greek experience, 1988–1999. Applied Economics, 40, 1023-1030.
Psacharopoulos, G. (1973). Returns to education: An international comparison. Amsterdam: Elsevier.
Psacharopoulos, G. (1982). Earnings and Education in Greece, 1960-1977. European Economic Review, 17, 333-347.
Psacharopoulos, G. (1985). Returns to Education: A Further International Update and Implications. The Journal of Human Resources, 20 (4), 583-604.
Psacharopoulos, G. (1994). Returns to Investment in Education: A Global Update. World Development, 22 (9), 1325-1343.
Psacharopoulos, G. (1999). Economics of education. Athens: Papazisi SA.
Psacharopoulos, G., & Kazamias, A. (1985). Education and Development in Greece: Social and Economic Study of Tertiary Education. Athens: National Centre of Social Research
Psacharopoulos, G., & Layard, R. (1979). Human Capital and Earnings: British Evidence and a Critique. The Review of Economic Studies, 46 (3), 485-503.
Psacharopoulos, G., & Mattson, R. (1998). Estimating the Returns to Education: A Sensitivity Analysis of Methods and Sample Size. Journal of Educational Development and Administration, 12 (3), 271-287.
Psacharopoulos, G., & Patrinos, H. A. (2002). Returns to Investment in Education. A Further Update. The World Bank.
Psacharopoulos, G., & Patrinos, H. A. (2004). Human Capital and Rates of Return. International Handbook on the Economics of Education, 1-57.
Psacharopoulos, G., & Patrinos, H. A. (2018). Returns to Investment in Education: A Decennial Review of the Global Literature. Policy Research Working Paper 8402, World Bank.

Psacharopoulos, G., & Tsamadias, C. (2001). Testing for Screening Using Vocational Skills: The Case of Technological Institutes of Greece. Journal of Educational Planning and Administration, 15 (4), 425-434.

Sakellariou, C. (2003). Rates of Return to Investments in Formal and Technical/Vocational Education in Singapore. Education Economics, 11 (1), 73-87.

Schultz, T. W. (1960). Capital Formation by Education. Journal of Political Economy. 68 (6), 571-583.

Schultz, T. W. (1961). Investment in Human Capital. American Economic Review, 51, 1-17.

Schultz, T. W. (1962). Reflections of investment in man. The Journal of Political Economy, 70 (5), Part 2 (University of Chicago Press).

Schultz, T. W. (1963). The Economic Value of Education. Columbia University Press. New York.

Schultz, T. W. (1968). The Concept of Human Capital: A Reply. Economics of Education. M. Blaug, Penguin.

Schultz, T. W. (1971). Investment in Human Capital: The Role of Education and of Research. Free Press. New York.

Seonkyung, C., Huihui, L., & Keiichi, O. (2023). Upper secondary vocational education and decent work in Indonesia: A gender comparison. International Journal of Educational Development. Elsevier.

Tsakloglou, P., & Cholezas, I. (2000-2001). Private returns to education in Greece. Athens University of Economics and Business.

Tsamadias, C. (2001). Rates of return to private investment in tertiary technological education by faculty. Spoudai, 51 (3-4), 90 – 113.

Tsamadias, C. (2002). The Returns of Investment in Tertiary Technological Education in Greece. Journal of Vocational Education and Training, 54 (1), 147-170.

Tsamadias, C. (2004). The Returns of Private Investments in the Greek Tertiary Technological Education by Gender. Archives of Economic History, 1, 267- 278.

Tsamadias, C. (2020). Economics of Education-Research-Innovation (Vol. I). Athens: Ion.

Vandenberg, P., & Laranjo, J. (2021). Vocational training and labor market outcomes in the Philippines. International Journal of Educational Development. Elsevier.

Yang, Y. (2017). A Research on the Difference of Education. Returns between Urban and Rural Areas. Open Journal of Social Sciences, 5, 59-67.

Zairis, P. (1991). Sampling Techniques. Athens: Rossi Publisher.