Higher education and efficiency in Europe: A comparative analysis.

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Abstract:

This paper analyses the efficiency of higher education in equalizing the feasible wages obtained for men and women in the labour market. To do that, It is estimated two stochastic frontiers. The first one measures the effect of higher education inside the group of men and women for six European countries. The results indicate that in Denmark, France and Italy men with higher education have higher gains in wages with respect men with the same characteristics with secondary education while for women appears the opposite result. In Germany and Spain, women with higher education experiment higher gains in terms of wages than obtain men. The second frontier shows the wages differentials obtained for women in each country by education level with respect men. Here, women with higher education experiment less wages differentials than do women with primary or secondary education. The data set is the ECHP (European Community Household Panel Data) from 1995 to 2001.

Key words: Higher education, Efficiency, wages differentials, Panel, Europe.

I. INTRODUCTION

According to the Human Capital theory (see Becker, 1964) education is an investment that increases productivity and consequently, in a competitive labour market, report higher wages. Other view thinks that the essential virtue of education is too select workers. From this perspective, formulated by Spence 1973), the educational system plays the role of a filter. In real world education serves both to acquire knowledge and to select individuals. If labour markets works properly wages differentials, attributed to differences in the amount of education, will serves as an incentive to stimulate young people to acquire higher levels of schooling. In 2000 the average duration of schooling were still widely disperse in the OCDE countries. The duration of schooling were increasing in all these countries without exception. Since 1960 United States has held a significant lead in this area. On the opposite we have in 2000 that Spain, France and Italy had not yet reached the average duration that the United States had in 1960.

The purpose of this paper is to estimate six hourly wages frontiers for Denmark, France, Germany, Italy, Spain and UK to explain the differences in the potential wage earned by workers with differences in the amount of education, formal training or experience. The frontier approach is used to consider the existence of inefficiency in the transformation of human capital into market earnings. The stochastic frontier methodology contributes to a better estimation of the wage equation in the following aspects. It establishes a relationship between the maximum wage attainable by an individual, given their human capital and other personal characteristics instead of considering an average wage obtained by the estimation of a reduced wage equation. Then, the wage function, represent the relation between the human capital variables (inputs) and the maximum wage attainable (output) and allows to compare the wage obtained by a worker with their potential or theoretical wage, given their level of inputs.

There is a growing literature that uses the stochastic frontier approach to estimate earnings functions. Among others, it can be finding the contributions from Hofler and Polacheck (1985), Herzog, Hofler and Schlottmann (1985), Polachek and Yoon (1987), Robinson and Wunnava (1989), Daneshvary et al. (1992), Hunt-McCool and Warren (1993) and Polachek, and Robst (1998).

The paper is organised as follows: section II analyses the stochastic frontier methodology and its application to the earnings equation. Section III shows the data and variables. Section IV provides the discussion of results. Finally, section V presents the concluding remarks.

II. THE ECONOMETRIC MODEL

Several methods have been used in the literature to obtain the frontier and calculate the relative inefficiency. In this paper it is chosen a parametric and stochastic frontier approach, SFA, which uses econometric techniques and imposes a structure on the data in order to estimate the frontier. This approach, first used independently by Aigner et al (1977) and Meeusen and van Broeck (1977), estimates a wage function assuming that the error term (deviation from the frontier) has two independent components. The first one is a two-sided term representing the random error, generally iid $N(0, \sigma^2)$ and the second one is a one-sided distributed term, usually assumed half-normal distributed, representing the inefficiency. The wage frontier to be estimated can be written as:

$$Y_{it} = f(X_{it};\beta)\exp(\varepsilon_{it})$$
$$\varepsilon_{it} = v_{it} - u_{it} \qquad (1)$$

Where: "X" is the set of inputs; "β" is the set of parameters and "ε" is the error term composed by "v_{it}" the random error and "u_{it}" which represents technical inefficiency (See: Greene (1997) and Kumbhakar and Lovell (2000) among others).

The technical efficiency can be defined as the ratio of the individuals observed wages over the maximum feasible or potential wage obtainable for this individual when there are not inefficiency (u_{it} =0). Here the efficiency (EF) of individual "*i*" in year "*t*" could be written as:

$$EF = \frac{f(Xit;\beta)\exp(v_{it} - u_{it})}{f(Xit;\beta)\exp(v_{it})} = \exp(-u_{it}) \qquad (2)$$

The scores obtained from expression (2) take value one when the individual totally transform its characteristics into wages and less than one otherwise.

Specification of the stochastic wage frontier

The earnings frontier describes the highest potential income associated with a given stock of human capital. Here it is adopted a standard semi-logarithmic earnings equation (Mincer, (1974)) of the type

$$\ln W^{*}_{it} = \alpha + \beta' X_{it} + v_{it} \qquad (3)$$

Where W^{*} is the potential or theoretical wage and X the set of human capital variables. However, potential or theoretical wage could differ from realized wage, that is, workers could not be able to transform totally their human capital stock into earnings because the existence of imperfection in the labour market. We call the difference between potential and realized wage "wage inefficiency" and it is included in the analysis adding a one-sided inefficiency error term to the earnings function. The stochastic earnings frontier represents an upper bound to the earnings. The observed wage (W) could be lower because of measurement errors or inefficiency in the transformation of human capital into earnings.

$$\ln W_{it} = \ln W^{*}_{it} - u_{it} = \alpha + \beta' X_{it} + v_{it} - u_{it} \qquad (4)$$

Moreover, the estimated wage inefficiency is explained by a set of variables that proxies some characteristics of the individuals, incomplete information and other market imperfections.

$$u_{it} = \delta_0 + \sum_{i=1}^{19} \delta_i Z_{it} + \Psi_{it} \qquad (5)$$

Where, Z_{it} represents a set of variables that could explain the degree of inefficiency in the transformation of human capital into earnings.

Then, we estimate the earnings function for the whole sample, adding a term of inefficiency, whose mean is a function of a set of inefficiency determinants. From the estimation, we expect a positive relationship between earnings and human capital endowment, according to the direct link between human capital variables and labour productivity.

III. DATA AND VARIABLES

We use data from the ECPH (European Community Household Panel Data) for Denmark, France, Germany, Italy, Spain and United Kingdom to estimate a stochastic frontier, for each country, to investigate the determinants of wage differentials. We analyze the corresponding unbalanced panel of wage earners currently working 15 or more hours per week, from 1995 to 2001. The samples are of employed people with an age ranged from 25 to 65 years old, which remain in the sample at least three consecutive years and work in the industrial and service sectors.

Education and experience are important variables in the classical formulation of wage equations (Mincer, 1974; Willis, 1986). Education is a variable that present difficulties of harmonization on an international level. In the ECHP we have only three levels and do not include any specialties. To solve partially that inconvenience we have included in our estimation the variable *formal training* or education that gives the individual skills needed for their present job. The highest percentage of people with formal training belong to United Kingdom (84%), Denmark (77%) and Germany (76%), followed with some distance for Spain (58%), France (55%) and Italy (36%). Seniority is a variable traditionally included in the estimation of the wage equations. We take from the ECPH the variable that picks the number of years that individual has been working with the last employer. France (18%), Italy (17.99%) and Spain (17.32%), have workers with more seniority in the current job than Denmark (13.63%), Germany (12.99%) and United Kingdom (8.43%). Mobility allows workers to obtain a better fit in the labour market. We have on average a 37% of mobility for Denmark, France and United Kingdom while these percentages are smaller for Germany (22%), Italy (27%) and Spain (29%). In this sample Denmark and United Kingdom have a high proportion of services' sector than the other countries. When we focus in type of contract we obtain that Spain is the country with the smallest percentage of permanent workers. The proportion of individuals that work in private sector is bigger in Spain (71%), United Kingdom (70%) and Germany (70%).

The variables

The dependent variable used for estimation is the logarithm of gross hourly wage.
The explanatory variables of the wage equation are:
*Trend***:** It is the time trend.
*Education Classification***:** This is a set of three dummy variables.
Lower: Less than second stage of secondary education (ISCED 0-2)
Second stage: Second stage of secondary level of education (ISCED 3), (this is the category of reference)
Higher: Recognised third level of education (ISCED 5-7)
*Education Classification by gender***:** This is a set of six dummy variables.
Women lower education: Less than second stage of secondary education (ISCED 0-2) by women that is a dummy that takes value one when the individual is a female, zero otherwise.
Women second stage: Second stage of secondary level of education (ISCED 3), by women (this is the category of reference)
Women higher education: Recognized third level of education (ISCED 5-7) by women.
Men lower education: Less than second stage of secondary education (ISCED 0-2) by men that is a dummy that takes value one when the individual is a male, zero otherwise.
Men second stage: Second stage of secondary level of education (ISCED 3), by men (this is the category of reference)
Men higher education: Recognized third level of education (ISCED 5-7) by men.

*Age***:** This is a set of four dummy variables
From 25 to 35 years old
From 36 to 45 years old
From 46 to 55 years old (category of reference)
More than 55
*Occupation in current job***:** This is a set of eight dummy variables
Legislator, seniors' officials and managers
Professionals
Technicians and associate professionals
Clerks
Service workers and shop and market sales workers
Craft and related trade workers
Plant and machine operators and assemblers
Elementary occupations (category of reference)
Seniority in the economic sector of activity:
Tenure in Industry: this variable measures the seniority (in years) of individual with the actual employer in any firm that belongs to the industrial sector.
Tenure in Services: this variable measures the seniority (in years) of individual with the actual employer in any firm that belongs to the service sector.
*Seniority in the economic sector of activity by gender***:** Tenure of women in industry: this variable measures the seniority (in years) of individual with the actual employer in any firm that belongs to the industrial sector by women.
Tenure of women in services: this variable measures the seniority (in years) of individual with the actual employer in any firm that belongs to the service sector by women.
Tenure of men in industry: this variable measures the seniority (in years) of individual with the actual employer in any firm that belongs to the industrial sector by men.
Tenure of men in services: this variable measures the seniority (in years) of individual with the actual employer in any firm that belongs to the service sector by men.
*Private sector***:** This is a dummy variable that takes value one when the individual works in the private sector, zero if belongs to the public sector.
Formal training: Formal training or education that gives workers the skills needed for their present type of work. This is a dummy variable that take value one when they have this formal training.
*Formal training by gender***:** Women formal training: this is a dummy variable that takes value one when a female has obtained formal training and zero if the woman has not obtained it.
Men formal training: this is a dummy variable that takes value one when a male has obtained formal training and zero if the woman has not obtained it.
Permanent contract: This is a dummy variable that takes value one when the worker has a permanent contract, zero otherwise (fixed-term contract or a non-standard contract)
Type of contract by gender: Women with permanent contract: This is a dummy variable that takes value one when a woman has a permanent contract, zero if the female has not permanent contract (fixed-term contract or a non-standard contract)
Men with permanent contract: This is a dummy variable that takes value one when a man has a permanent contract, zero if the male has not a permanent contract (fixed-term contract or a non-standard contract)
Mobility: this is a dummy variable that takes value one when the individual has move to another place, area or country, zero otherwise.
Level of job satisfaction: This is a set of three dummy variables:
Not satisfied, this variable takes value one when the individual has a level of satisfaction that range from 1 to 2.

Medium, this variable takes value one when the individual has a level of satisfaction that range from 3 to 4
Fully satisfied, this variable takes value one when the individual has a level of satisfaction that range from 5 to 6

IV. THE WAGE EQUATION

We have estimated six stochastic frontiers corresponding with the six European countries. The maximum-likelihood estimates of the wage frontier parameters, defined in equation (4) are presented in Table 1 and Table 2 of the Appendix. We obtain the estimated coefficient using the computer program LIMDEP 8.0.

The variance parameter, γ which lies between zero and one, indicates that technical inefficiency is stochastic and it is relevant to obtain an adequate representation of the data. The value of γ ($\gamma = \sigma_u^2/\sigma^2$, where $\sigma^2 = \sigma_v^2+\sigma_u^2$) picks up the part of the distance to the frontier explained for the inefficiency. In our estimation, the value of the variance parameter γ range from a value of 0.98 in the case of Denmark and Germany to a value of 0.77 in the case of Italy. That means that the variance of the inefficiency effects is a significant component of the total error term variance and then, deviations from the potential wage are not only due to random factors.

The variables included in these equations determine the potential wage. This is a practise potential wage, obtained from the best observations of the sample. As expected, we obtain that human capital variables had a positive sign in the estimation indicating that people with higher human capital could achieve a higher potential wage. In table 2 we estimate the wage equation focusing on the impact that human capital variables have in wages when we differentiate by gender. Here we obtain significant differences by gender trough the analyzed countries.

Wages differentials and education

Here we define the wage frontier as the maximum wage that can acquire an individual given individual, socio-economic and human capital characteristics. As we mentioned above the estimated coefficients for men and women are in Table 1 (Appendix).

The human capital variables are significant and they have the expected sign. Here we have two sets of variables that pick the effect of education and training in the potential wage of individuals. The ECHP have grouped the years of education in three levels: lower, second stage and higher education, as we have defined in section III. In terms of higher education we can dive the countries in three groups; countries in which women have a lower level of higher education than men (United Kingdom); those in which these levels are equivalent (Denmark and Italy) and those in which women have a higher level than men (France and Spain). From the whole sample we have make a sample selection of working people, more precisely, salaried workers that works 15 or more hours. These selections increased the average level of education for both, men and women. For women the differences in education with respect the whole sample are higher than for men in every country and over all in Spain (where the proportion of women with higher education rises from 28.8% for the whole sample to 48.3% for the sample restricted to salaried workers).

As we expected, to have primary education reduce the potential wage that could acquire the individual with respect secondary education, which is the category of reference in every country with the exception of UK, where we obtain the opposite sign, and Germany where there are not significant differences with respect secondary education. United Kingdom (50%) and Italy (13%) have the highest and the lowest percentage of workers with

higher education in our sample. Therefore, as it was expected the returns of education are bigger in Italy for both men and women than in United Kingdom. Therefore, to have university education increases the Italian women potential wage in a 25% with respect women of secondary education, while for men the wage premium is of 31%. In UK we found a reduction of 7%, on average, with respect the secondary education level for women while for men that is of 5%. Also in the case of Denmark and France are men who obtain more profitability in terms of wages derived from their investment in higher education. On the other way we have Germany and Spain where the differences in wages for women with higher education with respect women with secondary education are higher than for men with higher education compared with men with secondary education.

The hours spent working are also a method of learning and then of improving productivity. The tenure of individuals, measured in years, includes two levels that try to proxy the specific training of individuals by sectors of activity (Industry and Services). The coefficients of these variables have a positive and significant sign overall in the industry sector. The return of "learning by doing" is smaller than that reported by higher education. The election between formal education and training is taking under uncertainty. This election will depend on how uncertainty affects the returns of education with respect to other possible source of income. Increasing uncertainty could augment the accumulation of Human capital (see Cahuc and Zylderberg, 2004).

With the variable formal training, we measure if an individual have received specific education that gives the skills for its present type of work. The coefficient of this variable is positive and significant for the six countries analyzed. In this sample, United Kingdom, Denmark and Germany are the countries with a high percentage of formal training than Italy that is the country with the lowest percentage. Given everything equal, to have formal training increases the potential wage in a rank of 14.98% for UK to around a 2% in Spain.

The amount of hourly wages varies over life cycle. The hourly wage begins by increasing and reaches a maximum before retirement. As we expected as higher is the age of individual higher is the potential wage. The relation between age and wages is not lineal. The results indicate that in Denmark, France, Germany, Spain and UK earnings increase with age.

We include type of contracts as another source of wages differentials. Here we have two categories: permanent and fixed term contract that is the category of reference. Once controlled for human capital variables, individual and occupational characteristics, the type of contract have a positive effect over potential wage. The permanent contract variable increases the potential earning in every country from a value of 3% in Germany to 14 % in France.

To work in the private sector increase the potential wage for Danish workers while reduce the potential wage for French, Italian, Spanish and British people and do not affect German employees.

With the occupational variables, we have controlled the wages differentials due to the differences in occupations. The category of reference is elementary occupations.

At the end of Table 1, appear the results of the inefficiency model. We can define wage inefficiency as the distance between the wages that earn a particular group of workers and what they could effectively earn given their observed characteristics. These differences (distance to the frontier) could be explained by the existence of labour market imperfections that makes difficult and expensive for workers the job search process. In this analysis a negative sign reflects a reduction in the inefficiency in transforming labour attributes in wages in each of the six European countries analysed.

The variable time trend picks the evolution of efficiency along time. The results indicates that inefficiency have been reduced in the six countries analyzed. Women have more difficulties in transforming their endowments in labour wages than men in Germany,

Italy, Spain and UK while there are not significant differences with respect men in Denmark and France. The presence in the household of dependants children affect differently depending on the countries. Here we have a set of four dummy variables indicating the number of children in the household and the category of reference is the absence of children smaller than twelve years old. In addition, we have included a variable that indicates the born of a baby in this period. The coefficient of this variable is negative and significant for France (one, two and three or more children), Germany (two and three or more children), Spain (two children) and UK (for one and two children) what means that individuals with dependants under twelve are closer to the frontier. In addition, the results obtained for baby born in the household for France is negative and significant while for Italian employees is positive and significant.

These results could be related with the signal that this type of workers (especially men) send to the market in the sense that they are more stable workers. If these characteristics reduce the probability of quit then they could be promoted in a higher proportion than single people could without dependants. From another perspective, family characteristics and education are important factors in employment selection mechanisms. The difficulty here is the endogenous choice: less educated women have fewer job opportunities and then tend to have more children; or women that are more educated wait to have children once they have obtained a stable job.

Wages differentials and education by gender

In Table 2 we present the results obtained in the estimation of the wage equation when we estimate the variables that measure the human capital investment by gender. Here we focus on the set of variables that picks the returns of education, experience, formal training and type of contract. The values obtained for the other variables used in the estimation are quite similar to that obtained in Table 1 (Appendix).

To have primary education reduce the potential wage that could acquire a woman with respect a men with primary education in these six analyzed countries. These differences rage from Italy (-14.81%) to Spain (-29.60%).

Women with secondary education experiment a higher difference with respect men than do women with primary education in France, Italy and UK. On the contrary, in Spain and Denmark women with secondary education reduce differences with respect men. The differences for Germany women with respect men are similar with primary and secondary education.

The higher education is an instrument to reduce the wages differentials between men and women in Denmark, France, Germany, Italy and Spain, while the distance is higher for British women. Here it is possible to differentiate among countries. We have Denmark, France and Germany that women with higher education are better off than the same women with secondary or primary education compared with men and, on the other hand, we have Spain and Italy where we do not obtain significant differences with respect men with higher education. Thus, higher education is an instrument that reduce the wages differentials experimented by women in these European countries with the exception of UK where this wages differentials works in the other way around.

When we analyse tenure by gender we obtain that the returns of experience for men and women are similar across the countries. The experience is an important variable inside the human capital framework. The experience can result also from an accumulation of know-how that the worker builds up during his or her efficient working time.

For UK' male workers formal training proportionate a wage premium of more than 15% in their hourly wage instead of the returns of higher education that are negative for

them. In general, to have formal training increases the hourly wages of workers of the six countries analysed. The effect of formal training in wages are positive and significant for Danish, German, Italian, Spanish and British women being higher the gains in the later case.

The wages differentials generated by the type of contract are positive for both, male and female workers.

V. CONCLUDING REMARKS

The wage frontier will describe the highest potential earnings associated with a given stock of human capital. This method allows us to consider that there could be differences between the potential and the effective wage due to the existence of inefficiency in the transformation of human capital variables (schooling, experience, and tenure) into earnings. Moreover, this methodology allows us to know if identical observable workers can achieve different potential wage due to market discrimination.

From the estimation, we obtain a positive relationship between earnings and human capital endowment, according to the direct link between human capital and labour productivity.

In addition, we have obtained that a higher level of education increases the potential wage for Danish, French, German, Italian and Spanish workers while reduce the wage possibilities for British employees. Moreover, higher education is an instrument that allows the reduction of wages differentials that experiment the European females with respect to males. Thus it is an efficient mechanism to equalizing differences between men and women in Europe.

Also, the tenure in industry, measured in years, have a positive and significant effect in the six countries analysed.

When we disaggregate the Human Capital variables between women and men we obtain that the wage premium that can get women are reduced with respect to men for the most part of the countries.

VI. REFERENCES

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Table 1- The Wage Premium Results						
THE WAGE EQUATION						
	Denmark	**France**	**Germany**	**Italy**	**Spain**	**UK**
Constant	4.752 (218.69)	5.366 (229.52)	4.929 (0.018)	3.859 (0.000)	8.621 (0.035)	4.384 (0.000)
Level of Education by Gender (Category of reference: second stage)						
Women lower education	-0.1219 (-6.828)	-0.1259 (-7.809)	-0.0118 (-0.633)	0.0137 (0.602)	-0.1043 (-3.820)	0.0541 (3.95)
Women higher education	0.0049 (0.421)	0.0285 (2.738)	0.0938 (5.94)	0.2530 (8.74)	0.1509 (5.124)	-0.0777 (-5.49)
Men lower education	-0.0576 (-3.583)	-0.0188 (-2.015)	-0.0112 (-0.73)	-0.0638 (-5.05)	-0.0887 (-7.373)	0.0513 (3.71)
Men higher education	0.1238 (14.21)	0.1759 (17.33)	0.0817 (8.82)	0.3126 (17.41)	0.0529 (3.587)	-0.0566 (-3.39)
Age (Category of reference: 46 to 55 years old)						
25 to 35 years old	-0.1032 (-9.04)	-0.1433 (-12.95)	-0.1776 (-20.21)	0.0032 (0.438)	-0.2652 (-15.81)	-0.1957 (-14.79)
36 to 45 years old	-0.0323 (-3.64)	-0.0349 (-4.07)	-0.0795 (-11.37)	-0.0014 (-0.198)	-0.1157 (-9.61)	-0.0633 (-6.06)
More than 56	0.0391 (3.68)	0.0644 (5.106)	0.0507 (5.75)	0.0792 (5.14)	0.0895 (6.67)	0.0550 (4.21)
Occupation in current job (Category of reference: elementary occupations)						
Legislators, seniors officials and ma	0.3563 (22.28)	0.6418 (35.26)	0.1429 (10.63)	0.2790 (13.68)	0.3002 (12.83)	0.3200 (21.22)
Professionals	0.2388 (16.45)	0.6111 (35.28)	0.1708 (13.07)	0.2082 (10.49)	0.3008 (14.48)	0.2990 (18.87)
Technicians and associate professior	0.1613 (12.33)	0.3334 (20.67)	0.1009 (8.77)	0.1301 (7.37)	0.1930 (11.10)	0.2380 (15.48)
Clerks	0.0302 (1.95)	0.1449 (7.961)	0.0814 (6.51)	0.1009 (6.330)	0.1489 (8.68)	0.1768 (11.75)
Service workers and shop and marke sales workers	-0.0465 (-3. 044)	0.0472 (2.404)	-0.0400 (-2. 84)	0.0329 (2.028)	0.0316 (1.79)	0.0112 (0.819)
Craft and related trade workers	0.0081 (0.486)	0.1296 (7.33)	0.0327 (2.92)	0.0042 (0.299)	0.0568 (3.79)	0.1856 (10.99)
Plant and machine operators and assemblers	-0.0577 (-3.61)	0.1181 (6.70)	0.0140 (1.26)	0.0504 (3.05)	0.0670 (3.83)	0.1309 (8.29)
Seniority in the economic sector of activity						
Tenure in services	0.0024 (5.772)	0.0071 (17.90)	-0.0022 (-4.53)	0.0061 (9.81)	0.0042 (5.96)	-0.0103 (-16.92)
Tenure in industry	0.0036 (6.36)	0.0098 (21.83)	-0.0002 (-0.396)	0.0042 (5.89)	0.0039 (5.09)	-0.0059 (-8.16)
Sector of activity (category of reference: public sector)						
Private sector	0.1371 (19.72)	-0.1078 (-12.86)	-0.0086 (-1.301)	-0.0435 (-4.36)	-0.0303 (-2.61)	-0.0457 (-5.23)
Have you had formal training or education that has given you skills needed for your present type of work? (Category of Reference: No)						
Formal training	0.0290 (3.15)	0.0674 (9.68)	0.0610 (10.50)	0.0308 (4.52)	0.0263 (3.58)	0.1498 (10.08)
Type of contract (Category of reference: fixed-term contact)						
Permanent	0.1046 (5.99)	0.1456 (10.52)	0.0323 (4.69)	0.0932 (9.58)	0.1285 (13.99)	0.0457 (4.61)
Mobility to another place, area or country (Category of reference immobility)						
Mobility	0.0294 (4.04)	0.0168 (2.48)	-0.0046 (-0.757)	0.0966 (10.24)	0.1417 (10.64)	0.0751 (9.49)
INEFFICIENCY MODEL						
Constant	-2.047 (-0.529)	-0.2050 (-0.938)	5.940 (0.007)	6.753 (0.000)	5.847 (0.008)	7.405 (0.000)
Time trend						
Trend	-1.987 (-2.052)	-0.8575 (-8.53)	-0.1009 (-6.16)	-0.1428 (-4.23)	-0.9076 (-2.67)	-0.0311 (-1.68)
Gender (Category of reference: man)						
Woman	2.112 (1.577)	-0.0098 (-0.059)	0.5572 (10.41)	0.5926 (5.86)	0.6205 (5.56)	0.7439 (10.69)
Number of children under 12 years old in the household (category of reference: no child aged under 12)						

One child	0.0629 (0.042)	-0.6083 (-3.69)	-0.0712 (-1.136)	0.2096 (2.16)	-0.0050 (-0.062)	-0.2180 (-3.06)
Two children	-0.7911 (-0.596)	-1.0183 (-4.545)	-0.3622 (-4.42)	0.1473 (1.23)	-0.3017 (-2.76)	-0.4075 (-5.09)
Three children	-3.037 (-0.811)	-1.9470 (-4.19)	-0.3705 (-2.93)	0.0235 (0.083)	-0.4224 (-1.23)	-0.1529 (-1.28)
The born of a new baby (category of reference: not born a new baby)						
born	-0.4321 (-0.280)	-1.0034 (-2.45)	-0.0627 (-0.363)	0.0944 (3.82)	-0.1510 (-0.560)	-0.2655 (-1.94)
Household income (taking out the own wage)						
Household income	0.0000 (0.750)	-0.0000 (-4.403)	-0.0000 (-0.666)	-0.000 (-1.76)	-0.0000 (-4.16)	-0.0000 (-1.73)
Variance Parameter						
γ	0.9885	0.9463	0.8911	0.7722	0.8375	0.8273

Table 2- The Wage Premium Results by Gender.

THE WAGE EQUATION						
	Denmark	**France**	**Germany**	**Italy**	**Spain**	**UK**
Constant	4.8017 (186.167)	6.836 (68.64)	5.182 (0.001)	4.230 (0.000)	7.235 (3.29)	4.256 (0.000)
Level of Education of Women (Category of reference: men)						
Women lower education	-0.2560 (-5.703)	-0.2219 (-5.55)	-0.2242 (-7.24)	-0.1481 (-3.71)	-0.2960 (-8.75)	-0.2416 (-6.48)
Women secondary level of education	-0.2253 (-5.067)	-0.2837 (-7.23)	-0.2215 (-8.90)	-0.1875 (-4.75)	-0.1869 (-4.14)	-0.2904 (-7.66)
Women higher education	-0.1915 (-4.180)	-0.1842 (-4.60)	-0.1299 (-4.62)	0.0425 (0.975)	-0.0796 (-1.98)	-0.3645 (-9.90)
Age (Category of reference: 46 to 55 years old)						
25 to 35 years old	-0.0997 (-8.427)	-0.2791 (-19.77)	-0.1809 (-20.01)	0.0024 (0.332)	-0.1073 (-6.96)	-0.2008 (-15.03)
36 to 45 years old	-0.0378 (-4.178)	-0.1214 (-12.73)	-0.0804 (-11.31)	-0.0016 (-0.225)	-0.0226 (-1.78)	-0.0643 (-6.09)
More than 56	0.0491 (3.817)	0.1119 (7.79)	0.0519 (5.74)	0.0793 (5.12)	-0.0609 (-3.83)	0.0590 (4.50)
Occupation in current job (Category of reference: elementary occupations)						
Legislators, seniors officials and managers	0.4166 (19.067)	0.5973 (26.38)	0.1536 (11.39)	0.3274 (16.76)	0.8077 (32.85)	0.3244 (21.53)
Professionals	0.3027 (14.821)	0.6075 (29.57)	0.1869 (14.33)	0.2766 (14.41)	0.6053 (26.41)	0.3049 (19.24)
Technicians and associate professionals	0.2087 (10.524)	0.3651 (20.45)	0.1091 (9.56)	0.1657 (9.59)	0.3778 (17.17)	0.2404 (15.58)
Clerks	0.0884 (3.963)	0.1899 (8.79)	0.0881 (6.98)	0.1283 (8.28)	0.2546 (11.21)	0.1790 (11.93)
Service workers and shop and market sales workers	0.0061 (0.272)	0.0605 (2.59)	-0.0363 (-2. 55)	0.0412 (2.53)	0.0665 (2.85)	0.0152 (1.11)
Craft and related trade workers	-0.0097 (-0.404)	0.1232 (5.73)	0.0281 (2.47)	-0.0000 (-0.003)	0.1031 (4.88)	0.1832 (11.01)
Plant and machine operators and assemblers	-0.0841 (-3.844)	0.1170 (5.41)	0.0105 (0.947)	0.0470 (2.85)	0.0703 (3.23)	0.1287 (8.19)
Seniority in the economic sector of activity by gender						
Tenure of women in services	0.0035 (3.591)	0.0039 (2.98)	-0.0030 (-3.79)	0.0057 (4.77)	0.0096 (7.55)	-0.0124 (-12.43)
Tenure of women in industry	0.0058 (3.867)	0.0045 (1.55)	-0.0036 (-4.08)	0.0021 (1.331)	0.0094 (4.27)	-0.0071 (-4.21)
Tenure of men in services	0.0007 (1.187)	0.0028 (4.21)	-0.0020 (-3.06)	0.0064 (8.48)	0.0094 (14.76)	-0.0099 (-13.24)

Tenure of men in industry	0.0021 (2.753)	0.0047 (7.07)	0.0005 (0.730)	0.0043 (5.17)	0.0123 (18.18)	-0.0065 (-8.13)
Sector of activity (category of reference: public sector)						
Private sector	0.1169 (12.019)	-0.1260 (-9.31)	-0.0103 (-1.563)	-0.0484 (-4.79)	-0.0882 (-7.32)	-0.0467 (-5.33)
Have you had formal training or education that has given you skills needed for your present type of work? (Category of Reference: No)						
Women formal training	0.1007 (4.778)	0.0153 (1.001)	0.0765 (7.33)	0.0340 (2.88)	0.0723 (2.54)	0.1736 (8.34)
Men formal training	0.0422 (3.206)	0.0012 (0.171)	0.0599 (8.69)	0.0381 (4.59)	0.0921 (8.57)	0.1565 (7.55)
Type of contract by gender (Category of reference: fixed-term contact)						
Women with permanent contract	0.1051 (2.344)	0.2056 (8.38)	0.0451 (3.84)	0.1253 (7.23)	0.1787 (6.21)	0.0596 (3.72)
Men with permanent contract	0.1130 (4.497)	0.1118 (6.59)	0.0258 (3.02)	0.0786 (6.82)	0.1448 (9.20)	0.0337 (2.67)
Mobility to another place, area or country (Category of reference immobility)						
Mobility	0.0281 (2.955)	0.1148 (13.23)	-0.0055 (-0.894)	0.1052 (11.03)	0.0790 (7.22)	0.0779 (9.76)
THE INEFFICIENCY MODEL						
Constant	-1.108 (-0.336)	5.557 (0.023)	6.607 (0.00)	7.886 (0.000)	0.7168 (0.631)	6.900 (0.000)
Time trend						
Trend	-1.822 (-2.32)	-0.0754 (-4.32)	-0.1005 (-6.13)	-0.1528 (-4.44)	-0.0368 (-0.135)	-0.0327 (-1.76)
Number of children under 12 years old in the household (category of reference: no child aged under 12)						
One child	-0.1848 (-0.125)	-0.1460 (-2.04)	-0.0649 (-1.03)	0.2069 (2.06)	0.0114 (0.439)	-0.2246 (-3.17)
Two children	-0.4772 (-0.406)	-0.1874 (-2.36)	-0.3491 (-4.30)	0.1158 (1.06)	-0.0664 (-0.151)	-0.4164 (-5.15)
Three children	-2.405 (-0.665)	-0.3760 (-2.50)	-0.3821 (-3.07)	-0.0632 (-0.257)	-0.1053 (-0.234)	-0.1519 (-1.29)
The born of a new baby (category of reference: not born a new baby)						
born	-0.6690 (-0.395)	-0.3270 (-1.94)	-0.0782 (-0.459)	0.7965 (3.38)	-0.0152 (-0.158)	-0.2613 (-1.91)
Household income (taking out the own wage)						
Household income	0.0001 (1.52)	-0.0000 (-4.51)	-0.0000 (-0.728)	-0.0000 (-2.52)	-0.0000 (-5.89)	-0.0000 (-1.92)
Variance Parameter						
γ	0.9881	0.0.7859	0.8919	0.7981	0.3510	0.8314