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THE IMPACT OF THE CURRENT CRISIS ON PRIVATE RETURNS TO EDUCATION IN GREECE*

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I INTRODUCTION

Exploring the relationship between the position of individuals in the labour market (as reflected in their employment characteristics and remuneration) and their education level and type is an important aspect of economic research and analysis. Examination of these relationships typically brings to the fore efficiency and equality considerations, while also often leading to interesting education and/or employment policy proposals. These issues are particularly relevant and topical for Greece, a small economy for which EU membership and the adoption of the euro as legal tender in 2002 has limited the economic policy tools available, while at the same time has enhanced the role of education and labour market policies.

Furthermore, from 2008 onwards Greece has been experiencing a prolonged financial crisis, which has led it to adopt policies for public expenditure cuts and higher taxes combined with a variety of structural interventions targeting the labour market. The same period also saw major interventions in the field of education. This crisis had a dramatic impact on the Greek labour market, in terms as much of employment and unemployment as of wages. The effects of the crisis on employment and unemployment in most euro area countries, mainly of the European south, are considerable; however, the strength of this impact differs significantly across individual countries (ECB 2012). In Greece, the number of the employed in 2012 Q2 has dropped by 17.2% compared with 2008 Q2, while at the same time average labour costs for the whole economy have declined by 12.5% (data from ELSTAT's Labour Force Survey, following appropriate adjustments). Another driver of this development has been the structural reform efforts to increase labour market flexibility through specific legislative interventions (see Laws 3845/2010, 3899/2010, 4047/2012 and 4093/2012).[1]

Quite naturally, economic recession and the ensuing wage shrinkage in recent years have had a considerable impact on the labour market position and prospects of the young, who are called to decide whether to continue their studies or not, given also the increased probability of unemployment in the current crisis.[2] As recession has brought changes along the entire wage distribution, returns to education,

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1 For a detailed description of institutional changes in the Greek labour market during the crisis see, among others, Cholezas (2010, 2011, 2012 and 2013), Alpha Bank (2013), and the Bank of Greece Annual Reports of recent years. However, the dramatic drop in employment can also be explained in human capital theory terms (Mincer 1958, 1974, Schultz 1961, Becker 1964), given that lower economic activity and employment as a rule entail higher unemployment, which, in turn, may lead to discouragement and labour force exodus and/or emigration in search of work abroad (brain drain). Both these likelihoods result in a waste of economic resources, during a period in which they are more sought and prized than ever.

2 Indicative of the importance ascribed to the impact of the current financial crisis on young people's labour market prospects is the strong public debate held at both national and European level regarding youth unemployment and the need to adopt additional measures to promptly tackle it (see COM 2011, 2012, OECD 2013a, Castillo and Paraire 2013).

i.e. an individual's benefits from acquiring more (further) education, would most likely have changed as well. This means that, from a private perspective, investing in more education may no longer be profitable, considering all the adverse results this would entail for the economy's future growth. The aim of the present study is to examine precisely this likelihood and, specifically, how the current financial crisis has affected, so far, private returns to education for narrowly defined education groups.[3]

In this context, the study examines the development of education/wage relationships, before and during the current financial crisis. The next section briefly reviews the literature on returns to education in Greece, while the third section describes the statistical data and the methodology used. The fourth section presents the results of empirical analysis, and the last section summarises the study's main conclusions.

2 LITERATURE REVIEW

The issue of wage differentials between education system levels in Greece has been examined mainly in the context of exploring (usually private) returns to education. However, owing to limited availability of detailed statistical data, until recently at least, relevant studies estimating returns to education in Greece are relatively scarce. This section summarises the findings of the most prominent among them.[4]

2.1 THE STATISTICAL INFORMATION USED IN EARLIER STUDIES

The primary data used in the published studies on returns to education in Greece cover the period from 1957 up until recently, with the first attempt probably being the one by Leibenstein (1967). Most of the available studies rely on detailed data from household surveys conducted by the Hellenic Statistical Authority (ELSTAT) – typically the Household Budget Survey (HBS), the European Community Household Panel (ECHP), the European Union Statistics on Income and Living Conditions (EU-SILC)[5] – and predominantly from the Labour Force Survey (LFS). It should be noted, however, that practically all databases used in the existing studies estimating returns to education in Greece are cross-sectional, as rather recently most of these household surveys have been redesigned, based also on EU practice, and already simultaneously provide both cross-sectional and longitudinal data.

2.2 THE METHODOLOGY APPLIED IN EARLIER STUDIES AND RELATED PROBLEMS

The methodology applied in most of the available studies for Greece in order to estimate and calculate the effect of education on earnings is limited to an econometric estimation of Mincer's (1974) 'classical' semi-logarithmic human capital equation by way of the Ordinary Least Squares (OLS) method. The education variable is usually expressed in years or education levels using dummy variables, while explanatory variables – such as, among others, potential experience and its square, age, father's education level, etc. – are often added with a view to improve the model's explanatory power.

Kanellopoulos (1997), seeking to calculate real returns for individuals employed in the public sector, applies Heckman's two-step method for correcting the sample bias or selection error. Along the same methodological lines, Kanellopoulos and Mavromaras (2002) attempt to explain wage differentials between men and women. Papapetrou (2004, 2007) embarks on a similar effort through a different methodology, using the quantiles regression method that allows estimating the effect of the independent

3 Changes in the wages of workers of different education groups are usually not uniform and may increase or reduce the benefits from further education for one group compared to another. On the other hand, lower labour income means lower opportunity cost of education, i.e. the pecuniary earnings individuals would receive if they worked. It is impossible to determine a priori which of the two effects will be the strongest.

4 For a similar concise presentation of the relevant literature on private returns to education in Greece, see Mitrakos, Tsakloglou and Cholezas (2010b), while for a more detailed review see Cholezas and Tsakloglou (1999) and Cholezas (2005).

5 For a comparative presentation of the particular characteristics of three household surveys, see Mitrakos and Douros (2006).

variables on the dependent variable along the distribution of the latter.

More recently, Livanos and Pouliakas (2011) correct for selection error and at the same time employ the quantiles regression method, with a view to calculating private returns to education for individual categories of tertiary education graduates. Moreover, Mitrakos, Tsakloglou and Cholezas (2010b) take into account both selection error and unemployment probability at a given time after graduation and calculate private returns to education for narrowly defined specialties of tertiary education. These last two studies' conclusions agree as to the dissimilarity of returns to education among different tertiary education specialties. Finally, earlier works by Leibenstein (1967), Psacharopoulos (1982), Magoula and Psacharopoulos (1999) and Kanellopoulos, Mavromaras and Mitrakos (2003) have calculated social returns to education using cost/benefit techniques.

Almost all findings of the available studies for Greece are consistent with human capital theory, as they confirm a positive effect of education and potential experience on earnings. Moreover, returns to education levels increase with the years of schooling and all additional variables have the expected signs. However, it should be noted that other major assumptions cannot be tested based on the available statistical information, and in fact returns to education are very likely to differ considerably among individuals, depending on, for instance, their abilities or the particular educational institution they attended (in terms of its quality and reputation in the labour market). In addition, the typical use of potential (rather than actual) work experience as an explanatory variable in most studies, may be leading to an overestimated contribution of experience, since it takes no account of periods of unemployment, non-participation in the labour force (e.g. due to pregnancy) or transition between jobs, etc. Furthermore, as several studies use additional independent variables, returns to education are no longer comparable when these variables affect the estimated effect of education on earnings. On the other hand, these variables often enhance the model's explanatory power and enable an exploration of the numerous factors that affect wages, but may be variably affecting returns to education.

Another major consideration when calculating returns to education relates to possible sample selection errors. Indicatively, in the case of female workers, the sample includes only women who have consciously opted to participate in the labour market. Nevertheless, when working women are not chosen at random, i.e. if they are primarily women with more years of schooling or unmarried, then they are not adequately representative of the entire female population. As a result of such selection errors, estimates need to be corrected using appropriate techniques.

2.3 A COMPARATIVE PRESENTATION OF EARLIER FINDINGS

Obviously, the different statistical information, but above all the methodological dissimilarities and the considerations presented in the previous subsections, disallow a direct comparison of findings. Bearing in mind this limitation, the findings of the available studies reveal the following:

First, returns to education in Greece decrease until the late 1980s and increase in the following decade. This improvement of returns to education after the 1980s is attributed to the steady growth path of the Greek economy and the ensuing higher demand for skilled personnel, in parallel with the abandonment of the income policy for a convergence of wages pursued mainly in the 1980s.[6]

Second, in most studies returns to each individual education level reveal an almost linear

6 Indeed, the estimated return to one additional year of schooling stands at 7.8% in 1964 (Kanellopoulos 1985), falls to 5.8% in 1977 (Patrinos 1992) and to 2.5% in 1985 (men-women average, Patrinos and Lambropoulos 1993), only to recover to 7.6% in 1994 (Magoula and Psacharopoulos 1999) and to even higher levels in 1999 (Cholezas 2005, Prodromidis and Prodromidis 2008).

relationship with the years of schooling, with the possible exception of tertiary and, mainly, university education. For instance, in 1994 returns were estimated at 6.7% for higher general secondary education, 6.3% for the respective technical education, 6.9% for Technological Educational Institutes (TEI), and 8.7% for Universities (AEI) (Magoula and Psacharopoulos 1999), whereas in 1999 the corresponding percentages for men (women) were 9.3% (12.5%), 9.6% (7.9%), 11.1% (21.2%) and 14.5% (16.3%) (Cholezas 2005).[7]

Third, in terms of returns to education, Greece seems to rank at one of the top positions among EU Member States, at least according to the analysis by Cholezas (2005) for the second half of the 1990s based on ECHP data. The same study estimates higher returns to education for other South European countries as well, whereas other studies that use different databases for each country arrive at opposite conclusions (Harmon, Walker and Westergaard-Nielsen 2001, OECD 1998, 2010).

Fourth, based on the results of the available studies, the exploration of returns to education by gender seems to reveal a major change over time. Indeed, although women often seem to have enjoyed lower returns in the past, the latest data show a reversal of the situation, as returns to education for women now markedly surpass the respective returns for men.[8] Of course this does not mean that the wages of women are higher than those of men, as they mainly relate to other productive characteristics as well (Cholezas 2005).

Fifth, the coefficient of potential experience (including tenure or not) is always positive and demonstrates the importance of past professional experience in the wage-setting process. However, in the Greek labour market it is not clear whether past professional experience raises wages on account of increased productivity or because of statutory wage increases over the years, such as three-year and seniority increments. The tenure coefficient, albeit included only in a few studies, is positive and higher than the experience coefficient. This fact probably implies that employers value more the experience gained inside the enterprise at issue, deeming job-specific experience as more important than general experience. Indeed, when tenure is included in the independent variables, the return to one additional year of schooling falls by roughly one percentage point (Kanellopoulos 1985). All the other variables used have the expected signs. Of particular interest is the higher return to one additional year of schooling observed for individuals with higher father's education level (Patrinos 1992, 1995), as evidence of transmission of wage inequalities across generations. As regards returns to education by employment sector, it seems that these are usually higher in the private sector (Hadjidema 1998).

Sixth, gender discrimination in the labour market is yet another point of interest related to returns to education. Available studies show that wage differentials between men and women in Greece are largely due to discrimination in the labour market, since 71.5% (53.8%) of their wage differentials in 1988 (1994) cannot be explained based on differences in terms of male and female human capital (Kanellopoulos and Mavromaras 2002). Between 1988 and 1999 the gender wage gap in the private sector slightly increases but, regardless of the methodology used, most of it still cannot be explained by differences observed in the human capital stocks of men and women (Cholezas 2005).[9] Moreover,

7 Prodromidis and Prodromidis (2008) report slightly different results for these two years. Returns to higher general secondary education were 6.1% in 1994 and 5.7% in 1999, to higher technical secondary 5.3% and 3.5%, to TEI 5.1% and 9.4%, and to AEI 6.3% and 9%, respectively.

8 Specifically, in 1964 the estimated return to one additional year of schooling stood at 6.6% for male and 6.5% for female employees (Kanellopoulos 1985), while the respective percentages for men (women) were 7.1% (11.4%) in 1974, 5.2% (6.4%) in 1988, 6.7% (7.8%) in 1994, and 7.2% (8.9%) in 1999 (Cholezas 2005). Prodromidis and Prodromidis (2008) also find higher returns to all education levels for women in 1999, while in 1994 women have higher returns only to secondary education.

9 At this point it should be noted that, as a rule, human capital is measured in quantitative (e.g. years of education) and not qualitative (e.g. education specialty) terms, while other factors that may be having an effect on wages, such as inherent abilities, are not taken into account.

although major disparities emerge between the earnings of men and women when also taking into account the workers' education level and position along the wage distribution, in most cases wage differentials cannot be explained by differences in their productive characteristics (Papapetrou 2007, Papapetrou 2008).[10]

Finally, the literature also explores a series of individual questions related one way or another to returns to education. Thus, although according to human capital theory positive returns to education result from higher productivity, according to filter theory they may be stemming from the fact that education signals to employers their (prospective) employees' higher skills. In such cases education may actually represent a waste of resources, since it does not contribute to higher worker productivity.[11]

3 STATISTICAL INFORMATION AND METHODOLOGY

In light of what was discussed in the previous section, so far no study has attempted to estimate private returns to education in the period after the onset of the current financial crisis in late 2008. The present study attempts for the first time to fill this gap, applying the methodology of Mitrakos, Tsakloglou and Cholezas (2010a, 2010b) that takes both sample bias and unemployment probability into account, and focuses on the calculation of private returns to education before and during the current crisis in a way that allows comparisons. Thus, it explores the impact of the crisis on education, and the accompanying change of strategy possibly observed in young people's choices as regards pursuing tertiary education studies or not, as well as the content thereof.

3.1 DATA, DEFINITIONS OF THE VARIABLES AND THE SAMPLE

The data used for the purposes of this study are derived from ELSTAT's Labour Force Survey (LFS) and span from 2004 Q1 to 2012 Q2, excluding years 2008 and 2009 because during these eight quarters on the one hand the economy seems to have attained historically low unemployment rates (lowest in 2008 Q3: 4.7% for men and 10.8% for women), and on the other hand it is not clear whether the early symptoms of the crisis had already begun to appear by then or not. Thus, with a view to ensuring a clear-cut sample before the crisis and a clear-cut sample during the crisis, the former includes observations between 2004 Q1 and 2007 Q4, and the latter between 2010 Q1 and 2012 Q2 (the last period for which data were available at the inception of the present study). It should be noted that the LFS information collection methodology was radically revised in 2004, while also from 2004 onwards microdata have been made available by ELSTAT in a 'rotating panel' form, as each member in the sample participates in the survey for six consecutive quarters ('waves').

Since 1998 ELSTAT has been conducting the LFS on a quarterly basis (previously only in Q2 of each year). The main purpose of this sample survey is to collect detailed data on the employment and unemployment status of household members aged 15 or over. The LFS quarterly sample includes approximately 30,000 households, with 1/6 of them rotated (replaced) every quarter, which implies at least 120,000 interviews conducted each year.

The final question in the LFS questionnaire —addressed only to household members working as employees— relates to monthly wages. Its exact wording is "What are the total monthly earnings from your main job including extra payments monthly paid? (Data should refer to last month's payments)", and employee's responses can be given on the basis

10 Interesting findings are offered by Livanos and Nuñez (2012), who associate race discrimination in the labour market with the function of education as a filter, an assumption apparently relevant in Greece where wage differentials are smaller among tertiary education graduates.

11 In any case, with respect to this issue the results of the various studies of the Greek labour market (Lambropoulos 1992, Magoula and Psacharopoulos 1999, Cholezas 2005) are evidently not always consistent, and tend to be heavily influenced by the investigation methodology applied.

Table 1 Percentages and numbers (N) of employees in the total number of employed persons aged 15-64

	Men				Women			
	2004-2007		2010-2012		2004-2007		2010-2012	
Education level	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**
Primary	45.1	7,228	41.3	3,143	33.1	2,815	32.2	1,438
Lower secondary	56.8	4,890	53.0	2,585	57.0	1,704	56.1	1,141
General lyceum	61.7	8,980	59.6	5,120	71.2	7,113	66.2	4,075
Technical lyceum	67.5	1,993	64.6	1,390	81.2	737	78.0	504
Post-gymnasium technical school	62.8	1,972	57.4	1,021	69.7	297	68.1	143
IEK	70.3	2,615	65.7	1,586	82.8	3,018	80.3	1,657
Other post-lyceum education	71.6	479	73.3	285	73.5	310	70.3	149
TEI								
Structural Engineering	54.9	117	54.6	59	79.4	85	74.6	50
Mechanical & Computer Engineering	73.7	808	69.9	593	85.3	163	87.8	137
Agricultural & Food Technology	72.9	186	71.2	141	82.6	123	77.0	87
Economics & Management	70.0	507	67.7	394	86.6	722	84.4	601
Medical Sciences	59.2	42	75.0	36	90.5	142	91.0	101
Other TEI	66.0	177	70.3	137	91.9	971	88.8	696
AEI								
Structural Engineering	38.6	346	36.0	191	57.1	185	52.5	105
Mechanical Engineering	67.3	497	64.5	321	85.3	104	79.8	79
IT	69.9	51	75.5	40	81.9	104	83.0	88
Physical Sciences	82.8	111	86.2	94	92.8	64	97.6	41
Mathematics & Statistics	68.8	245	69.6	133	91.4	106	82.2	88
Medical School, etc.	51.9	545	46.9	294	47.7	344	48.5	221
Horticulture & Forestry	81.7	433	78.2	248	83.7	221	92.4	171
Law School	78.3	343	80.8	215	85.6	173	87.5	112
Economics & Management	31.7	148	25.3	76	47.2	296	42.8	179
Social Sciences	71.0	1,113	68.7	657	86.2	962	84.8	631
Humanities	71.1	81	84.0	68	85.6	208	81.9	149
Physical Education & Sports	82.2	457	82.7	287	87.1	1,525	86.8	942
Pedagogics	84.0	309	80.0	184	90.3	168	84.4	103
Other AEI	97.1	165	95.8	136	97.4	660	97.7	602
Postgraduate studies								
Postgraduate degree	76.6	396	73.9	387	79.8	297	81.2	324
Doctorate	80.2	210	84.5	131	88.6	117	86.3	82
TOTAL	**58.5**	**35,444**	**56.8**	**19,952**	**65.1**	**23,734**	**64.7**	**14,696**

of income brackets.[12] The present study makes use of these data, although grouped information is admittedly not entirely appropriate for an econometric analysis of wage differentials between sample members.

With respect to net monthly wages for the purposes of the analysis, in the case of the "closed"

12 For the period before the crisis (2004-2007) the brackets are: up to €250; €251-€500; €501-€750; €751-€1,000; €1,001-€1,250; €1,251-€1,500; €1,501-€1,750; €1,751–€2,000; and €2.001 or more. For the second period, during the crisis, there are two different bracket distributions. Specifically, for the period 2010-2011 the brackets are: up to €400; €500-€699; €700-€799; €800-€899; €900-€999; €1,000-€1,099; €1,100-€1,299; €1,300-€1,599; €1,600-€1,749; and €1,750 or more. For 2012, the wage brackets were revised as follows: up to €499; €500-€699; €700-€799; €800-€899; €900-€999; €1,000-€1,099; €1,100-€1,199; €1,200-€1,299; €1,300-€1,449; and €1,500 or more.

Table 2a Distribution of male employees in income brackets per education level (percentages, all LFSs, at 2009 constant prices)

Education level	Net monthly earnings (EUR)								
	Up to 400	401-600	601-800	801-1,000	1,001-1,200	1,201-1,400	1,401-1,600	1,601-1,800	1,801 or more
2004-2007									
Pre-lyceum education	1.1	2.8	24.6	31.8	17.3	12.4	6.7	1.8	1.6
Lyceum	0.7	1.7	20.8	29.0	16.2	14.9	10.8	3.3	2.7
Post-lyceum non-tertiary education	0.5	1.4	21.0	25.2	15.1	12.8	11.9	4.3	7.8
TEI	0.3	1.3	12.5	26.3	17.7	18.6	15.1	4.0	4.3
AEI	0.3	0.5	6.4	13.7	14.8	20.7	21.8	8.6	13.3
Postgraduate studies	0.4	0.6	3.6	10.3	11.5	11.5	20.6	10.1	31.6
Total	*0.8*	*1.8*	*19.5*	*27.1*	*16.3*	*14.8*	*11.3*	*3.7*	*4.8*
2010-2012									
Pre-lyceum education	4.4	9.2	48.0	25.7	7.4	3.6	0.8	0.4	0.6
Lyceum	2.5	5.2	37.9	25.6	12.5	8.7	5.0	1.3	1.3
Post-lyceum non-tertiary education	2.1	5.2	35.9	25.9	13.2	10.1	5.3	1.0	1.4
TEI	1.8	2.2	21.8	26.2	18.3	16.4	10.0	2.1	1.3
AEI	0.9	1.7	12.1	19.2	17.3	21.5	17.9	4.8	4.7
Postgraduate studies	0.0	0.3	6.8	18.9	11.8	14.2	19.8	7.1	21.0
Total	*2.3*	*4.8*	*32.0*	*24.2*	*13.2*	*11.5*	*7.7*	*2.0*	*2.2*

income brackets we assumed that the respective employee's wage was the mean of the range, whereas for the means of the two "open" brackets (at the top and bottom ends of the distribution) we used the detailed data of the Household Income and Living Conditions Survey conducted annually by ELSTAT, which collects information on net employee wage rates without the use of income brackets. Given that the LFS sample utilised in the analysis of the wages covers the period 2004-2012 on a quarterly basis, the individual value of each income bracket in each quarter of the LFS was suitably adjusted for inflation, based on the Consumer Price Index data published by ELSTAT, in order for all wage data to be expressed at 2009 constant prices.

As regards the definition of education groups, the LFS divides the population into a large number of education categories. Given that this study focuses on tertiary education graduates, we chose to discern and group AEI and TEI degree holders with as much detail as possible. Yet, in several cases this was unfeasible, due to the limited number of employees in the groups at issue. In the end, the criterion for keeping or merging tertiary education groups was, apart from the similarity of the disciplines, the existence of a minimum number of observations (around 100 men or women) spread over a large number of years after graduation. For the lower education levels we formed relatively fewer groups, and also decided to exclude from the sample a few groups that presented either a rather small number of observations or specific problems (graduates of: special needs schools; Open University and interdisciplinary selection programmes; military and law enforcement academies; the School of Pedagogical and Technological Education (SELETE); and pedagogic academies with a two-year duration of studies).

The sample selected for the study includes all employees from the aforementioned quarters of the survey, the last time they appear in the LFS. Thus, we obtain a higher number of

Table 2b Distribution of female employees in income brackets per education level (percentages, all LFSs, at 2009 constant prices)

Education level	Net monthly earnings (EUR)								
	Up to 400	401-600	601-800	801-1,000	1,001-1,200	1,201-1,400	1,401-1,600	1,601-1,800	1,801 or more
2004-2007									
Pre-lyceum education	2.7	11.2	26.0	32.4	19.2	5.0	1.5	0.1	1.9
Lyceum	1.3	6.7	20.7	31.3	24.8	9.1	2.2	0.3	3.6
Post-lyceum non-tertiary education	1.1	3.6	17.4	28.1	24.8	11.2	3.3	0.3	10.2
TEI	0.6	3.9	15.7	27.0	29.9	13.2	3.5	0.4	5.9
AEI	0.4	1.9	6.5	19.1	30.8	20.2	5.8	0.4	15.1
Postgraduate studies	0.5	0.2	3.2	11.6	24.5	16.3	8.4	0.5	34.9
Total	*1.5*	*6.6*	*19.0*	*28.7*	*24.4*	*10.2*	*2.9*	*0.3*	*6.4*
2010-2012									
Pre-lyceum education	5.2	25.0	35.8	25.8	6.5	1.1	0.3	0.0	0.4
Lyceum	2.8	14.6	33.0	26.6	16.2	4.5	0.7	0.1	1.4
Post-lyceum non-tertiary education	2.0	13.1	28.3	30.2	18.8	5.2	0.9	0.1	1.5
TEI	1.3	6.6	24.0	30.5	25.7	6.9	2.1	0.4	2.4
AEI	1.2	3.6	11.1	22.0	34.2	16.1	4.7	0.4	6.7
Postgraduate studies	0.6	2.7	5.3	20.9	31.0	16.8	5.9	0.3	16.5
Total	*2.5*	*12.4*	*25.9*	*26.1*	*20.6*	*7.4*	*1.9*	*0.2*	*3.0*

observations, which enables a more thorough analysis based on education specialty, without creating in parallel any other technical problems.[13] This means that, ceteris paribus, the sample includes proportionately more employees from the last quarter of the period before the crisis (2007 Q4) and the last quarter of the period during the crisis (2012 Q2). Table 1 shows the total sample used, and the numbers and shares of male and female employees in the total number of employed persons aged 15-64 for the various education levels and individual schools. As it appears, overall women are more often employed as employees, both before and during the crisis. Moreover, the share of tertiary education graduates working as employees is larger than that of lower education level graduates, probably on account of the —according to many— oversized public sector in Greece (high formal qualifications are a prerequisite for recruitment in the public sector). Considerable gender differentials are detected even for graduates of the same field of study. Indicatively, among AEI graduates of structural engineering, men working as employees represent a minority, in contrast with what is recorded among female graduates. Finally, owing to the crisis and the ensuing drop in employment, the share of male employees in the total of the employed fell by 1.7 percentage points, while for women the respective change is marginal. This, however, varies considerably across specialties. For instance, male law school graduates work more often as employees during the crisis compared with what was the case before the crisis. The same is true for female AEI graduates of medical sciences. Therefore, it appears that the crisis has changed, to some extent, the type of employment for certain degree holders.

To convert monthly wages into hourly earnings we used the employees' responses to the ques-

13 Selecting the first or the last observation from the rotating panel, we effectively construct a sample consisting of successive layers, which nevertheless covers 16 quarters (2004 Q1 - 2007 Q4) before the crisis and 10 quarters (2010 Q1 - 2012 Q2) during the crisis, respectively.

tion "How many days and hours per week do you usually work in the above job?" (referring to their main job). This led to the exclusion from the analysis of some additional responders who stated that they cannot define the number of hours they usually work, because it differs significantly from one week or month to the other. The new distributions of the employees in the sample, resulting on the basis of nine income brackets (at 2009 constant prices), appear in Tables 2a (for men) and 2b (for women) grouped according to education level. It should be noted that around 15% of the employees in the sample (14.2% in the period 2004-2007 and 16.4% in the period during the crisis) have not responded to the question regarding net monthly wages (stated: NA) and, as a consequence, were excluded from the analysis. This share does not seem to be closely related to the employees' education level.

Tables 2a and 2b lead to two main conclusions. First, the recorded clear shift of all distributions to the left shows that net monthly wages during the crisis declined for both genders. Second, the net monthly wages of men are higher than those of women, both before and during the crisis. Indicatively, during the crisis 11.9% of men receive net monthly wages of more than €1,400, while the respective percentage for women is 5.1%.

3.2 METHODOLOGY

The methodology to calculate returns to education aims at estimating the internal rate of return that equates the present value differences in the wages of different education groups. This implies an initial calculation of employees' earnings for each year after graduation, weighted by the unemployment (or employment) probability already estimated at an earlier stage, and then a calculation of returns to education. Thus, the method consists of two stages, while all estimations are carried out separately for men and women, both for the sample before the crisis (2004 Q1-2007 Q4) and for the sample during the crisis (2010 Q1-2012 Q2). More specifically, the methodology can be broken down into a series of successive steps.

In a first step, we calculate unemployment probability for each individual separately and for each year since graduation from the highest education level completed, depending on his/her characteristics (including education specialty, years since graduation, region of residence, urbanisation, year and quarter of the interview, etc.). To this end, we estimate the probability of the individual being unemployed (probit model), after adjusting for the labour force participation bias (in a variation on Heckman's method for correcting the sample selection error).[14]

In a second step, we estimate earnings equations for the employees in the sample based on human capital theory, after adjusting for the probability of bias in the sample used (i.e. the individuals' probability of earning wages, or, in other words, of having a paid job), in a way similar to that followed for estimating unemployment probability (i.e. applying Heckman's sample selection method). According to human capital theory, labour income differences are due to the different human capital stock of individual workers. This stock governs their productivity, which in a competitive market determines their wage rate. The specific elements human capital consists of are the knowledge, abilities and skills acquired by individuals through formal or informal education and past work experience, as well as their inherent abilities. On the basis of these assumptions, we form the Mincerian earnings equation (Mincer 1974), extensively used in the literature on education economics. Thereafter, we estimate wages for each individual separately and for each year since graduation from the highest education level completed.

In a third and final step, we calculate the expected wage of each education group and

14 For a detailed description of the method, see Mitrakos, Tsakloglou and Cholezas (2010a).

adjust it for each education group's probability to work (1 minus the estimated unemployment probability).[15] Thus, we construct "wages/years since graduation" profiles for each education group. The discount term that equates the present values of different "education groups" wages, known as the "internal rate of return", ultimately yields private return to education. This method is similar to the one applied by Mitrakos, Tsakloglou and Cholezas (2010b).

4 EMPIRICAL RESULTS

4.1 ESTIMATION OF UNEMPLOYMENT PROBABILITY

As already discussed in the previous section, the first step in our effort to calculate private returns to education involves an estimation of unemployment probability. Needless to note that an individual's unemployment probability is affected by a multitude of factors, not just education qualifications. Moreover, these factors are interdependent, while random factors may also affect this probability. The LFS waves provide enough information on variables considered to affect unemployment probability. Therefore, the best approach to the examination of the phenomenon would be through the use of multivariate econometric probability analysis.

The labour force participation rate seems to be related both to the individual's age (and probably years since graduation) and education level, as well as to gender and perhaps other factors (such as family status). Therefore, without testing and correcting for labour force participation probability, the results of the unemployment probability estimation may very likely be biased. In other words, another econometric technique that takes this bias into account by simultaneously estimating both labour force participation probability and unemployment probability (in a variation on Heckman's method) is most likely in order.

Descriptive data examination reveals that the variable most likely related to unemployment probability is the time since graduation, and not the individual's age. The same results seem to show that time since graduation affects unemployment probability non-linearly, a fact that must be taken into account during the econometric estimation. Moreover, both the unemployment rate and its change after graduation differ considerably between men and women, and therefore necessitate an econometric estimation of separate equations for men and women, not just the introduction of a dummy variable for women in the unemployment probability equation. Finally, given that the evolution of the unemployment rate by years since graduation seems to be substantially different even among groups of graduates of the same education level, instead of using dummy variables to differentiate among various graduates of different specialisations, we need to use flexible non-linear types of equations that allow us to differentiate unemployment probability as a function of time since graduation for different types of education groups.[16]

All the above considerations have been taken into account during specification of the econometric model developed for estimating unemployment probability. The adjustment for selection error (the key issue is labour force participation or not, regardless of unemployment or type of work) revealed the existence of a statistically significant bias in the case of men, but not in the case of women, a finding inconsistent with our expectations, although the correlation between the two equations' residuals is marginally statistically insignificant.[17] However, for reasons of comparability with men, and after controlling for the esti-

15 Thus taking into account the period an individual remains unemployed, since unemployment rate varies in each year since graduation for each narrowly defined education group and for each gender, an element that according to Caporale and Gil-Alana (2012) seems to differentiate younger from older workers.

16 For a detailed descriptive exploration of the factors that possibly affect unemployment probability in the period before the current crisis, see Mitrakos, Tsakloglou and Cholezas (2010a).

17 See the statistically insignificant *rho* at the last column of Table A in the Appendix (-0.124).

mated wages' deviation from the actual ones, it was decided to use common estimates for both genders. The methodology applied is a variation on Heckman's (1979) two-step method, by which we attempted to correct the sample's selection error.[18] The detailed results of these estimations are presented in Table A of the Appendix.[19]

The dependent variable is unemployment probability, while independent variables include the individuals' education characteristics, years since graduation (and their square), demographic characteristics as to their household composition, their nationality, the region and degree of urbanisation of their place of residence, the local unemployment rate, and dummy variables for the year and quarter of the LFS they took part in. Compared with the labour force participation probability equations, education groups in the estimation of unemployment probability are discerned in much more detail, while demographic groups (household composition) are much fewer. To obtain a differentiation of each education group's unemployment probability broken down by time since the graduation year, we also introduce multiplicative terms between the dummy variable of each education group and the individual's time since graduation and its square.

Tables 3a (for men) and 3b (for women) show the ratio of the estimated unemployment rates for the two periods (before and during the crisis) by education level for selected years since graduation – specifically, for less than 1 year since graduation, and for 5, 10, 20 and 30 years since graduation. The larger than 1 this ratio is, the higher the unemployment during the crisis compared with the period before the crisis. A first glance reveals that the crisis seems to have increased unemployment more for the graduates of lower education levels and for older graduates, since the unemployment rate ratio for almost all education levels increases as we move further away from graduation. The pattern is clearer in the case of men. An exception to this rule are postgraduate degree holders, among whom younger graduates see their employment prospects worsen more than those of older graduates. This may be due to the fact that postgraduate studies have flourished considerably in recent years, and thus graduates are comparatively younger. The same cannot be argued, however, in the case of female TEI graduates.

The impact of the crisis appears to vary considerably across schools. For instance, in the case of men, TEI graduates of "structural engineering" schools seem to have been hit by the crisis rather disproportionately, a fact not applicable in the case of female graduates of the same school. A particular case among male AEI graduates seems to involve the graduates of "horticulture and forestry", "physical sciences" and "law school", as the crisis has dealt a considerable blow to the former group along the entire age range, and had a major impact on the two latter groups for older graduates compared with other schools. Among women, "horticulture and forestry" graduates seem to face similar problems with male graduates of the same school, while female graduates of "mathematics and statistics" also stand out, as their unemployment rate ratio increases particularly for older graduates.

Finally, running contrary to the overall pattern —i.e. of a greater rise in unemployment for older graduates— are both male and female graduates of "mechanical engineering" and

18 Specifically, in the outcome equation, as a dependent variable we use a binomial rather than a continuous one (as in Heckman's classical method), a fact that entails changes in the maximum likelihood function (Greene 2003). On account of heteroskedasticity, the coefficients' estimated standard errors in the estimated equations have been corrected using White's (1980) method. The control group consists of partners in couples without children, who are general lyceum graduates, of Greek nationality, residents of Athens and have participated in the LFS in 2007 Q4 or 2012 Q4.

19 For a chart illustration and description of the estimated unemployment rate in the period before the crisis for all the individual factors/variables affecting it, as a function of the first 20 years since the individual's graduation from the highest education level completed, having each time isolated the effect of all other variables (family status, region, urbanisation, nationality, local unemployment rate, etc.), see Mitrakos, Tsakloglou and Cholezas (2010a). Corresponding charts based on the estimates of the present study for both periods (before and during the crisis), as well as the results of the econometric estimations of Table A for more detailed education levels and schools, are available upon request.

Table 3a Ratio of pre-crisis to crisis estimated male unemployment rates (by education level; at a given number of years after graduation)

	Years after graduation				
Education level	**<1**	**5**	**10**	**20**	**30**
Pre-lyceum education	**1.9**	**2.2**	**2.5**	**3.0**	**3.4**
Primary	1.3	1.8	2.2	3.1	3.6
Lower secondary	2.2	2.4	2.6	2.9	3.1
Lyceum	**1.8**	**2.1**	**2.4**	**3.0**	**3.4**
General lyceum	1.7	2.0	2.3	3.1	3.6
Technical lyceum	1.9	2.1	2.4	2.8	3.0
Post-gymnasium technical school	2.3	2.7	2.9	3.2	3.0
Post-lyceum non-tertiary education	**1.9**	**2.1**	**2.3**	**2.7**	**2.8**
IEK	1.7	2.1	2.4	3.1	3.7
Other post-lyceum education	2.1	2.0	1.9	1.7	1.4
TEI	**1.6**	**2.3**	**3.1**	**3.8**	**2.2**
Structural engineering	2.5	3.6	5.4	11.8	24.4
Mechanical & Computer Engineering	1.7	2.4	3.3	3.8	2.0
Agricultural & Food Technology	1.4	2.2	3.4	4.5	1.8
Economics & Management	1.6	2.0	2.4	2.3	1.5
Medical Sciences	1.0	2.0	4.5	8.8	1.4
Other TEI	1.7	2.4	3.1	3.5	2.1
AEI	**1.4**	**1.7**	**2.0**	**2.4**	**2.3**
Structural Engineering	1.5	1.9	2.4	3.3	2.9
Mechanical Engineering	2.5	2.3	1.9	1.4	1.6
IT	*31.8*	*9.3*	*2.6*	*0.2*	*0.0*
Physical Sciences	1.5	1.6	1.7	2.6	6.6
Mathematics & Statistics	0.9	1.7	3.6	8.7	3.2
Medical School, etc.	1.1	1.5	2.0	3.2	3.1
Horticulture & Forestry	2.4	2.5	2.6	2.7	3.0
Law School	1.5	2.3	3.3	5.3	4.4
Economics & Management	0.9	1.2	1.9	3.5	2.4
Social Sciences	2.8	2.7	2.2	1.3	1.3
Humanities	1.4	1.7	2.0	2.6	2.8
Physical Education & Sports	1.1	1.3	1.6	2.2	2.0
Pedagogics	-	*9.2*	*1.2*	*52.6*	-
Other AEI	0.8	0.9	1.0	1.3	1.3
Postgraduate studies	**1.5**	**1.7**	**1.7**	**1.4**	**1.0**
Postgraduate degree	1.9	1.7	1.4	1.1	1.1
Doctorate	0.8	1.5	2.8	3.8	0.7

Note: Italics are used to identify education categories that need to be treated with caution due to the scarcity of observations or the uneven distribution of graduates over time.

"social sciences", as well as female graduates of "medical sciences", "law school", "pedagogics" and "other AEI". In the case of female TEI graduates, where the pattern is different anyway —in the sense that the impact is greater for younger graduates— only female graduates of "medical sciences" follow a course in the opposite direction.

Table 3b Ratio of pre-crisis to crisis estimated female unemployment rates (by education level; at a given number of years after graduation)

	Years after graduation				
Education level	**<1**	**5**	**10**	**20**	**30**
Pre-lyceum education	**1.7**	**1.6**	**1.5**	**1.4**	**1.4**
Primary	2.0	1.8	1.7	1.4	1.4
Lower secondary	1.6	1.6	1.6	1.5	1.5
Lyceum	**1.4**	**1.5**	**1.5**	**1.6**	**1.6**
General lyceum	1.6	1.6	1.6	1.6	1.6
Technical lyceum	1.2	1.3	1.4	1.7	2.3
Post-gymnasium technical school	1.4	1.3	1.2	1.2	1.7
Post-lyceum non-tertiary education	**1.5**	**1.6**	**1.6**	**1.7**	**2.0**
IEK	1.4	1.4	1.5	1.6	1.9
Other post-lyceum education	1.6	1.5	1.4	1.3	1.3
TEI	**1.5**	**1.5**	**1.4**	**1.2**	**1.3**
Structural engineering	2.2	2.6	2.8	1.8	0.7
Mechanical & Computer Engineering	2.6	2.6	2.3	1.6	1.5
Agricultural & Food Technology	1.3	1.3	1.2	0.9	0.6
Economics & Management	1.3	1.2	1.0	0.8	0.7
Medical Sciences	1.2	1.2	1.2	1.4	2.6
Other TEI	1.5	1.6	1.5	1.3	1.2
AEI	**1.4**	**1.5**	**1.6**	**1.8**	**2.0**
Structural Engineering	0.9	1.3	2.0	3.1	1.9
Mechanical Engineering	0.8	1.0	1.3	1.4	0.8
IT	*0.8*	*4.8*	*40.4*	-	*0.6*
Physical Sciences	0.8	0.8	0.9	2.0	8.6
Mathematics & Statistics	1.3	1.6	1.9	3.8	11.7
Medical School, etc.	0.5	0.7	0.9	0.9	0.4
Horticulture & Forestry	1.7	1.3	0.8	0.6	2.3
Law School	0.9	0.7	0.5	0.4	0.9
Economics & Management	1.4	1.4	1.3	1.4	1.8
Social Sciences	1.6	2.0	2.2	1.6	0.8
Humanities	1.5	1.6	1.6	1.8	2.9
Physical Education & Sports	*2.5*	*1.3*	*1.0*	*11.5*	-
Pedagogics	1.0	0.9	0.8	0.7	0.9
Other AEI	1.4	1.7	2.0	1.6	0.5
Postgraduate studies	**2.5**	**1.9**	**1.3**	**0.9**	**1.1**
Postgraduate degree	2.0	1.8	1.5	1.1	1.1
Doctorate	1.5	0.7	0.5	0.4	0.9

Note: Italics are used to identify education categories that need to be treated with caution due to the scarcity of observations or the uneven distribution of graduates over time.

4.2 ESTIMATION OF EARNINGS EQUATIONS

In the second phase of our econometric analysis we estimate expanded Mincerian functions of hourly earnings, which we then use in order to calculate wages/years since graduation profiles. Traditionally, in econometric estimations of earnings functions, the dependent variable

is the logarithm of the employees' hourly earnings, while the main explanatory variables that proxy for the human capital accumulated in the worker are his/her education and work experience. As in all steps of the analysis, education here is expressed using dummy variables that reflect the highest education level and specialisation completed by the individual. For work experience we use the worker's years since graduation and their square.[20] Given that theory suggested no reason to expect that the relationship between experience and earnings would be the same for all education levels and specialisations, we include as explanatory variables in the estimated equation multiplicative terms introduced between the dummy variables of education levels and years since graduation and their square.

In addition to the variables that proxy the worker's human capital stock, a few other variables related to the workers' wage rates have been included in the analysis as explanatory variables. These refer to the region and degree of urbanisation of their place of residence, their employment sector (public/private), their nationality and family status, the size of the local unit and the branch of economic activity of the firm for which they work, and the year and quarter of the LFS they took part in. The reference group consists of single men or women (depending on the equation), who are general lyceum graduates, of Greek nationality, residents of Athens, employed in a business unit of 10 or fewer employees, in the private (retail or wholesale) trade sector.

Selection error correction (in the first phase we estimated the individuals' probability of working as employees, having excluded from the sample all pensioners and non-employee workers) proved to be statistically significant, with the exception of the sample of men during the crisis (see Table B in the Appendix). For comparability reasons, our initial choice was to use the estimates of the two-step correction method, but the sign of the –always statistically insignificant– correction term (inverse Mill's ratio) was the opposite than what was expected. Therefore, only in this case, we used the earnings estimates derived from a simple least squares model (see the OLS column in Table B of the Appendix). On account of heteroskedasticity, the coefficients' estimated standard errors have been corrected using White's (1980) method.

Tables 4a (for men) and 4b (for women) show the calculated percentage change of net monthly wages in the crisis period. Although as a rule earnings fell during the crisis, differentiations between education levels and genders are considerable.[21] For both genders, a marginally larger wage reduction is recorded among postgraduate degree holders (-10.3%). Moreover, among both TEI and AEI graduates, wages dropped more for men. With respect to years since graduation, in the case of men wages fell more for younger graduates, with the exception of post-lyceum school graduates, AEI graduates and postgraduate degree holders. The picture is not the same for women, as there are even some wage increases recorded for younger graduates of low education levels (e.g. technical lyceum) and, in any case, the pattern of a larger wage reduction for younger graduates is not confirmed.[22]

As also in the case with unemployment, changes in wages vary remarkably among

20 The variable used for the individual's work experience is not ideal, since it only partly approximates actual work experience and overlooks any periods of unemployment, withdrawal from the labour market, or even work combined with studies. This may be leading to an overestimation of actual experience, and hence of its effect on earnings. Nevertheless, compared with the corresponding variable used in most other studies (i.e. age minus the minimum years of study required for obtaining the degree minus 6), it is undoubtedly a much better proxy for the actual work experience of the sample members. The quadratic term of work experience, expected to take a negative sign in the econometric estimations, implies that experience accumulation has an increasing effect on the individual's earnings, but at a declining rate, and thus may have a negative marginal effect beyond a certain point (due to the depreciation of knowledge and skills).

21 A closer look reveals that, overall, earnings reduction for men, with the exception of post-lyceum non-tertiary education graduates, lies close to 10%, whereas for women it is considerably lower, except for postgraduate degree holders.

22 Lower earnings for younger workers may be attributed to downward wage rigidity in the crisis period for those already working, who as a rule are older and less educated. In addition, no pattern seems to emerge as regards market behaviour towards the low-wage earners, as this would require a more detailed analysis of changes in the earnings distributions.

Table 4a Growth in male hourly earnings between the pre-crisis and crisis periods (in percentages; by education level; at a given number of years after graduation)

	Number of years after graduation					
Education level	**<1**	**5**	**10**	**20**	**30**	**Total**
Pre-lyceum education	**-11.3**	**-10.6**	**-10.0**	**-9.1**	**-8.8**	**-9.9**
Primary	-9.5	-9.6	-9.6	-9.6	-9.5	-9.6
Lower secondary	-11.5	-10.4	-9.5	-8.4	-8.2	-9.6
Lyceum	**-9.2**	**-8.9**	**-8.6**	**-8.4**	**-8.6**	**-8.7**
General lyceum	-8.1	-8.4	-8.6	-8.9	-9.0	-8.6
Technical lyceum	-10.7	-8.1	-6.0	-3.6	-3.7	-6.4
Post-gymnasium technical school	-13.1	-11.3	-9.9	-7.8	-7.0	-9.8
Post-lyceum non-tertiary education	**-0.1**	**-3.1**	**-5.4**	**-8.1**	**-8.3**	**-5.0**
IEK	-2.0	-4.3	-6.0	-7.5	-6.6	-5.3
Other post-lyceum education	4.6	2.6	0.4	-5.1	-11.6	-1.8
TEI	**-10.3**	**-10.6**	**-10.6**	**-9.3**	**-6.2**	**-9.4**
Structural engineering	-9.0	-12.7	-14.8	-14.8	-8.8	-12.0
Mechanical & Computer Engineering	-6.5	-8.7	-10.0	-9.9	-6.4	-8.3
Agricultural & Food Technology	-22.5	-18.7	-14.1	-1.5	16.8	-8.0
Economics & Management	-10.2	-11.4	-11.7	-9.8	-4.1	-9.4
Medical Sciences	-9.9	-9.5	-9.6	-11.7	-15.8	-11.3
Other TEI	-7.6	-1.6	3.0	6.8	3.1	0.8
AEI	**-6.2**	**-7.7**	**-9.0**	**-10.7**	**-11.5**	**-9.0**
Structural Engineering	1.2	-0.5	-2.1	-4.9	-7.1	-2.7
Mechanical Engineering	5.5	-0.1	-4.2	-8.3	-7.5	-2.9
IT	*-19.3*	*-15.4*	*-12.1*	*-7.4*	*-5.7*	*-12.0*
Physical Sciences	-8.9	-12.4	-14.5	-15.2	-11.1	-12.4
Mathematics & Statistics	-0.6	-3.1	-5.7	-11.4	-17.7	-7.7
Medical School, etc.	-14.3	-12.2	-10.7	-9.5	-10.9	-11.5
Horticulture & Forestry	-9.0	-7.3	-6.3	-7.0	-10.9	-8.1
Law School	-11.6	-11.9	-12.6	-15.5	-20.0	-14.3
Economics & Management	0.6	-3.5	-6.5	-9.5	-8.9	-5.6
Social Sciences	-22.1	-16.9	-12.9	-9.4	-12.6	-14.8
Humanities	4.5	-7.5	-15.4	-22.3	-19.0	-11.9
Physical Education & Sports	-3.8	-4.7	-6.4	-12.0	-19.9	-9.4
Pedagogics	*5.4*	*-0.9*	*-6.9*	*-17.8*	*-27.4*	*-9.5*
Other AEI	-39.5	-23.2	-8.9	4.3	-9.3	-15.3
Postgraduate studies	**-8.3**	**-6.5**	**-6.2**	**-10.3**	**-20.0**	**-10.3**
Postgraduate degree	2.6	-0.7	-4.5	-13.3	-23.1	-7.8
Doctorate	-30.7	-18.9	-9.8	-4.1	-16.7	-16.1

Note: Italics are used to identify education categories that need to be treated with caution due to the scarcity of observations or the uneven distribution of graduates over time.

graduates of different schools. Male TEI graduates record a larger reduction in the wages of younger graduates, with the most indicative example being the "agricultural and food technology" graduates. Moving in the opposite direction —in the sense that older graduates see their wages drop more— are the graduates of "medical sciences". For female TEI graduates the crisis has a greater impact on older graduates, as there are even some increases

Table 4b Growth in female hourly earnings between the pre-crisis and crisis periods (in percentages; by education level; at a given number of years after graduation)

	Number of years after graduation					
Education level	**<1**	**5**	**10**	**20**	**30**	**Total**
Pre-lyceum education	**5.9**	**5.2**	**4.6**	**3.4**	**2.3**	**4.3**
Primary	7.2	5.3	3.7	1.3	0.0	3.5
Lower secondary	-4.3	-0.8	1.8	3.7	1.3	0.3
Lyceum	**6.6**	**3.2**	**0.3**	**-3.6**	**-5.5**	**0.2**
General lyceum	1.8	-0.1	-1.7	-4.3	-6.0	-2.1
Technical lyceum	7.6	3.8	0.8	-2.5	-2.7	1.4
Post-gymnasium technical school	7.6	6.3	4.2	-2.0	-10.5	1.1
Post-lyceum non-tertiary education	**-1.2**	**-2.5**	**-3.5**	**-5.1**	**-5.8**	**-3.6**
IEK	-2.7	-3.2	-3.7	-5.2	-7.1	-4.4
Other post-lyceum education	-7.9	-8.2	-7.6	-3.9	3.6	-4.8
TEI	**1.4**	**-0.9**	**-2.4**	**-3.0**	**-0.4**	**-1.1**
Structural engineering	-21.1	-12.5	-5.7	0.6	-4.2	-8.6
Mechanical & Computer Engineering	-7.7	-7.7	-7.5	-6.3	-4.2	-6.7
Agricultural & Food Technology	8.8	0.0	-3.8	2.1	30.3	7.5
Economics & Management	-3.3	-3.9	-4.3	-4.6	-4.3	-4.1
Medical Sciences	7.0	1.3	-2.4	-4.7	-0.4	0.2
Other TEI	-6.0	3.1	8.4	5.5	-13.3	-0.5
AEI	**-1.6**	**-3.7**	**-5.3**	**-6.7**	**-5.7**	**-4.6**
Structural Engineering	-16.9	-13.0	-9.0	-0.7	8.2	-6.3
Mechanical Engineering	-25.0	-15.9	-7.5	6.4	13.9	-5.6
IT	*-14.3*	*-6.5*	*0.1*	*9.2*	*11.2*	*0.0*
Physical Sciences	14.4	2.8	-5.4	-13.8	-13.3	-3.1
Mathematics & Statistics	60.6	28.8	7.7	-14.7	-20.0	12.5
Medical School, etc.	12.2	3.7	-2.6	-10.0	-11.4	-1.6
Horticulture & Forestry	-19.8	-14.0	-10.7	-11.9	-23.0	-15.9
Law School	2.8	-4.3	-8.6	-10.1	-2.1	-4.5
Economics & Management	-5.7	-5.3	-5.1	-4.6	-4.4	-5.0
Social Sciences	-4.5	-5.0	-5.2	-4.7	-2.9	-4.5
Humanities	-5.9	-6.3	-6.5	-6.5	-5.9	-6.2
Physical Education & Sports	*-21.7*	*-19.4*	*-16.2*	*-6.2*	*9.8*	*-10.7*
Pedagogics	-5.9	-2.0	-1.6	-11.3	-31.1	-10.4
Other AEI	-18.0	-15.5	-13.7	-13.0	-15.7	-15.2
Postgraduate studies	**-6.2**	**-9.3**	**-11.4**	**-13.2**	**-11.5**	**-10.3**
Postgraduate degree	-7.1	-10.2	-12.4	-14.5	-13.5	-11.5
Doctorate	-8.1	-9.8	-11.1	-12.6	-12.7	-10.9

Note: Italics are used to identify education categories that need to be treated with caution due to the scarcity of observations or the uneven distribution of graduates over time.

recorded among the younger. A possible explanation would be the small number of observations, i.e. of younger graduates of specific schools. Overall, among male TEI graduates, the largest earnings reduction appears for graduates of "structural engineering" schools and "medical sciences", while among female TEI graduates for those of "structural engineering" schools and "mechanical and computer engineering" schools.

In the case of AEI graduates, the earnings development pattern is the same for men and women, with older graduates suffering the larger wage reductions, quite higher in the case of men (6.2% to 11.5%, against 1.6% to 5.7% for women). Exceptions to this rule include male graduates of "medical schools", "social sciences" and "other AEI", and female graduates of "structural engineering", "mechanical engineering", "social sciences" and "other AEI", as in these cases younger graduates face larger wage reductions. Among the schools with the largest reductions of their graduates' wages are "social sciences" and "law" schools for men, and "horticulture and forestry" and "pedagogics" for women.

4.3 ESTIMATION OF PRIVATE RETURNS TO EDUCATION

Having drawn the picture of the graduates' unemployment and wages and the impact of the financial crisis, we approach the main investigation of our study, i.e. the calculation of private returns to education, so as to assess whether education remains a rewarding investment in crisis conditions. Despite the lower earnings and increased unemployment due to the financial crisis, no a priori assumptions can be made regarding the impact of the crisis on returns to education. The main reason for this is the large number of factors involved in the calculation of returns to education, and their conflicting effects. Of course, in view of the fact that some of the respective groups in our sample are relatively small, not adequately represented throughout the entire range of years since graduation, or showing high percentages of self-employment, the corresponding results should be treated with caution.

Tables 5 and 6 present the results of the calculations of returns to education for tertiary education graduates, first unadjusted and then adjusted for unemployment probability. As already discussed in previous sections, we initially calculate the expected wage of each education group and then adjust it for each education group's probability of having a job (1 minus the unemployment probability).[23] The internal rate of return reflected by the discount term that equates the present values of different education groups' wages ultimately yields the wanted private return to education (for more details, see Mitrakos, Tsakloglou and Cholezas 2010b).

Before embarking on the analysis of the results, it should be noted that, as a consequence of the use of multiplicative terms between education levels and specialties and years since graduation and their square, the returns to education derived from our analysis are not invariable, but change as we move further away from the time of graduation. Calculation of these returns relies on a number of assumptions. As regards TEI graduates, we assumed that they come mainly from technical lyceums, and so their estimated wages were compared with those of technical lyceum graduates. Given that the latter are lower than the wages of general lyceum graduates, if TEI graduates actually come mainly from general lyceums, then their returns have been overestimated in the tables below. Until recently, TEI (or formerly KATEE) studies lasted 3 years. However, since 2001 the required duration of studies for all TEI (for certain ones already since 1999) is 4 years. Thus, owing to the rather limited number of TEI graduates with 4 years of studies in our sample, the estimates presented below rely on the assumption of a 3-year duration of studies for all TEI graduates. Obviously, the estimated internal rates of return would have been lower had we assumed a 4-year duration of studies.

Similarly, we assumed that studies in technical university as well as "horticulture and forestry" schools last 5 years. Returns for "medical school, etc." graduates were also calculated based on the assumption of

23 As Mitrakos, Tsakloglou and Cholezas (2010a) show, the estimated unemployment rates vary significantly among education levels and specialisations and change considerably as we move further away from the graduation year. Therefore, to calculate the expected wage, the estimates of hourly earnings have to be multiplied by the employment probability of the respective education group at the specific time interval from the year of graduation.

Table 5 Private returns to education, not adjusted for the probability of unemployment

	2004-2007		2010-2012	
	Men	Women	Men	Women
TEI				
Structural engineering	4.7	6.7	2.8	3.5
Mechanical & Computer Engineering	4.3	6.7	3.6	3.5
Agricultural & Food Technology	-0.7	-	3.3	4.5
Economics & Management	2.1	4.6	1.4	2.7
Medical Sciences	3.6	4.0	-2.8	3.9
Other TEI	4.2	2.6	6.0	-
AEI				
Structural Engineering	4.2	4.8	5.9	4.4
Mechanical Engineering	5.2	4.8	6.7	4.3
IT	5.6	6.0	4.9	6.7
Physical Sciences	5.3	5.6	4.3	4.8
Mathematics & Statistics	4.9	5.6	4.5	8.2
Medical School, etc.	6.8	5.5	6.1	5.4
Horticulture & Forestry	3.5	5.2	3.4	-
Law School	6.7	5.1	4.8	4.6
Economics & Management	4.7	4.6	5.5	4.0
Social Sciences	4.0	4.4	2.1	4.1
Humanities	6.0	6.9	4.4	5.9
Physical Education & Sports	4.1	6.3	2.8	4.9
Pedagogics	8.0	8.7	7.4	5.9
Other AEI	7.4	7.9	5.3	3.5
Postgraduate studies				
Postgraduate degree	7.2	7.9	7.4	5.8
Doctorate	6.8	5.3	5.3	3.8

Note: "-" means the inability to compute the present value (such as when an education group systematically earns less than the reference group).

5-year-long studies because, although medical school studies last 6 years, other schools of that group are completed in only 5 or even 4 years. In this case as well, the estimated internal rates of return would have been lower had we assumed a longer duration of studies. For all other AEI graduates, we assumed that studies last 4 years. For postgraduate degree holders, it was assumed that studies after lyceum last 5 years and, therefore, if postgraduate studies last mainly 2 years and most graduates come from schools with 5 or more years of bachelor studies, then the respective returns have been overestimated in the tables below. Finally, we assumed that the acquisition of a doctorate degree requires 8 years of studies after lyceum.

Needless to say, estimates in both Table 5 and Table 6 focus on pecuniary private returns to education and ignore other, non-pecuniary benefits a student may enjoy by participating in the higher levels of the education system. To calculate the returns listed in these tables we assumed that the individuals' working life is 35 years. This limit is most likely realistic in the case of men, but perhaps excessive in the case of women, at least based on present-day data (although recent developments in retirement age limits seem to rapidly move in this direc-

Table 6 Private returns to education, adjusted for the probability of unemployment

	2004-2007		2010-2012	
	Men	Women	Men	Women
TEI				
Structural engineering	6.2	16.4	3.1	10.4
Mechanical & Computer Engineering	4.7	16.6	5.2	-2.0
Agricultural & Food Technology	-	-	3.2	7.2
Economics & Management	2.1	-1.3	4.0	10.7
Medical Sciences	3.5	9.2	3.5	13.1
Other TEI	1.5	-1.4	2.9	-0.1
AEI				
Structural Engineering	4.4	7.8	7.2	10.1
Mechanical Engineering	5.1	6.0	6.5	10.5
IT	6.7	10.6	6.8	12.9
Physical Sciences	4.5	6.4	4.3	11.2
Mathematics & Statistics	4.3	7.2	4.9	10.4
Medical School, etc.	6.7	8.3	8.0	16.4
Horticulture & Forestry	3.3	5.2	2.5	0.9
Law School	8.3	9.2	9.0	15.1
Economics & Management	4.1	7.1	7.0	9.4
Social Sciences	3.0	5.3	1.1	5.7
Humanities	5.1	8.7	4.1	9.2
Physical Education & Sports	3.0	8.8	2.9	8.6
Pedagogics	9.8	9.7	7.8	15.4
Other AEI	5.8	10.9	7.7	9.1
Postgraduate studies				
Postgraduate degree	7.5	11.9	9.6	12.8
Doctorate	6.6	7.8	7.2	10.0

Note: "-" means the inability to compute the present value (such as when an education group systematically earns less than the reference group).

tion). In the literature, working life is often estimated based on a person's (theoretical) graduation year and (theoretical) retirement year. In the case of Greece, however, this would translate into lyceum graduates with up to as much as 46 years of experience as employees after graduation. Yet, our sample includes very few workers (and practically no employees) with such characteristics.

Taking no account of employment probability (or alternatively unemployment risk) and assuming that upon finishing their studies and throughout their entire working life individuals can immediately find employment, and so their wages are equal to those observed in the market, we construct Table 5. As typically seen in the literature, as a rule returns to education are higher for women (e.g. TEI graduates of "economics and management" or AEI graduates of "physical education") and for AEI graduates and postgraduate degree holders, compared with TEI graduates. This fact should not come as a surprise, despite women's lower wages, given that the key element in the calculation of returns to education is the wage gap between each education category and the reference education group (general or technical lyceum in our case). However, the crisis has resulted in a reduction of the number of schools that yield

higher returns for women. Thus, whereas before the crisis only 6 schools led to higher returns for men, during the crisis these schools became 10. Returns to education are relatively higher for male "mechanical engineering" graduates (6.7%) and postgraduate degree holders (7.4%) and for female graduates of "IT" (6.7%) and "mathematics and statistics" (8.2%). Finally, there are 6 tertiary education schools which record an increased return to education during the crisis for men (graduates of "other TEI", "structural engineering", "mechanical engineering", "economics and management", and postgraduate studies) and only 2 for women ("IT" and "mathematics and statistics"). A closer look reveals that AEI graduation seems to be justified more during the crisis.

Table 6 takes unemployment risk into account and re-calculates the adjusted returns to education. As a result, returns to education increase in some cases (mainly for men) and decrease in others (e.g. AEI "structural engineering" school). The correction seems to produce larger changes in the returns to education during the crisis, a rather anticipated fact considering the much higher unemployment rates involved. A major point that must not be overlooked is that, despite the financial crisis, returns to education increase both for men and women, with very few exceptions (7 education groups in the case of men, and 5 in the case of women).[24] Thus, education remains a rewarding investment even in crisis conditions, at least for AEI graduates. For instance, male graduates of "law school" enjoy returns in the order of 9% during the crisis, and of "medical sciences" 8%, while female graduates of "medical sciences" have a return of 16.4%, followed by graduates of "pedagogics" with a return of 15.4%. Moreover, opportunity cost has declined considerably in the period of the current crisis, making the acquisition of further education more attractive, given also the extremely high unemployment rates observed among the young.

The fact that tertiary education graduates receive higher wages does not necessarily imply that they have become more productive because of their studies. They may simply be more capable of using their tertiary education qualifications as a signalling mechanism vis-à-vis employers, an aspect not explored in the context of the present study. In addition, all returns to education examined in this study are private returns.[25] High private returns do not necessarily imply high social returns, which would be indispensable in order to support the view that investment in tertiary education is profitable for society. Furthermore, one cannot safely predict whether high private returns will persist in the future, as the supply of skilled and specialised labour will increase due to the rapid expansion of "mass" tertiary education attendance observed in our country over the past decade. Finally, high unemployment rates after the period examined in this study, currently galloping at dramatic levels, may have brought about changes in the previous findings.

5 CONCLUSIONS

The aim of the study was to estimate the impact of the crisis on private returns to education, also taking into account the higher unemployment risk. To this end it made use of the primary data of the LFS on the periods both before (2004 Q1-2007 Q4) and during (2010 Q1-2012 Q2) the current crisis. Specifically, by successively estimating unemployment and earnings equations, adjusting for selection error and employment probability as per case and, thereafter, calculating the internal rate of return that equates the present value of different education levels' wages, always on the basis of years since graduation, it estimated private returns to education for individual groups of tertiary education graduates.

24 Fernandes, Ferreira and Winters (2013) show that facilitation of new business start-ups in Portugal has resulted in a 5% increase of the wage return to university education and a 3% increase of the return to high qualifications. Therefore, structural reforms in the labour market during the crisis may have had a positive effect on returns to education in Greece as well.

25 For a comparative analysis of Greece vis-à-vis other OECD countries as regards private and public returns to education, see OECD (2013b).

The main conclusions of the study are the following:

First, the financial crisis has resulted in a higher unemployment probability for all. However, this probability increase varies across education levels, genders, and tertiary education schools. Thus, in terms of unemployment, lower education level graduates, men, and older graduates have suffered a greater impact. An exception to the age pattern are postgraduate degree holders of both genders and female TEI graduates, while there are many differentiations among graduates of different schools.

Second, higher unemployment was accompanied by a drop in the employees' wages, albeit with considerable variations across individual groups. For both genders, a larger earnings reduction is recorded for postgraduate degree holders. Moreover, wages fell more for male AEI and TEI graduates. With respect to the years since graduation, in the case of men as a rule the wages of younger graduates fell more, unlike women for whom the pattern of a larger wage reduction for younger graduates is not confirmed.

Third, as to the main question of the study, i.e. the calculation of private returns to education and the changes brought about by the financial crisis, some further interesting conclusions came to the fore. More specifically, in accordance with the literature, private returns to education increase along with the education level, and are higher for women. The crisis period examined in this study, i.e. up to mid-2012, seems to have had mixed results, in the sense that returns to education are higher in some cases and lower in others. However, even after adjusting for unemployment risk, the analysis shows that education continues to yield high returns even in the period of the current financial crisis experienced by the Greek economy. It is of course true that some graduates fare better than others, depending on their tertiary education type (AEI graduates better than TEI graduates) and graduation school. In any case, from a private perspective, education seems to remain a rewarding investment. In parallel, it should be noted that, in order to be able to generalise this result and safely make suggestions such as "improve education financing", one should estimate social returns to education rather than private ones. This would be the only way to obtain a clear and accurate picture of society's overall benefits from education.

In conclusion, the main finding of the analysis is that, from a private perspective, education continues to be a rewarding investment even in the period of the current financial crisis. Undoubtedly, graduates of some schools fare better than others, but in general terms tertiary education graduates —always compared with lower education level graduates— enjoy better prospects in the labour market.

REFERENCES

Alpha Bank (2013), "Labour market deregulation as a lever to restart the economy", Alpha Bank, *Economic Bulletin*, 118, Athens [in Greek].

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

Caporale, G.M. and L.A. Gil-Alana (2012), "Persistence of youth unemployment", CESifo Working Paper No. 3961.

Castillo, J. and S. Paraire (2013), "New deal for Europe: a plan for youth unemployment", NATIXIS Special Report: Economic Research No. 87, NATIXIS.

Cholezas, I. and P. Tsakloglou (1999), "Private returns to education in Greece: A review of the empirical literature", in R. Asplund and P. Telhado-Pereira (eds), *Returns to human capital in Europe*, 147-162, Helsinki: ETLA.

Cholezas, I. (2005), "Private returns to education in Greece and the European Union", doctoral thesis, Athens University of Economics and Business [in Greek].

Cholezas, I. (2010, 2011, 2012, 2013), "Labour market developments", *Oikonomikes Exelixeis*, 13/14/18/20, Centre of Planning and Economic Research (KEPE), Athens [in Greek].

COM (2011) 933 Final, "Youth Opportunities Initiative", European Commission, Brussels, 20.12.2011.

COM (2012) 729 Final, "On Establishing a Youth Guarantee", European Commission, Brussels, 5.12.2012.

ECB (2012), *Euro Area Labour Markets and the Crisis*, European Central Bank, Germany.

Fernandes, P.A., P. Ferreira and L.A. Winters (2013), "Firm entry deregulation, competition and returns to education and skills", CEPR Discussion Paper No. 9550.

Greene, W.H. (2003), *Econometric Analysis*, 5th ed., Upper Saddle River, NJ: Prentice Hall.

Hadjidema, S.H. (1998), "Rates of Return on Higher Education in Greece", *Spoudai*, 48(1-4), 157-168.

Harmon, C., I. Walker and N. Westergaard-Nielsen (2001), "Introduction", in C. Harmon, I. Walker and N. Westergaard-Nielsen (eds), *Education and earnings in Europe*, Edward Elgar, Cheltenham.

Heckman, J. (1979), "Sample selection bias as a specification error", *Econometrica*, 47, 153-162.

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

Kanellopoulos, C.N. (1997), "Public-Private Wage Differentials in Greece", *Applied Economics*, 29, 1023-1032.

Kanellopoulos, C.N. and K.G. Mavromaras (2002), "Male-Female Labour Market Participation and Wage Differentials in Greece", *Labour*, 16(4), 771-801.

Kanellopoulos, C.N., K.G. Mavromaras and Th. Mitrakos (2003), "Education and labour market", Study No. 50, Centre of Planning and Economic Research (KEPE), Athens [in Greek].

Lambropoulos, H.S. (1992), "Further Evidence on the Weak and Strong Versions of the Screening Hypothesis in Greece", *Economics of Education Review*, 11(1), 61-65.

Leibenstein, H. (1967), "Rates of Return to Education in Greece", *Economic Development Report*, No. 94, Harvard University.

Livanos, I. and I. Nuñez (2012), "The Effect of Higher Education on Gender Wage-Gap", *International Journal of Education Economics and Development*, 3(1), 33-47.

Livanos, I. and K. Pouliakas (2011), "Wage Returns to University Disciplines in Greece: are Greek Higher Education Degrees Trojan Horses?", *Education Economics*, 19(4), 411-445.

Magoula, T. and G. Psacharopoulos (1999), "Schooling and Monetary Rewards in Greece: An Over-education False Alarm?", *Applied Economics*, 31, 1589-1597.

Mincer, J. (1958), "Investments in Human Capital and Personal Income Distribution", *Journal of Political Economy*, 66(4), 281-302.

Mincer, J. (1974), *Schooling, Experience and Earnings*, New York: Columbia University Press.

Mitrakos, Th. and G. Douros (2006), "Household sample surveys in Greece: statistical techniques and problems", in *Dimoskopiseis kai Statistiki*, 343-353, proceedings of the 19th Pan-Hellenic Conference on Statistics (26-29 April 2006, Kastoria), Greek Statistical Institute [in Greek].
Mitrakos, Th., P. Tsakloglou and I. Cholezas (2010a), "Determinants of youth unemployment in Greece with an emphasis on tertiary education graduates", Bank of Greece, *Economic Bulletin*, 33, 21-62.
Mitrakos, Th., P. Tsakloglou and I. Cholezas (2010b), "Determinants of the wage rates in Greece with an emphasis on the wages of tertiary education graduates", Bank of Greece, *Economic Bulletin*, 34, 7-40.
OECD (1998), *Human Capital Investment: An International Comparison*, OECD Publishing.
OECD (2010), *Jobs for the Youth: Greece*, OECD Publishing.
OECD (2013a), *Employment Outlook 2013*, OECD Publishing.
OECD (2013b), *Education at a Glance 2013: OECD Indicators*, OECD Publishing.
Papapetrou, E. (2004), "Gender wage differentials in Greece", Bank of Greece, *Economic Bulletin*, 23, 47-64.
Papapetrou, E. (2007), "Education, labour market and wage differentials in Greece", Bank of Greece, *Economic Bulletin*, 28, 51-74.
Papapetrou, E. (2008), "Evidence on gender wage differentials in Greece", *Journal of Economic Change and Restructuring*, 41, 155-166.
Patrinos, H.A. (1992), "Higher Education Finance and Economic Inequality in Greece", *Comparative Education Review*, 36(3), 298-308.
Patrinos, H.A. (1995), "Socioeconomic Background, Schooling, Experience, Ability and Monetary Rewards in Greece", *Economics of Education Review*, 14(1), 85-91.
Patrinos, H.A. and H.S. Lambropoulos (1993), "Gender Discrimination in the Greek Labour Market", *Education Economics*, 1(2), 153-164.
Prodromidis, K. and P. Prodromidis (2008), "Returns to education: the Greek experience, 1988-1999", *Applied Economics*, 40, 1023-1030.
Psacharopoulos, G. (1982), "Earnings and Education in Greece, 1960-1977", *European Economic Review*, 17(3), 333-347.
Schultz, T.W. (1961), "Investment in Human Capital", *American Economic Review*, 51(1), 1-17.
White, H. (1980), "A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity", *Econometrica*, 48(4), 817-838.

APPENDIX

Table A Results of econometric estimations of unemployment equations, with adjustment for selection error by Heckman's two-step method (aggregate education levels)

	Before crisis		During crisis	
	2004 Q1-2007 Q4		2010 Q1-2012 Q2	
Variable	Men	Women	Men	Women
a. Dependent variable: unemployed (1=yes, 0=no)				
Pre-lyceum education	-0.290***	-0.254***	-0.363***	-0.039
Lyceum	0.000	0.000	0.000	0.000
Post-lyceum non-tertiary education	0.230***	-0.094	0.327***	-0.127
TEI	0.511***	-0.080	0.560***	-0.101
AEI	0.492***	-0.037	0.417***	-0.156
Postgraduate studies	0.208	-0.815***	0.084	-0.651***
Years after graduation	-0.044***	-0.060***	-0.031***	-0.068***
Years after graduation sqrd.	0.000***	0.001***	0.000**	0.001***
Years after graduation x Pre-lyceum education	0.034***	0.049***	0.045***	0.030***
Years after graduation x Lyceum	0.000	0.000	0.000	0.000
Years after graduation x Post-lyceum non-tertiary education	-0.022**	-0.005	-0.037***	-0.011
Years after graduation x TEI	-0.093***	-0.034***	-0.078***	-0.062***
Years after graduation x AEI	-0.073***	-0.057***	-0.081***	-0.063***
Years after graduation x Postgraduate studies	-0.064**	0.003	-0.084***	-0.064**
Years after graduation sqrd. x Pre-lyceum non-tertiary education	-0.001***	-0.001***	-0.001***	-0.001***
Years after graduation sqrd. x Lyceum	0.000	0.000	0.000	0.000
Years after graduation sqrd. x Post-lyceum non-tertiary education	0.001*	0.000	0.001***	0.001**
Years after graduation sqrd. x TEI	0.002***	0.001***	0.002***	0.002***
Years after graduation sqrd. x AEI	0.002***	0.001***	0.002***	0.001***
Years after graduation sqrd. x Postgraduate studies	0.002*	0.000	0.002**	0.002**
Single with children	0.542***	0.332***	0.485***	0.308***
Single with children and other household members	0.522***	0.291***	0.492***	0.439***
Couple with children, without other household members	0.232***	0.192***	0.204***	0.157***
Couple with children and other household members	0.215***	0.162***	0.367***	0.229***
Single with no children, with other household members	0.159***	-0.039	0.113***	-0.094**
Couple, no children, no other household members	0.000	0.000	0.000	0.000
Single with no children, with other household members	0.296***	-0.042	0.129***	0.060
Couple with no children, with other household members	0.237**	-0.171*	0.078	-0.159
Greek national	0.000	0.000	0.000	0.000
EU-27 national	-0.153	-0.058	0.169**	-0.024
Third-country national	-0.159***	0.030	0.253***	-0.000

*** Statistically significant at the 1% level.
** Statistically significant at the 5% level.
* Statistically significant at the 10% level.

Table A Results of econometric estimations of unemployment equations, with adjustment for selection error by Heckman's two-step method (aggregate education levels) *(continued)*

	Before crisis		During crisis	
	2004 Q1-2007 Q4		2010 Q1-2012 Q2	
Variable	Men	Women	Men	Women
Eastern Macedonia – Thrace	-0.025	0.084*	-0.008	-0.008
Central Macedonia	-0.039	0.187***	-0.143***	0.030
Western Macedonia	-0.082	0.126*	-0.019	0.072
Epirus	0.040	0.199***	-0.088**	0.106**
Thessaly	0.009	0.215***	-0.125***	0.074*
Ionian islands	0.084	0.189***	-0.045	0.209***
Western Greece	-0.040	0.184***	-0.124***	-0.001
Central Greece and Euboea	-0.017	0.220***	-0.106**	0.118***
Attica	0.000	0.000	0.000	0.000
Peloponnese	0.077*	0.228***	-0.106**	0.104**
North Aegean	-0.117*	0.220***	-0.131**	0.117*
South Aegean	-0.015	0.100*	-0.064	0.126**
Crete	0.022	0.132***	-0.055	0.017
Capital region – Athens	0.000	0.000	0.000	0.000
Thessaloniki city complex	-0.106*	-0.198***	0.161***	0.160***
Other urban areas	-0.098***	-0.054	0.009	0.127***
Semi-urban areas	-0.183***	-0.167***	-0.102***	-0.021
Rural areas	-0.240***	-0.257***	-0.229***	-0.191***
Regional unemployment rate	7.261***	7.030***	3.262***	3.894***
Year 2004	-0.028	-0.012		
Year 2005	-0.055**	0.002		
Year 2006	-0.011	0.012		
Year 2007	0.000	0.000		
Year 2010			-0.211***	-0.038
Year 2011			-0.079**	-0.024
Year 2012			0.000	0.000
1st quarter	-0.040	-0.039*	-0.074***	-0.043*
2nd quarter	-0.041*	-0.010	0.000	0.000
3rd quarter	-0.025	-0.032	-0.029	-0.016
4th quarter	0.000	0.000	-0.002	-0.029
Constant term	-1.861***	-1.114***	-1.319***	-0.596***

*** Statistically significant at the 1% level.
** Statistically significant at the 5% level.
* Statistically significant at the 10% level.

Table A Results of econometric estimations of unemployment equations, with adjustment for selection error by Heckman's two-step method (aggregate education levels) *(continued)*

	Before crisis		During crisis	
	2004 Q1-2007 Q4		2010 Q1-2012 Q2	
Variable	Men	Women	Men	Women
b. Dependent variable: labour force participation (1=yes, 0=no)				
Pre-lyceum education	0.016	-0.231***	-0.083***	-0.168***
Lyceum	0.000	0.000	0.000	0.000
Post-lyceum non-tertiary education	0.428***	0.740***	0.356***	0.579***
TEI	0.513***	0.914***	0.554***	0.846***
AEI	0.456***	0.889***	0.496***	0.837***
Postgraduate studies	0.802***	1.380***	0.715***	1.269***
Age	0.425***	0.260***	0.427***	0.283***
Age sqrd.	-0.005***	-0.003***	-0.005***	-0.003***
Married	0.306***	-0.365***	0.279***	-0.317***
No children under 14	0.000	0.000	0.000	0.000
With children aged 0-4 years	0.568***	-0.194***	0.503***	-0.257***
With children aged 5-14 years	0.031	-0.127***	-0.019	-0.185***
With children aged 0-4 and 5-14 years	0.292***	-0.327***	0.243***	-0.371***
Greek national	0.000	0.000	0.000	0.000
EU-27 national	0.379***	0.098**	0.387***	0.229***
Third-country national	0.634***	0.127***	0.643***	0.133***
Eastern Macedonia – Thrace	-0.049	0.260***	-0.121***	0.060*
Central Macedonia	-0.044	0.099***	-0.063	-0.059*
Western Macedonia	-0.273***	0.040	-0.268***	-0.041
Epirus	-0.131***	0.110***	-0.133***	0.041
Thessaly	0.039	0.166***	0.029	0.072**
Ionian islands	-0.024	0.167***	0.096	0.068
Western Greece	-0.086**	0.003	-0.033	-0.089***
Central Greece and Euboea	0.009	0.095***	-0.169***	0.028
Attica	0.000	0.000	0.000	0.000
Peloponnese	0.039	0.286***	0.043	0.108***
North Aegean	-0.136***	-0.078**	-0.156***	-0.224***
South Aegean	0.112**	-0.059*	0.134**	-0.053
Crete	-0.009	0.298***	-0.013	0.157***
Capital region – Athens	0.000	0.000	0.000	0.000
Thessaloniki city complex	0.009	-0.180***	0.017	-0.042
Other urban areas	0.057**	-0.121***	0.070**	-0.014
Semi-urban areas	0.221***	0.007	0.296***	0.114***
Rural areas	0.339***	0.226***	0.397***	0.300***
Regional unemployment rate	0.542	0.929**	0.910*	-0.517

*** Statistically significant at the 1% level.
** Statistically significant at the 5% level.
* Statistically significant at the 10% level.

Table A Results of econometric estimations of unemployment equations, with adjustment for selection error by Heckman's two-step method (aggregate education levels) *(continued)*

	Before crisis		During crisis	
	2004 Q1-2007 Q4		2010 Q1-2012 Q2	
Variable	Men	Women	Men	Women
Year 2004	0.014	-0.005		
Year 2005	0.010	-0.004		
Year 2006	0.024	0.003		
Year 2007	0.000	0.000		
Year 2010			0.209***	-0.070
Year 2011			0.099***	-0.028
Year 2012			0.000	0.000
1st quarter	0.037**	-0.024*	0.031	-0.013
2nd quarter	0.023	-0.019	0.000	0.000
3rd quarter	-0.019	-0.001	-0.041	-0.027
4th quarter	0.000	0.000	-0.060**	0.022
Number of working household members (apart from oneself)	0.223***	0.104***	0.195***	0.065***
Number of retired household members (apart from oneself)	-0.099***	-0.081***	-0.124***	-0.111***
Number of economically inactive household members (apart from oneself)	0.016	0.115***	-0.039**	0.090***
Constant term	-7.234***	-4.665***	-7.478***	-4.827***
rho	0.53	0.07	0.60	-0.12
LR test (rho=0): x^2 (1)	129.90	0.91	146.03	1.27
Prob>x^2	0.00	0.35	0.00	0.26
Log likelihood	-39,893.99	-66,164.26	-33,227.77	-45,837.06
Number of observations	84,763	88,588	55,515	57,863

*** Statistically significant at the 1% level.
** Statistically significant at the 5% level.
* Statistically significant at the 10% level.

Table B Results of econometric estimations of earnings equations, with adjustment for selection error by Heckman's two-step method (aggregate education levels)

	Before crisis		During crisis		
	2004 Q1-2007 Q4		2010 Q1-2012 Q2		
Variable	Men	Women	Men	Women	Men OLS
a. Dependent variable: logarithm of hourly earnings					
Pre-lyceum education	-0.012	0.159***	-0.042	0.154***	-0.036
Lyceum	0.000	0.000	0.000	0.000	0.000
Post-lyceum non-tertiary education	0.015	0.008	0.117***	-0.069**	0.112***
TEI	0.075***	0.047	0.074**	-0.007	0.065**
AEI	0.164***	0.194***	0.206***	0.110***	0.197***
Postgraduate studies	0.401***	0.304***	0.425***	0.171***	0.412***
Years after graduation	0.013***	0.008***	0.016***	0.003	0.015***
Years after graduation sqrd.	-0.000***	-0.000	-0.000***	0.000	-0.000***
Years after graduation x Pre-lyceum education	-0.003**	-0.017***	-0.002	-0.011***	-0.002
Years after graduation x Lyceum	0.000	0.000	0.000	0.000	0.000
Years after graduation x Post-lyceum non-tertiary education	0.005**	0.005*	-0.003	0.009***	-0.003
Years after graduation x TEI	0.005*	0.007**	0.003	0.009**	0.003
Years after graduation x AEI	0.009***	0.007***	0.004	0.009***	0.005*
Years after graduation x Postgraduate studies	-0.001	0.016**	0.003	0.015**	0.004
Years after graduation sqrd. x Pre-lyceum education	0.000	0.000***	0.000	0.000	0.000
Years after graduation sqrd. x Lyceum	0.000	0.000	0.000	0.000	0.000
Years after graduation sqrd. x Post-lyceum non-tertiary education	-0.000	-0.000	0.000	-0.000*	0.000
Years after graduation sqrd. x TEI	-0.000	-0.000	-0.000	-0.000	-0.000
Years after graduation sqrd. x AEI	-0.000***	-0.000	-0.000	-0.000	-0.000
Years after graduation sqrd. x Postgraduate studies	0.000	-0.000*	-0.000	-0.000	-0.000
Married	0.074***	0.056***	0.105***	0.045***	0.101***
Greek national	0.000	0.000	0.000	0.000	0.000
EU-27 national	-0.125***	-0.111***	-0.173***	-0.198***	-0.174***
Third-country national	-0.151***	-0.106***	-0.148***	-0.158***	-0.151***
Eastern Macedonia – Thrace	-0.082***	-0.039***	-0.031***	-0.002	-0.033***
Central Macedonia	-0.083***	-0.068***	-0.021*	-0.020	-0.024**
Western Macedonia	-0.007	0.047***	0.089***	0.086***	0.088***
Epirus	-0.015*	0.000	0.040***	0.013	0.039***
Thesssaly	-0.061***	-0.016	0.013	0.010	0.011
Ionian islands	-0.057***	-0.003	-0.005	-0.014	-0.008
Western Greece	0.003	0.028**	0.018	-0.003	0.018
Central Greece and Euboia	0.013	0.003	0.061***	0.003	0.058***
Attica	0.000	0.000	0.000	0.000	0.000

*** Statistically significant at the 1% level.
** Statistically significant at the 5% level.
* Statistically significant at the 10% level.

Table B Results of econometric estimations of earnings equations, with adjustment for selection error by Heckman's two-step method (aggregate education levels) *(continued)*

	Before crisis		During crisis		
	2004 Q1-2007 Q4		2010 Q1-2012 Q2		
Variable	Men	Women	Men	Women	Men OLS
Peloponnese	-0.042***	-0.021*	0.026**	0.022	0.024**
North Aegean	0.017	0.048***	-0.024	0.023	-0.024
South Aegean	0.024**	0.055***	0.020	0.024	0.018
Crete	-0.020**	-0.015	0.044***	0.013	0.042***
Capital region – Athens	0.000	0.000	0.000	0.000	0.000
Thessaloniki city complex	0.067***	0.086***	-0.044***	-0.030*	-0.041***
Other urban areas	-0.002	-0.005	-0.059***	-0.020*	-0.057***
Semi-urban areas	-0.022***	-0.012	-0.056***	-0.024*	-0.055***
Rural areas	-0.015*	-0.014	-0.067***	-0.042***	-0.066***
Agriculture, forestry and fishing	-0.097***	-0.038*	-0.089***	-0.001	-0.089***
Mining and quarrying*	-0.089**	0.171**	0.010	0.107	0.010
Manufacturing	0.190***	0.185***	0.210***	0.117	0.210***
Electricity, gas, steam and air conditioning supply*	0.057***	0.076***	0.065***	0.076***	0.065***
Water supply, sewerage, waste management and remediation activities*	0.171***	0.122***	0.053***	0.094***	0.053***
Construction**	0.097***	0.165***	0.070***	0.148***	0.070***
Wholesale and retail trade; repair of motor vehicles and motorcycles	0.000	0.000	0.000	0.000	0.000
Transportation and storage	0.014*	0.036***	0.049***	0.049***	0.049***
Accommodation and food service activities	0.108***	0.116***	0.131***	0.136***	0.131***
Information and communication	0.153***	0.183***	0.151***	0.217***	0.152***
Financial and insurance activities	0.025**	0.065***	0.006	0.068***	0.007
Real estate activities*	0.101***	0.120***	0.021*	0.100***	0.021*
Professional, scientific and technical activities	0.317***	0.337***	0.310***	0.357***	0.310***
Administrative and support service activities	0.080***	0.121***	0.019	0.058***	0.019
Public administration and defence; compulsory social security	0.047***	0.046***	0.053***	0.021	0.053***
Education	-0.108***	-0.104***	-0.097**	-0.044***	-0.097**
Human health and social work activities	0.248***	0.498***	0.116	0.240**	0.116
Large firm (>10 employees)	0.072***	0.067***	0.082***	0.076***	0.082***
Private sector	0.000	0.000	0.000	0.000	0.000
Public sector	0.091***	0.084***	0.110***	0.083***	0.109***
Years after graduation x Public sector	0.003***	0.010***	0.002	0.006***	0.002
Years after graduation sqrd. x Public sector	-0.000	-0.000***	-0.000	-0.000*	-0.000

*** Statistically significant at the 1% level.
** Statistically significant at the 5% level.
* Statistically significant at the 10% level.

Table B Results of econometric estimations of earnings equations, with adjustment for selection error by Heckman's two-step method (aggregate education levels) *(continued)*

	Before crisis		During crisis		
	2004 Q1-2007 Q4		2010 Q1-2012 Q2		
Variable	Men	Women	Men	Women	Men OLS
Year 2004	0.026***	0.031***			
Year 2005	-0.001	0.006			
Year 2006	-0.004	0.005			
Year 2007	0.000	0.000			
Year 2010			0.170***	0.137***	0.166***
Year 2011			0.117***	0.081***	0.115***
Year 2012			0.000	0.000	0.000
1st quarter	0.002	0.007	0.044***	0.036***	0.043***
2nd quarter	-0.013***	-0.001	0.000	0.000	0.000
3rd quarter	0.004	0.001	0.011	0.014	0.011
4th quarter	0.000	0.000	-0.001	-0.011	-0.000
Full-time employment	0.000	0.000	0.000	0.000	0.000
Part-time employment	0.176***	0.199***	0.198***	0.163***	0.198***
Constant term	1.396***	1.324***	1.174***	1.357***	1.199***
b. Dependent variable: employee (1=yes, 0=otherwise)					
Pre-lyceum education	-0.163***	-0.405***	-0.281***	-0.367***	
Lyceum	0.000	0.000	0.000	0.000	
Post-lyceum non-tertiary education	0.193***	0.510***	0.150***	0.318***	
TEI	0.222***	0.684***	0.234***	0.630***	
AEI	0.055**	0.684***	0.259***	0.661***	
Postgraduate studies	0.203***	0.833***	0.421***	0.766***	
Age	0.272***	0.250***	0.236***	0.241***	
Age sqrd.	-0.003***	-0.003***	-0.003***	-0.003***	
Married	0.400***	-0.337***	0.330***	-0.247***	
No children under 14	0.000	0.000	0.000	0.000	
With children aged 0-4 years	0.104***	-0.054**	0.136***	-0.034	
With children aged 5-14 years	-0.132***	-0.094***	-0.147***	-0.102***	
With children aged 0-4 and 5-14 years	-0.032	-0.223***	-0.110***	-0.187***	
Greek national	0.000	0.000	0.000	0.000	
EU-27 national	0.459***	0.206***	0.169***	0.306***	
Third-country national	0.463***	0.236***	0.271***	0.265***	
Eastern Macedonia – Thrace	0.344***	0.122***	0.164***	0.038	
Central Macedonia	0.256***	0.019	0.302***	0.026	
Western Macedonia	0.301***	-0.024	0.133**	-0.074	
Epirus	0.050	0.000	0.072*	0.012	
Thessaly	0.235***	0.015	0.330***	0.072*	

*** Statistically significant at the 1% level.
** Statistically significant at the 5% level.
* Statistically significant at the 10% level.

Table B Results of econometric estimations of earnings equations, with adjustment for selection error by Heckman's two-step method (aggregate education levels) *(continued)*

	Before crisis		During crisis		
	2004 Q1-2007 Q4		2010 Q1-2012 Q2		
Variable	Men	Women	Men	Women	Men OLS
Ionian islands	0.309***	0.229***	0.392***	0.205***	
Western Greece	0.171***	-0.079**	0.079**	-0.025	
Central Greece and Euboia	0.341***	0.093***	0.323***	0.103***	
Attica	0.000	0.000	0.000	0.000	
Peloponnese	0.170***	0.060**	0.196***	0.023	
North Aegean	0.266***	-0.120***	-0.023	-0.252***	
South Aegean	0.156***	-0.007	0.159***	-0.058	
Crete	0.145***	0.164***	0.232***	0.194***	
Capital region – Athens	0.000	0.000	0.000	0.000	
Thessaloniki city complex	0.062	0.078**	-0.302***	-0.138***	
Other urban areas	-0.013	-0.040*	-0.229***	-0.255***	
Other semi-urban areas	-0.039	-0.138***	-0.159***	-0.234***	
Rural areas	-0.006	-0.198***	-0.078**	-0.279***	
Regional unemployment rate	-3.275***	-2.804***	-0.064	-1.550***	
Year 2004	0.101***	0.062***			
Year 2005	0.077***	0.052***			
Year 2006	0.013	0.022			
Year 2007	0.000	0.000			
Year 2010			0.493***	0.097*	
Year 2011			0.267***	0.056	
Year 2012			0.000	0.000	
1st quarter	0.086***	0.002	0.060***	0.030	
2nd quarter	0.065***	-0.001	0.000	0.000	
3rd quarter	-0.010	-0.011	-0.030	0.021	
4th quarter	0.000	0.000	-0.095***	0.026	
Number of working household members (apart from oneself)	0.148***	0.058***	0.084***	0.017*	
Number of retired household members (apart from oneself)	-0.058***	-0.096***	-0.116***	-0.143***	
Number of economically inactive household members (apart from oneself)	0.078***	0.019	-0.026*	-0.077***	
Constant term	-5.076***	-4.685***	-4.976***	-4.626***	
lamda	-0.045***	-0.066***	0.014	-0.105***	
Number of observations	53,364	70,143	35,686	45,570	17,019

*** Statistically significant at the 1% level.
** Statistically significant at the 5% level.
* Statistically significant at the 10% level.