The Gender Wage Gap as a Function of Educational Degree Choices in an Occupationally Segregated EU Country

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Key Words: salary wage differentials, school choice, human capital, rate of return

Abstract

This study investigates the extent to which differences in the subject of degree studied by male and female university graduates contributes to the gender pay gap, and the reasons underlying their distinct educational choices. The case of Greece is examined due to the fact that it is an EU country with historically large gender discrepancies in earnings and occupational segregation. Using micro-data from the Greek Labour Force Survey (LFS), the returns to academic disciplines are firstly estimated by gender. It is found that the subjects in which women are relatively over-represented (e.g. Education, Humanities) are also those with the lowest wage returns. Oaxaca-Blinder decompositions subsequently imply that gender differences in the type of degree studied can explain an additional 8.4% of the male-female pay gap. Risk-augmented earnings functions of the Hartog-type also indicate that women seek for less risky educations that consequently command lower wage premiums in the job market.

JEL- Code: J16, J24, J31, J71.

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1. Introduction

In the traditional theory of human capital (HC) (Becker, 1964; Mincer, 1974; Ben-Porath, 1967) "*all* of the variation in wage rates can be attributed *only* to differences in *amounts* of human capital. *No implications exist concerning kinds of human capital*" (Polachek, 1981, p. 60). Since the conventional practice of using years or levels of schooling as an explanatory variable in human capital earnings functions conceals most of the diversity of education, the HC model has been criticized for its inability to yield any predictions about the occupational distribution (Blaug, 1976). Yet there are plenty of reasons why considering variations in *types* of human capital may be as important as considering variations in *quantity*. Most importantly, at the micro level interest continues to focus on the under-representation of women and minorities in many technical degree subjects, which tend to lead to higher-paid occupations once the student enters the job market. By examining the kinds of human capital in which people choose to invest in, one can thus explain important economic phenomena such as the gender wage gap, provided that the occupational distribution reflects the spread of the chosen fields of study by individuals.

What is clear from above is that consideration of the variation in types of educational investments may shed light into a much-researched question in the economics literature, namely the cause of wage differentials among men and women in the job market. Numerous studies have utilized standard decomposition techniques in order to investigate the factors which give rise to differences in earnings among genders (Blau & Kahn, 1997; Altonji & Blank, 1999). In Greece, in particular, an EU country with historically large discrepancies in the earnings of male and female workers, the empirical evidence has tended to attribute the gender wage differential to the existence of discriminatory practices against women (Kanellopoulos, 1982; Psacharopoulos, 1983; Patrinos & Lambropoulos, 1993; Kanellopoulos & Mavromaras, 2002; Karamesini & Ioakimoglou, 2003; Papapetrou, 2004; Cholezas & Tsakloglou, 2006; Papapetrou, 2007). Nevertheless, none of the aforementioned studies have taken into account the issue of gender segregation, whereby women are usually concentrated in certain poorly-paid occupations as a result of their ex ante choices of less-financially rewarding academic streams (e.g. Arts, Humanities, Education).

Studying the labour market implications of the degree conferral process may therefore be crucial for the sake of the elimination of discriminatory barriers among the two genders. Examining this issue within the Greek labour market context, in particular, assumes greater significance due to the fact that Greece has one of the highest levels of occupational and sectoral gender segregation in the OECD (OECD, 2002). This paper therefore focuses on investigating the extent to which gender differences in the subject of degree may have contributed to the pay gap of the two sexes. Machin & Puhani (2003) and Sloane and O' Leary (2005) are the only other papers to the author's knowledge that have examined this issue within a European labour market context.

Section 2 describes the available literature on the gender wage gap, focusing primarily on the case of Greece. Descriptive statistics of differences in the subject of degree and in the relative wages of men and women are then provided in Section 3, based on available microdata from the Greek Labour Force Survey (LFS). The relevant econometric methodology is outlined in section 4. Section 5 presents Oaxaca-Blinder decompositions of the gender pay gap from Mincerian earnings functions that initially exclude and subsequently include the type of degree as explanatory variable. Section 6 attempts to shed some light on the reasons for the gender disparity in educational choices in Greece. With the help of the first-ever 'Risk-augmented Mincer earnings equations' (Hartog, 2006) estimated for this country, it is confirmed that (Greek) women tend to seek refuge in less risky educations that command lower compensation in wages. Section 7 concludes with suggestions for future research and appropriate educational policies.

2. Literature Review

Following the increasing interest in the non-linearity of the returns to a university education (Heckman, Lochner & Todd, 2003), a number of studies have examined the role of the field of qualification in the US context. For instance, Brown and Corcoran (1997), Eide (1994) & Loury (1997) find a sizeable contribution of the field of major to the US gender wage gap, which in some cases explains up to 40-50% of the difference. The lack of appropriate information in most available European datasets, by contrast, had previously inhibited the study of the contribution of educational

gender segregation to the male-female pay gap. Machin & Puhani (2003) and O'Leary & Sloane (2005) are the first studies to have shown that women tend to select disciplines that offer lower lifetime earnings (e.g. Arts, Education and other Social Sciences), so that controlling for the subject of degree can explain a significant part (between 9 to 19 percent) of the gender wage gap in Britain and Germany.

In Greece, a number of research papers studying the gender wage differential have shown that the ratio of female to male earnings has declined from around 35% in the 1970s to approximately 25-30% in the 1990s, and that the largest part of the wage differential between Greek men and women cannot be explained by a discrepancy in their physical or human capital endowments. The earliest studies of Kanellopoulos (1982) and Psacharopoulos (1983) reported that discrimination accounted for around 60% and 89% of the observed pay gap in the mid-1960s and mid-1970s, respectively. In Patrinos & Lambropoulos (1993) the entire earnings gap of male and female workers employed in the Greek labour market in the years 1981 and 1985 is attributed to discrimination. Using samples from the 1988 and 1994 waves of the Household Budget Surveys, Kanellopoulos & Mavromaras (2002) have also credited the gender wage differential in Greece to discrimination, which takes place primarily through the adverse treatment of female labour market participation. In this study the share of the gap that is unexplained declines substantially between 1988 and 1994 from 74% to 54%. This is believed to be the outcome of the intense legislative process promoting equality of opportunity in Greece (on the lines of the regulations and directives issued by the EU), as well as the increased labour force participation of women that has taken place in recent decades. Papapetrou (2004) extends the analysis using the 1997 wave of the European Community Household Panel (ECHP) in order to estimate the differences in wages among the two sexes at various deciles of the wage distribution. By applying quantile regression techniques, her analysis shows that differences in the employees' characteristics explain 41% of the gender wage differential in the entire sample, while the remaining 59% is the component due to differences in returns. She also illustrates that the largest part (37.5%) of the unexplained component is due to a female disadvantage (i.e. females receive lower wages relative to the non-discriminatory wage structure) and that the discriminatory element varies along the earnings

distribution (it ranges from 59% in the 10th decile to 55% in the 90th percentile). Cholezas & Tsakloglou (2006), using data from three Household Budget Surveys (1988, 1994, 1999) and a number of decomposition techniques, show that in the more competitive private sector of the economy around three quarters of the observed gap can be attributed to discrimination. Finally, Papapetrou (2007) investigates (using the EU-SILC database) whether the so-called "glass-ceiling" hypothesis of women being underrepresented in highly-paid positions is applicable to the Greek labour market context. She finds evidence of a widening discrepancy in the wages of Greek men and women as one move towards the higher rungs of the wage distribution.

There are plausible reasons to believe that the above studies may have overstated the "true" discrimination experienced by women in the Greek labour market. As acknowledged by Cholezas & Tsakloglou (2006, p. 14), "there is evidence that female labour force participants who were tertiary education graduates were concentrated in less rewarding disciplines, such as disciplines of Humanities and Social Sciences, while males were over-represented in the more rewarding disciplines of Science, Engineering and Medicine (Ministry of Education, 1995; Gouvias, 1998)…It is likely that if such differences were controlled for, the earnings gap could have shrank further."

Moreover, Greece shows one of the highest levels of both sectoral and occupational gender segregation amongst the group of advanced Western economies (OECD, 2002). In particular, only 14 occupations (out of a total of 115) are found to be female dominated in this country. Karamesini & Ioakimoglou (2003) have attempted to control for this segregation by including controls for sector, occupation and tenure in their wage regressions. They argue that once the occupational and sectoral effects are taken into account, discrimination accounts for only 27% of the observed gap in industry and for 24% in services. However, given that the concentration of women in particular sectors and occupations may well be part of the discrimination process, the inclusion of such variables in the analysis is likely to make the proportion of the pay gap that is attributed to discrimination "artificially" low.

Importantly, the occupational segregation experienced by women may be traced to their educational choices between different types of academic degrees prior to them entering the job market.

As this decision occurs ex ante it cannot be the outcome of discrimination, at least not in a labour market sense. It follows that controlling for the diverse distribution of types of university degrees amongst men and women may be crucial for understanding the pattern of wage differences that are observed between the two sexes. This is particularly the case once one considers that Greece has experienced a large expansion of its education sector in recent decades (Magoula & Psacharopoulos, 1999). Gender wage differences among individuals of higher educational attainment rates are therefore unlikely to be the outcome of 'traditional' labour market forces (e.g. lower participation of women, discrimination, marginal attachment to the labour force etc.), and are expected to reflect differences in productive characteristics instead (Papapetrou, 2007).

3. Data and Descriptive Statistics

The analysis draws on the most credibly available micro-data from the Greek Labour Force Survey (LFS) for the second quarter of the years 2000-2003. The Greek LFS is conducted by the National Statistical Service of Greece (ESYE). Since 1998, the LFS is being conducted four times per year in order to meet the standards set by Eurostat. The yearly sample of the survey consists of 30 000 households and includes approximately 80 000 observations. The questionnaire used is comprised of approximately 100 questions and both the questions and the definitions are agreed internationally (European Communities, 2003). In this study the four cross-sections have been pooled together to create a unique dataset.

Those individuals that during the reference week worked at least one hour, or those that have a job even if they were absent in the reference period for reasons of illness/leave/strike etc, are classified as being "employed". In the sample 118 813 observations (43,6%) correspond to employed individuals, 13 185 to the unemployed (4,9%) and 140 441 to the inactive (51,5%). The percentage of inactivity and unemployment is considerably higher among females (62, 5% and 5,7%, respectively) than males (39,5% and 3,9%, respectively). Amongst the employed, 39 383 are self-employed (33,1%) and 68 866 are in paid employment (57,9%). The remaining 10 564 (8,9%) are classified as assistants of the family business. For the purposes of this study a sample of paid

employees is retained[3], aged between 15-74 years and with completed studies, resulting in a total of 67 715 observations. 60% of the entire sample is comprised of male employees while the remaining 39% are females.

In Table 1 the difference between average male and female net monthly earnings is reported for each year of the sample (2000-2003). Earnings are calculated as the nominal net monthly wage that the respondents receive from their main employment inclusive of any extraneous payments (such as Christmas and Easter bonus, annual leave remuneration and other irregular bonuses).[4] From the statistical data it is clear that there is a notable gender gap in mean earnings with women receiving on average approximately 85% of the earnings received by men.[5]

Table 2 examines this discrepancy in wages further by breaking down the data according to the sector (public-private) in which the respondents were employed. The rationale for this is that in the sizeable Greek public sector the wage distribution tends to be more compressed, given that wage bargaining between the government and powerful public sector unions is the norm. In contrast, wages are more likely to reflect differences in gender productivity within the more competitive private segment of the economy. Indeed, Table 2 confirms this a priori expectation as it is shown that the gender pay gap lies at around 20% in the private sector, as opposed to 10% in the public sector. The higher average wages received by workers in the public relative to the private sector also reflects the fact that state jobs attract a disproportionate amount of highly-skilled individuals (Kanellopoulos, 1997).

[INSERT TABLES 1 AND 2 HERE]

Table 3 presents descriptive statistics of some of the most important variables that may contribute to the above discrepancy in pay rates among men and women. Male workers are on average older than females. There is an equiproportionate spread of male and female employees between the

[3] Self-employed individuals had to be left out of the analysis as there is no information about the income of this particular group in the LFS.

[4] The Greek LFS database collects information on wage bands rather than precise wage levels. Our analysis therefore adopts the standard practice of utilizing the median wage per band as an approximation. It is also important to notice is that using nominal rather than real wage terms should not affect the decomposition results regarding important characteristics as only the constant term would change in the estimation procedure.

[5] This agrees with the most recent evidence of Papapetrou (2007) using the EU-SILC database for the years 2003-2004.

private and public sector, which is indicative of the positive anti-discrimination steps that the Greek state has taken in recent years in terms of hiring requirements for the attractive public sector jobs. Large gender differences are nevertheless observed in terms of the higher percentages of women that are employed in atypical contracts involving part-time or temporary work. Partly for this reason, women are found to work on average 3 hours less per week compared to men. Significant differences are also detected with respect to the differential human capital characteristics of the two sexes, as measured by their educational attainment levels and the years of job tenure. Importantly, the percentage of tertiary education graduates appears to be higher among Greek women than men. By contrast, men enjoy (approximately three) more years of actual experience in their current jobs relative to women.[6] The above patterns indicate that it is plausible that the higher earnings of male workers can be attributed to the fact that men are older, more experienced, work longer hours and are more likely to be in full-time and permanent jobs relative to women. At first sight educational attainment does not appear to be a good candidate for the observed lower earnings of female employees.

[INSERT TABLE 3 HERE]

Crucially, Table 4 illustrates that despite the fact that a larger proportion of females have matriculated from higher education institutions, there are marked differences in the degree subject studied compared to men. Women are more heavily represented in Law, Social Sciences, Humanities, Education, Librarianship and other medical-related sciences (e.g. speech therapy, physiotherapy, nursing etc.). In contrast, men are mostly found in the more technically-oriented academic Schools such as Polytechnics, Computer Science, Agricultural Studies, Physics and Mathematics, Medicine, Economics and Business and Physical Education. Given that the latter degrees are more highly-paid disciplines than the former, it becomes obvious that the subject of degree is a potential culprit for explaining the gender wage differential of university graduates in Greece. Indeed, it can be seen that the mean wage of the 'male-dominated (MD)' degrees is found to

[6] These patterns are in agreement with other studies that have used alternative Greek datasets in the past (Papapetrou, 2004; Cholezas & Tsakloglou, 2006).

be equal to 954 euros while that of the respective 'female-dominated (FD)' subjects is significantly lower at 865 euros (H_0: $w_{MD} - w_{FD} = 0$; t-statistic = 15.17***).[7] The remaining part of the paper therefore turns to an extensive investigation of this hypothesis based on multivariate analysis.

[INSERT TABLE 4 HERE]

4. Econometric Methodology

The empirical analysis of the paper follows the standard decomposition framework of Oaxaca (1973) and Blinder (1973).[8] The procedure requires the estimation of separate earnings functions for male and female university graduates who are in paid employment. The gender wage gap is then deconstructed into a part that is attributable to differences in the mean productive characteristics (the explained part) and a part that is due to different returns to such characteristics (the unexplained part). In this manner it becomes possible to detect the extent to which gender differences in the field of study contribute to wage differences between males and females.

Prior to estimating the earnings equations, it is necessary to correct for the potential non-randomness of the selected sub-samples of employed university graduates (Heckman, 1979). This is done by estimating a two-equation system, one for the endogenous choice into paid employment (that is conditional on individuals having a university degree) and one for the main wage equation, using a maximum likelihood technique. Correlation between the random error terms of the two equations is then indicative of the presence of selectivity bias that will lead to biased estimates of the determinants in the wage equation.

The first-step selection equation into paid employment is based on probit estimation as follows:

$$E_i^* = \mathbf{Z}_i\boldsymbol{\gamma} + u_i \qquad (1)$$

[7] A predominantly female subject of degree is defined as any category where the female share exceeds 59%, obtained by the total female share (39%) multiplied by 1.5 (a standard weighting factor).

8 The analysis was replicated using the amended methodologies proposed by Neumark (1988) and Oaxaca and Ransom (1994), showing very similar results to the ones discussed in the paper.

where, for each individual *i*, **Z** is a vector of observable variables that includes at least one identifying exogenous variable that is orthogonal to the wage determination process, $\boldsymbol{\gamma}$ is a vector of regression parameters and *u* is the error term. From equation (1) it is calculated that the realization of participation into paid employment, denoted by *E*, occurs with probability $\Phi(\mathbf{Z}_i\boldsymbol{\gamma})$ whenever $P_i^* > 0$ and probability 1- $\Phi(\mathbf{Z}_i\boldsymbol{\gamma})$ when $P_i^* \leq 0$, where Φ is the standard normal distribution function.

The Mincer-type earnings functions that are subsequently fitted for each gender are defined as follows:

$$\ln W_{ij} = \sum_{j=1}^{J} S_{ij}\alpha_j + \mathbf{X}_i\boldsymbol{\beta} + \varepsilon_i \qquad (2)$$

where W_{ij} are the monthly earnings of individual *i* who graduated in subject *j* (*j* = 1,…, *J*), S_{ij} are dummy variables taking the value 1 if individual *i* graduated in a given subject and 0 otherwise, $\boldsymbol{X}_i$ is a vector of personal and job characteristics which affect occupational earnings and ε_i is a random error term. The coefficients α_j subsequently indicate the earnings premium that graduating from subject *j* imparts relative to the default case (usually the subject which has the lowest return), while $\boldsymbol{\beta}$ is the vector of the marginal returns of the characteristics in $\boldsymbol{X}$.

The total difference in the mean wages of the two genders can then be decomposed as follows:

$$\overline{W}_m - \overline{W}_f = (\overline{S}_m - \overline{S}_f)\hat{\alpha}_m + (\overline{X}_m - \overline{X}_f)\hat{\beta}_m + (\hat{\alpha}_m - \hat{\alpha}_f)\overline{S}_f + (\hat{\beta}_m - \hat{\beta}_f)\overline{X}_f \qquad (3)$$

The first part of equation (3) (i.e. the 'explained' part) measures the component of the average wage difference between the two genders that is attributed to differences in the means of the explanatory variables, which are in turn weighted by the estimated coefficients of the male equation. The second term (i.e. the 'unexplained' part) refers to the part of the wage gap that is often ascribed to 'discrimination', as it measures the different manner with which the labour market rewards the characteristics of male and female employees.

5. Wage Decompositions

The output of the probit model explaining the selection of Greek university graduates into paid employment by gender is provided in Table 5. The results mirror the findings of previous studies of the determinants of labour market participation in the Greek labour market (Kanellopoulos and Mavromaras, 2002; Livanos, Yalkin & Nunez, forthcoming).

In particular, it is found that the probability of employment has an inverse U-shaped relationship with age, marriage is detrimental to employment only for females, while immigrant workers have a lower chance of being in employment in contrast to those who are head of the household. Regarding regions of residence, some strong regional disparities in the chances of employment for university graduates are observed, in accordance with the literature (Livanos 2008). Importantly, the regression also takes into account differences in the chances of employment that are associated with the different subjects studied. For instance, it is found that Law and Social Science *male* graduates have a lower chance of being in paid employment relative to the reference category (Agricultural Science - Technical University). In contrast, graduation from Physics and Maths, Education, Humanities and Medical-related degrees (so-called "female-dominated") enhances the chances of *female* employment. Finally, it should be pointed out that the identifying variable used in this study, namely the number of children in the household, corresponds to the predictions of previous studies in the literature (e.g. Mroz, 1987), as it is found to be a significant (negative) predictor of the likelihood of employment in the female sub-sample only.

[INSERT TABLE 5 HERE]

Controlling for the effect of the academic degree on the probability of employment is crucial for the subsequent analysis, as the wage differentials between genders, shown in Table 6, should not reflect any participation penalties that workers of particular degree types may incur in the Greek labour market (Kanellopoulos and Mavromaras, 2002). The returns to broad types of university degrees reported in Table 6 are therefore robust to the fact that some of them may affect the probability of individuals entering the labour market.

The substantial diversity in the returns to particular degree programmes within the Greek labour market is discussed in detail in Livanos & Pouliakas (2008). Here it is highlighted that although female workers holding female-dominated degrees are rewarded higher than their male counterparts, the subjects in which women are relatively over-represented (such as Education, Humanities, Librarianship and Medical-Related sciences) command lower wage returns in the job market[9]. Furthermore, as no significant evidence of a correlation between the error terms of the employment participation and wage equations is found, selection does not appear to be a driving force of the above findings.

[INSERT TABLE 6 HERE]

Table 7 explores the implications of the differential degree choices of men and women on the "explained" and "unexplained" part of the gender pay gap, along the lines of Machin & Puhani (2003).[10] Specifically, the two columns of the Table compare the results of the wage decompositions with and without the subject of degree included as part of the control set. Using the main specification of the earnings equation as in Table 6, it is found that the effect of controlling for broad subject of degree is quite significant, explaining an additional 8.4% of the male-female wage differential. This corresponds very closely to the findings of Machin & Puhani (2003), who showed using similar LFS data from the UK and Germany that the field of study explains around 9-19% of the gender wage gap in those countries. Importantly, even after the type of degree is accounted for, only 58% of the gender pay gap can be explained in the more competitive private sector in terms of differences in the productive characteristics of male and female employees. It is also interesting that a larger proportion (9.8%) of the gender wage gap can be accounted for by the heterogeneity in academic disciplines in the private sector relative to the whole sample. This is reasonable given that

[9] "Technical University-Agricultural Sciences" is chosen as the comparator group as this degree is found to yield no statistically significant benefit in terms of higher wages in comparison to secondary school graduates.
[10] Note that since we are considering a sample of university graduates only, the impact of educational qualifications is implicitly controlled for.

wages in the private sector are more likely to mirror any productivity differences that exist among male and female workers.[11]

[INSERT TABLE 7 HERE]

6. Exploring Gender Differences in Educational Choices

The findings of this paper suggest that in an era of rising educational attainment levels observed in most OECD economies, the promotion of gender pay equality should not only rest on a legislative process that focuses on "traditional" factors underlying the gender wage gap, such as female participation and employer discrimination. Instead, attempts to establish gender equality should also pay attention to the *educational choices* of men and women between different types of degrees prior to entry into the job market. What this implies is that academics and policymakers should focus more on the potential differences in the determinants of human capital investments between the two sexes. Following this logic, a number of potential explanations for the gender disparity in educational choices are explored in the remainder of this section.

The study of Polachek (1981) is among the first to provide a simple illustration of how occupational variations in the cost of labour force intermittency may result in females choosing occupations that impose the smallest penalty given their desired participation, *ceteris paribus*. This line of reasoning has unambiguous implications for gender differences in educational-occupational choice, and, hence, wages. Moreover, the available models of occupational choice stress than an individual's choice of college major is likely to depend on the gain in predicted future earnings (e.g. Freeman, 1971; Boskin, 1974; Berger, 1988; Montmarquette, Cannings & Mahseredjian, 1997). However, in the face of substantial evidence from the recent job satisfaction literature (EPICURUS, 2007; Pouliakas & Theodossiou, 2005, 2010) that has suggested that pay is not a dominating factor in terms of the job satisfaction of women, gender differences in choice of degree could also be explained in terms of the differential 'tastes' of men and women for various pecuniary and non-pecuniary

[11] We have also experimented with alternative specifications that include variables such as "Tenure", "Industry" and "Occupation" in the earnings equation. In all cases the conclusion that the type of degree approximately explains an additional 8% of the gender wage differential persists.

aspects of jobs. An example of this hypothesis can be seen from the superior wage returns that women enjoy in female-dominated subjects, shown in Table 6, indicating that certain unobserved female traits are valued more highly by employers in these disciplines.

Related to the above is the well-documented higher risk aversion that typically characterizes women as compared to men. In this case one would expect to observe women selecting less risky career paths relative to men, that subsequently command lower wage premiums in the job market, or to request higher risk compensation in pay for occupations which are similar in terms of their uncertainty.

In order to test this hypothesis within the Greek labour market context, the two-step methodology of McGoldrick (1995) and Hartog (2006) has thus been implemented, whereby the variance of earnings of a given education cell is taken as a measure of the uncertainty or "risk" associated with the respective human capital investment. In particular, a wage equation similar to equation (2) is estimated separately for each year of the sample, albeit with a reduced control set including only the variables female, age group dummies, immigration status and region of residence. These are selected on the basis they are known to the individual at the time of his/her selection of educational field of study. As suggested by Hartog (2006), dummy variables corresponding to the different degree subjects are also included as fixed effects. Measures of risk (R) and skewness (K) within the alternative field of study cells, j, are then calculated as the second and third moments of the distribution of $exp(\varepsilon_i)$, as in equation (4), where ε_i are the estimated residuals and the measure of skewness is believed to capture the phenomenon of individuals typically being willing to incur a wage loss in return for a positive prospect of high earnings:

$$R_j = \frac{1}{N_j}\sum_i (\varepsilon_{ij} - \bar{\varepsilon}_j)^2 \ , \ K_j = \frac{1}{N_j}\sum_i (\varepsilon_{ij} - \bar{\varepsilon}_j)^3 \qquad (4)$$

Following estimation of R and K, it is indeed confirmed that the so-called female-dominated subjects are characterized by a lower mean level of risk ($R_{FD} = 0.127$) relative to their male-dominated counterparts ($R_{MD} = 0.166$), and that this difference is statistically significant at conventional levels of

significance (H_0: $R_{MD} - R_{FD} = 0$; t-statistic = 106.52***). Moreover, '*risk-augmented Mincer earnings functions*' are then estimated by gender (Hartog, 2006). These regressions include *R* and *K* as controls in the wage equation (2), omitting the degree dummies as these are already fixed in *R* and *K* and adjusting for clustering at the field of study cells. The evidence, as shown in Table 8, indicates that on average women receive lower risk compensation relative to men in the Greek job market. This is particularly the case in the private sector, whereby only men receive a compensating wage premium to uncertain educational degree prospects. In addition, the negative effect of skewness in the wage distribution is found to predominantly affect women. Such conclusions are in line with the results of a number of other cross-country studies in the literature (e.g. Berkhout , Hartog & Webbink, 2006) for the Netherlands and Hartog (2006) for a survey).

[INSERT TABLE 8 HERE]

Finally, the importance of family, societal and cultural factors in determining the educational decisions of Greek students cannot be underestimated (Lianos, Asteriou & Agiomirgianakis, 2004). For instance, it is found from the LFS dataset used in this paper that approximately 45% of the respondents whose parents were graduates of a female-dominated discipline also chose to study a female-dominated subject. In contrast, only 28% followed such an academic path when their parents were graduates of male-dominated fields instead.

7. Conclusion

This study investigates the extent to which differences in the subject of degree studied by male and female university graduates contributes to the gender pay gap. The case of Greece is used as an example given that it is an EU country with historically large gender discrepancies in earnings and occupational segregation. Using micro-data from the Greek LFS, it is found that the subjects in which women are relatively over-represented (e.g. Education, Humanities) are also those commanding the lowest wage returns. Oaxaca-Blinder decompositions subsequently indicate that

controlling for such gender differences in the subject of degree can explain an additional 8.4% of the male-female pay gap in Greece. As this corresponds closely to previously reported evidence from the UK and Germany, this paper provides further confirmation that a sizeable part of the gender pay gap of university graduates in EU countries can be attributed to the differential educational choices of men and women before they enter into the job market. Recent advances that have integrated the role of uncertainty within the standard human capital earnings framework have also allowed us to estimate the first-ever 'risk-augmented Mincer earnings functions' for Greece. The results indicate that Greek women are similar to their European counterparts in that they tend to find refuge in less risky educations that consequently offer lower compensation in terms of pay. This is in accordance with the higher risk aversion exhibited by females relative to males that is typically presumed in the economic literature.

These findings suggest that, in addition to the traditional forces believed to contribute to the gender wage gap (e.g. participation penalty, discrimination etc.), the promotion of gender equality in Greece and in other advanced Western economies should pay closer attention to the educational choices of men and women prior to entry into the labour market. This is likely to be particularly important in the face of the rapidly rising tertiary educational attainment levels observed in OECD economies. Greater understanding the factors that underlie the selection of individuals of different gender into diverse academic disciplines is therefore required in future research.

Acknowledgements

We are grateful for the helpful comments of Dr. Evangelia Papapetrou of the Bank of Greece and of participants at the 2nd International Conference of Educational Economics organized by the University of Athens in July 2008 in Athens, Greece.

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Table 1
Mean net monthly earnings (€) disaggregated by gender, Greece, LFS, 2000-2003

Year	All (W)	Male (W_m)	Female (W_f)	Wage ratio (W_f/W_m)
2000	735	783	660	0.84
2001	751	804	670	0.83
2002	775	826	700	0.85
2003	852	902	777	0.86
2000-2003	777	827	701	0.85

Table 2
Net monthly earnings (€) by gender and sector of employment, Greece, LFS, 2000-2003

Year	Public sector			Private sector		
	Male (W_m)	Female (W_f)	Wage ratio (W_f/W_m)	Male (W_m)	Female (W_f)	Wage ratio (W_f/W_m)
2000	903	801	0.89	712	569	0.80
2001	917	815	0.89	740	584	0.79
2002	941	842	0.90	761	614	0.81
2003	1011	918	0.91	842	694	0.82

Table 3
Descriptive Statistics by Characteristics and Gender, Greece, LFS, 2000-2003

(%)	N	All	Male	Female
Male	41,034	60.60		
Married	42,770	63.16	65.64	59.36
Private	43,333	63.99	64.72	62.88
Part-time	2,294	3.39	1.63	6.09
Permanent	59,393	87.71	89.27	85.32
Occupation				
Legislators/managers	1,251	1.85	2.42	0.97
Professionals	10,193	15.05	12.13	19.55
Technicians/associates	6,306	9.31	7.54	12.04
Clerks	11,440	16.89	11.97	24.46
Services and Sales	11,040	16.30	13.86	20.06
Skilled agriculture etc.	622	0.92	1.24	0.43
Craft/trade	12,371	18.27	26.32	5.89
Plant/machine operators	6,492	9.59	14.13	2.59

Elementary	6,924	10.23	7.98	13.68
Education				
PhD	218	0.32	0.38	0.23
Masters	354	0.52	0.51	0.54
AEI	12,980	19.18	15.45	24.90
TEI	2,420	3.58	2.85	4.68
Tertiary non-university	6,519	9.63	7.62	12.73
Other	1,236	1.83	2.78	0.36
Secondary	30,321	44.80	47.43	40.75
Primary	13,639	20.15	22.98	15.80
Means				
Age	67715	33.14	39.99	37.87
Actual Hours	67715	40.30	41.51	38.45
Job tenure	33073	10.16	11.10	8.71

Table 4
Gender Differences in Type of Degree, Greece, LFS, 2000-2003

	All				
	N	**%**	**Male (%)**	**Female (%)**	**Mean Wage by Subject (€)**
Higher Education Institutes					
Polytechnic	1,338	8.69	13.36	4.25	1007
Computing Science	98	0.64	0.79	0.49	1010
Agricultural Science	455	2.95	4.22	1.75	924
Physics and Maths	1,355	8.80	11.77	5.97	944
Medicine	874	5.68	7.00	4.41	1161
Law	559	3.63	3.21	4.03	1009
Economics & Business	3,270	21.23	22.41	20.11	901
Social Sciences	240	1.56	1.33	1.77	928
Humanities	2,189	14.21	6.98	21.10	860
Physical Education	549	3.56	4.77	2.42	804
Education	2,053	13.33	8.56	17.87	905
Technical Education Institutes					
Polytechnic	1,091	7.08	11.69	2.70	888
Agricultural Science	143	0.93	1.09	0.77	742
Food Technology	62	0.40	0.40	0.41	778
Librarianship	25	0.16	0.04	0.28	736
Medical-related	1,034	6.71	1.96	11.24	794
Applied Arts	65	0.42	0.41	0.43	797
Female-dominated	5,668	35.49	18.77	51.75	865
Male-dominated	10,304	64.51	81.23	48.25	954
Total	**15,400**	**100%**	**7,509**	**7,891**	**914**

Table 5
Selection into paid employment by gender, Greece, LFS, 2000-2003

	Male	Female
Field of study		
Female-dominated§	-0.011	0.116
	(0.036)	(0.025)***
Higher Education Institutes		
Polytechnics	-0.091	0.068
	(0.146)	(0.137)
Computer Science	0.275	0.354
	(0.223)	(0.218)
Agricultural Science	0.111	0.358**
	(0.158)	(0.157)
Physics & Maths	0.139	0.371***
	(0.148)	(0.136)
Medicine	-0.074	0.148
	(0.150)	(0.137)
Law	-0.326**	0.055
	(0.157)	(0.139)
Economics & Business	-0.058	0.202
	(0.143)	(0.127)
Social Sciences	-0.374**	-0.032
	(0.177)	(0.150)
Humanities	0.049	0.245*
	(0.150)	(0.127)
Physical Education	-0.077	0.172
	(0.155)	(0.148)
Education	-0.072	0.364***
	(0.148)	(0.128)
Technical Education Institutes		
Polytechnics	0.082	0.149
	(0.147)	(0.145)
Food Technology	0.350	-0.151
	(0.320)	(0.209)
Librarianship	-0.371	0.164
	(0.770)	(0.265)
Medical-related	0.107	0.450***
	(0.178)	(0.131)
Applied Arts	-0.076	0.159
	(0.268)	(0.212)
(omit: Technical Agricultural)		
Demographic		
Number of children in HH	-0.008	-0.036***
	(0.011)	(0.010)
Age group		
25-34	1.922***	1.073***
	(0.059)	(0.047)
35-44	2.223***	1.417***
	(0.057)	(0.051)
45-54	2.167***	1.245***
	(0.058)	(0.054)
55-64	1.102***	-0.021
	(0.059)	(0.063)
(omit: 15-24)		
Married	0.061	-0.210***

	(0.046)	(0.033)
Head of Household	0.273***	0.153***
	(0.050)	(0.041)
Immigrant	-0.109*	-0.191***
	(0.061)	(0.043)
Region of residence		
East Macedonia	0.158**	-0.106*
	(0.074)	(0.062)
Central Macedonia	0.224***	-0.111*
	(0.082)	(0.061)
West Macedonia	0.186**	0.061
	(0.095)	(0.079)
Ipeiros	0.065	-0.126*
	(0.073)	(0.064)
Thessaly	0.359***	0.020
	(0.081)	(0.064)
Ionian Islands	0.196	0.064
	(0.137)	(0.117)
Western Greece	-0.056	-0.132**
	(0.072)	(0.062)
Mainland Attica	-0.008	-0.060
	(0.082)	(0.079)
Rest of Attica	0.107	-0.224***
	(0.076)	(0.064)
Peloponnisos	0.087	-0.018
	(0.082)	(0.066)
North Aegean	0.014	-0.055
	(0.122)	(0.096)
South Aegean	-0.007	-0.018
	(0.111)	(0.096)
Crete	-0.015	-0.063
	(0.073)	(0.061)
Salonica	0.170***	-0.058
	(0.048)	(0.039)
(omit: Athens)		
Time dummies		
2001	-0.076*	-0.031
	(0.041)	(0.035)
2002	0.064	0.179***
	(0.067)	(0.049)
2003	-0.038	0.072**
	(0.042)	(0.036)
(omit: 2000)		
Constant	-1.455***	-0.776***
	(0.156)	(0.135)
N	9958	11612
Wald $\chi^2(41)$	2816***	1759***
Pseudo R^2	0.35	0.13

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Subjects in which the female share exceeds 59% of the total proportion are classified as "female-dominated"; The reported coefficients on the female-dominated dummy variable arise from separate earnings regressions in which the variable has been entered separately as control instead of the detailed field of study indicator variables.

Table 6
Wage equations by gender, Greece, LFS, 2000-2003

	Male	Female
Field of Study		
Female-dominated§	-0.042	-0.026
	(0.010)***	(0.007)***
Higher Education Institutes		
Polytechnics	0.187***	0.172***
	(0.036)	(0.039)
Computer Science	0.328***	0.250***
	(0.053)	(0.059)
Agricultural Science	0.112***	0.095**
	(0.039)	(0.043)
Physics & Maths	0.151***	0.167***
	(0.036)	(0.039)
Medicine	0.290***	0.268***
	(0.038)	(0.039)
Law	0.215***	0.184***
	(0.041)	(0.039)
Economics & Business	0.168***	0.115***
	(0.035)	(0.037)
Social Sciences	0.177***	0.152***
	(0.048)	(0.043)
Humanities	0.112***	0.138***
	(0.037)	(0.037)
Physical Education	0.091**	0.055
	(0.038)	(0.042)
Education	0.136***	0.154***
	(0.037)	(0.037)
Technical Education Institutes		
Polytechnic TEI	0.094***	0.053
	(0.036)	(0.041)
Food Technology	0.002	0.033
	(0.065)	(0.061)
Librarianship	0.216	0.005
	(0.212)	(0.070)
Medical-related	0.031	0.034
	(0.043)	(0.038)
Applied Arts	0.148**	0.066
	(0.069)	(0.060)
(omit: Technical Agricultural)		
Demographic		
Age group		
25-34	-0.067	0.106***
	(0.052)	(0.027)
35-44	0.037	0.195***
	(0.056)	(0.031)
45-54	0.109*	0.258***
	(0.056)	(0.030)

55-64	0.166***	0.284***
	(0.042)	(0.025)
(omit: 15-24)		
Married	0.052***	0.064***
	(0.012)	(0.009)
Head of Household	0.074***	0.048***
	(0.013)	(0.010)
Immigrant	-0.131***	-0.080***
	(0.015)	(0.013)
Job-related		
Usual Weekly Hours	0.002***	-0.000
	(0.001)	(0.000)
Full time	0.219***	0.378***
	(0.034)	(0.018)
Permanent contract	0.191***	0.190***
	(0.015)	(0.011)
Public sector	0.072***	0.146***
	(0.009)	(0.008)
Firm Size		
11-19	0.043***	0.074***
	(0.010)	(0.009)
20-49	0.075***	0.094***
	(0.012)	(0.010)
> 50	0.167***	0.154***
	(0.011)	(0.011)
Unknown > 10	0.070***	0.078***
	(0.013)	(0.012)
(omit: < 10)		
Constant	5.957***	5.626***
	(0.084)	(0.059)
N (uncensored)	9958 (6689)	11612 (7148)
R-squared	0.31	0.42
Wald $\chi^2(48)$	2932***	5023***
LR test ($\rho = 0$) $\chi^2(1)$	0.26	0.12

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Region and Yearly dummy variables are also included as controls; Subjects in which the female share exceeds 59% of the total proportion are classified as "female-dominated"; The reported coefficients on the female-dominated dummy variable arise from separate earnings regressions in which the binary variable has been entered separately as control instead of the detailed field of study indicator variables.

Table 7
Oaxaca-Blinder Decompositions of Gender Wage Differences of University Graduates, Greece, LFS, 2000-2003

	Without subject of degree	With subject of degree
Whole sample		
Log(Wage Gap)	0.156	0.156
Explained	0.111	0.124
Unexplained	0.045	0.032
% Gap Explained	71.0	79.4
Increase in % Gap Explained		8.4
Private Sector		
Log(Wage Gap)	0.247	0.247
Explained	0.143	0.168
Unexplained	0.104	0.080
% Gap Explained	58.0	67.8
Increase in % Gap Explained		9.8

Table 8
Risk-augmented Earnings Functions, Greece, LFS, 2000-2003

	Risk	*t*	*Skew*	*t*	*N*
Whole sample					
All	1.08	2.44**	-0.10	-1.86*	13837
Men	1.29	3.31***	-0.08	-1.64	6689
Women	1.03	1.94*	-0.14	-2.08**	7148
Private sector					
All	0.85	1.65	-0.02	-0.42	5399
Men	1.20	2.05*	-0.03	-0.47	2788
Women	0.64	1.73	-0.07	-1.59	2611
Public sector					
All	1.52	2.67**	-0.15	-2.07*	8438
Men	1.56	2.96 **	-0.11	-1.74*	3901
Women	1.50	2.19**	-0.19	-2.09**	4537

Notes: s.e's robust and clustered by education type; ** p<0.05, * p<0.1; Regressions include controls as in Table 6. Measures of risk and skewness are derived as in Hartog (2006).