Education and wage differentials by gender in Italy

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Abstract

In this work we estimate the gender wage gap in Italy using the last available (2001) cross-section of the European Community Household Panel. The most recent literature highlights the need to evaluate the wage differential at different points of the distributions. We use quantile regressions and an adaptation of the procedure suggested by Machado and Mata to derive the marginal distributions of the female predicted wages and the female counterfactual wages and to evaluate the distribution of the unexplained part of the wage gap. We show that in Italy the wage gap due to gender differences in the rewards to productive characteristics is higher in the tails of the distributions, suggesting the presence of strong glass ceiling and sticky floor effects. We then condition on different educational levels and show that low-educated women suffer a higher unexplained wage gap across the whole distribution. However, we detect a strong sticky floor effect for women with low educational levels and some evidence of a glass ceiling effect in the sample of women with at least a second stage of secondary educational level.

1. Introduction[1]

One of the key characteristics of the Italian labour market is the lower than European average level of female labour supply and the lower access of women to apical jobs. Moreover, many differences arise among women with different levels of education: highly-educated women show a higher attachment to the labour market and a lower discouraging effect of the presence of young children than lower educated women.[2]

The European Commission (2002) shows that the raw gender wage gap computed on a sample of employees working at least 15 hours a week in 1998 amounts to 16.2% on average in the UE countries; Italy, together with Portugal and Belgium, has a wage gap at the disadvantage of women lower than 10%. Cross country analyses have shown that the estimated gender wage gap in Italy is still persistent but lower than in other European countries; the wage gap obtained by estimating an OLS regression model on a sample of European countries using ECHP data shows that in 1993 on average women's wage was 81% of what it should have been if women and men would have been equal returns to the same characteristics, this measure stands between a range of 66% in the UK and 86% in Denmark (Comitato nazionale parità e pari opportunità, 2001). However, by focussing only on a point of the distribution one neglects the differences occurring in the level of the wage differentials across the distribution. Given the different labour supply behaviour of lower and higher educated women, splitting the sample of workers according to their level of education can allow to detect different

[1] A previous version of this paper has been presented at the workshop 'Differenziali retributivi di genere' under the research project promoted by the Italian Ministry of Welfare and Labour, and coordinated and funded by ISFOL. A different version of this paper has been presented at the Applied Econometrics Association Conference on Labour Market Policies and Unemployment (Naples 1-2 June 2006). We thank the participants to the research project and to AEA Conference for useful comments.

[2] See Addabbo (1999), Bettio and Villa (1999) for analyses on labour supply differences by gender and education level.

factors affecting the wage gap (higher educated women being more likely to show higher and uninterrupted work experience than lower educated women, but probably the latter can be more affected by statistical discrimination when they enter the labour market). By widening the focus of the analysis to the whole wage distribution and by different groups of the population characterized by different level of education one can provide a better foundation for the design of policies.

In this paper we focus on the estimation of the wage gap across the wage distributions of the whole samples of female and male workers and of the samples conditioned on different educational levels. We estimate quantile regression models in order to derive the coefficients of the individual characteristics across the wage distributions and then apply a simplified procedure of the Machado and Mata (2005) methodology for computing the decomposition of the wage gap at different quantile levels.

In Section 2 we present the results of the most recent literature on the evaluation of the wage differentials in Italy and refer to the literature on measuring the wage gap across the wage distribution by quantile regressions. In Section 3 we introduce some methodological issues and discuss the technique used to decompose the wage gap across the distribution. The model is then estimated by using a sample of employees drawn from the ECHP (2001) that is described in Section 4. Results of the estimations and of the wage gap decomposition across the wage distributions are then presented in Section 5 with reference to the whole sample and in Section 6 by education level.

2. Wage differentials by gender across the wage distribution

The value of the estimated gender wage gap is sensitive to the type of data, variables (gross or net income, hourly wage) and estimation techniques used, as well at the point in the wage distribution at which the wage gap is evaluated as Table 1 shows with respect to the Italian case. The wage gap is usually estimated at the mean of wage distribution; however the literature has shown the limits of this methodology since the gender wage gap may be different over the wage distribution (Jenkins, 1994). Regarding the Italian case Favaro and Magrini (2005) evaluate the wage gap across the female wage distribution by using bivariate density functions and by conditioning upon the distribution of the individual characteristics. Favaro and Magrini (2005) show a different size of the wage gap along the level of the individual human capital characteristics. Istat (2005), by using Juhn, Murphy and Pierce's technique, find a wage gap that increases with women's wage level.

Table 1. The Wage gap by gender in Italy

Authors	Data	Years	Model	Sample	Wage gap by gender	% characteristics	% returns
Addis and Waldmann (1996)	SHIW	1989	OLS log earnings	Employee	13		
Arulampalam, Booth and Bryan (2005)	ECHP	1995-2001	QR - Decomposition MM, with or without industry dummies	Employee 22-54 yrs old			
	BHPS						
	GSOEP		Weekly Hours>=15 whole sample and by industries	Non agricultural sectors			
			public vs private	Public Sector	6-19*		
			Hourly wage in main job	Private Sector	15-20*		
				Whole sample	14-18*		
Beblo, Beninger, Heinze and Laisney (2003a e 2003b)	ECHP	1998	OLS log gross earnings	Employee			
			QR Correction for self-selection	25-55 yrs employed for at least 8 hours a week			
Com.Parità and PO (2001)	SHIW	77-98	OLS log earnings	Employee			
	ECHP	1993	OLS log earnings		25	19	81
		1995			20	16	84
European Commission (2002)	ECHP	1995-1998	OLS log gross hourly wages	Employed in 1998 for at least 15 hours			
		1998	Raw gap		8,6		
Favaro e Magrini (2005)	INPS	1990	OLS log daily wages	Employees 15-29 yrs in 1990 managers and seasonal workers excluded No agricult. And Public Sectors	Wage distribution analysis		
		1997					
Flabbi (2001)	SHIW	1977	OLS log net income normalized by number of months worked	Employees (in 1995 PT not included)	29.4	45.7	54.3
		1995			18.9	27.2	72.8

Istat (2005)	SES	2002	OLS log gross hourly income Wage gap computed at The mean at quantiles	Employees firms with at least 10 employees in Manufacturing and Service and Trade	16	30.6	69.4
OECD (2002)	ECHP	1998	OLS log gross hourly wage	full-time 20-64 yrs			
			Raw wage gap	mean	15		
				median	9		
				20-80 perc.	10-13		
			Raw wage gap	Employee 20-64 yrs with at least weekly working hours >=15			
				Mean	9		
				Median	7		
				20-80 perc.	9-7		
Olivetti and Petrongolo (2005)	ECHP	1994-2001	OLS log gross hourly wage actual or imputed	Individuals 16-64 yrs self employees, military service and students not included			
		1999			6.3-8.2**		
	PSID						
Pissarides et al. (2005)	ECHP	1998	OLS log hourly wages – without self selection correction	Employee Weekly hours worked>=15	8.5		
			With self selection correction	Without apprentices	15.9		
Rustichelli (2005)	INPS	1996-2002	OLS log daily wages random effects	Employee in Private Sector, without Agriculture			
			Without education RHS	Whole sample	27.8		69
			With education proxies RHS	Born after 1968	18		89

* range of the wage gap estimated by means of quantile regressions

** Range of the wage gap by different methods of wage imputation adopted.

Measuring the wage gap at different points across the wage distribution can be obtained by using quantile regression (QR). This technique will be more extensively introduced in Section 3 where we refer also to the decomposition technique used to evaluate the different impact of returns and characteristics on the wage gap at different quantiles.

Quantile regression models have been estimated amongst others by Albrecht, Bjorklund and Vroman (2003) on Swedish data, on Netherlands data by Albrecht, Van Vuuren and Vroman (2004), on Spain by Garcìa, Hernandez and Lòpez-Nicolàs (2001), Gardeazàbal and Ugidos (2005), del Rìo, Gradìn and Cantò (2006) and de la Rica, Dolado and Llorens (2005) and on a sample of European countries by Arulampalam, Booth and Bryan (2005).

Evidence in favour of the existence of a glass ceiling effect is found by Albrecht, Bjorklund and Vroman (2003) with regards to Swedish data (Swedish Level of living surveys and LINDA 1998 data by Statistics Sweden). By analysing the wage gap across time in Sweden (Swedish Level of living surveys, 1968, 1981 and 1991), by group of workers (immigrants versus non immigrants, women versus men) and by countries (Sweden versus USA) they found the glass ceiling phenomenon to occur only for the gender wage gap in 1990's Sweden. Their quantile regression estimations on 1992 and 1998 Statistics Sweden data and on 1991 Swedish Level of Living Survey show an increase of the gender wage gap moving from the bottom to the top of the wage distribution. By applying an adaptation of the Machado and Mata method to decompose the gender wage gap at quantiles, they found that the most important factor in explaining the differential at the top of the wage distribution are the differences in the returns of the characteristics (the importance of this factor decreases only when they control for the type of occupation).

Albrecht, Van Vuuren and Vroman (2004) estimate quantile regressions on a sample of full-time workers from 1992 Labour Supply Panel of the Dutch Institute for Labour Studies, they apply the Albrecht at al. (2003) adaptation of Machado and Mata technique to decompose the wage gap and they correct for the non random selection of women to full-time employment. Their results are consistent with the existence of a glass ceiling effect in the Netherlands and with a higher effect of returns to this gap. When they adjust for selection the wage gap becomes higher and the effect of characteristics (though lower than the effect of their returns) on the wage gap increases.

The results of the estimation of the gender wage gap across the distribution correcting also for non random selection of women workers and the endogeneity of education made by Garcìa, Hernandez and Lòpez-Nicolàs (2001) on a sample from the 1991 Encuesta de Conciencia, Biografia y Estructura de Clase are consistent with an increasing gender wage gap when one moves along the wage scale in Spain.

Gardeazàbal and Ugidos (2005) use the quantile regression applied to a sample of the 1995 Spanish survey of wage structure and, differently from other authors they found evidence of a higher wage gap due to differences in returns of the characteristics at the bottom of the distribution. One should however notice the differences in the data set used, in the model estimated and in the moment of the characteristics they condition on in the wage gap decomposition.

De la Rica, Dolado and Llorens (2005) show that by splitting the sample of full-time workers in Spain (drawn from the European Community Household Panel, year 1999) by level of education, the shape of the wage distribution found at aggregate level changes showing a higher gender wage gap (measured as the difference between log

hourly wage of men and women) at the top of the distribution for the highly educated and at the bottom of the distribution for the lower educated. By applying Albrecht et al. (2003) adaptation of Machado and Mata technique to decompose estimated wage gap at quantile of wage distributions, De la Rica, Dolado and Llorens (2005) show that the difference in returns explains most of the wage gap at the top of the distribution for the higher educated and at the bottom for the lower educated. These results are consistent, according to the authors, to the existence of a glass ceiling effect for the highly educated and of a glass floor effect for the lower educated, effects that if one does not disaggregate the sample by level of education and does not use estimation of the wage gap across the whole wage distribution would not appear. De la Rica, Dolado and Llorens (2005) draw attention also to the irregularity shown by the patterns of the raw gender wage gap in Greece and Italy (by using ECHP 1999 data) as compared to those of UK and Denmark when one splits the sample by level of education. Their descriptive analysis and the results of the estimation they carried out on Spain microdata call for further analyses and our paper tries to provide a deeper insight to the gender wage gap across the wage distribution and by level of education in Italy.

Del Rìo, Gradìn and Cantò (2006) use a different decomposition methodology to measure the extent of discrimination in Spain and apply their model to a sample of the 1995 Survey of Wage Structure in Spain that covers employees in firms with ten or more workers and excludes Agriculture, Public Administration, Health Services and Education workers. Their results are consistent with De la Rica, Dolado and Llorens (2005). Their method allows also to estimate the contribution of each group of workers' discrimination to the whole gap, they found evidence of glass ceiling for the highly educated workers but the weight of this effect is lower if compared to the sticky floor effect on the whole discrimination.

The estimation of quantile regression models on a sample of eleven European countries allows Arulampalam, Booth and Bryan (2005) to show how the gender wage gap changes along the distribution, the glass ceiling effect (with wider wage gap at the top part of the wage distribution) is found in about half of the analysed countries. By applying the same model to Italian data by sector (public and private sector) they found wider wage differentials in the private sector both at the top and at the bottom of the wage distribution and a wider gap only at the top of the wage distribution with regards to employees in the Public Sector.

3. Methodological aspects

In this section we present the econometric model that we will use to estimate the rewards of the characteristics and describe the procedure that allows us to derive the marginal distributions of female wages, both predicted and counterfactual.
As far as the econometric estimates are concerned, we estimate separate models for female and male earning functions. Following the most recent contribution to the analysis of the wage gap, we estimate wage equations at different points of the distributions; we adopt the quantile regression method (Koenker e Bassett, 1978; Buchinsky, 1998) according to which earning functions are centered on different quantiles of the wage distribution. Given the covariates vector *z*, we estimate $Q_\theta(\omega|z)$, corresponding to the θ-th quantile of the distribution of the log wage (ω), at any $\theta \in (0,1)$. The quantile regression model is assumed to be linear:

$$\omega = z'\beta_\theta + u_\theta$$

Where ω is the log of wages and β_θ is a vector of coefficients, the quantile regression coefficients. The distribution of the error term u_θ is unspecified and it is simply assumed that $Q_\theta(u_\theta|z) = 0$.

The estimated values of the θ-th quantile of the log wages, conditioned to covariates z, is equal to: $Q_\theta(\omega|z) = z'\hat{\beta}_\theta$.

For given $\theta \in (0,1)$, β_θ can be estimated by minimising in β_θ the following expression:

$$n^{-1}\sum_{i=1}^{n}\rho_\theta(\omega_i - z_i'\beta)$$

where:

$$\rho_\theta(u_i) = \begin{cases} \theta u_i & \text{for} \quad u_i \geq 0 \\ (\theta - 1)u_i & \text{for} \quad u_i < 0 \end{cases}$$

The vector of coefficients β_θ can be obtained by estimating each equation separately or simultaneously. We chose to estimate the equations simultaneously in order to obtain an estimate of the entire variance-covariance matrix of the estimated coefficients[3].

Following the above described procedure, we end up with the estimated values of the quantile coefficients for the female and the male samples. For any θ-th quantile, we obtain the male value $\hat{\beta}_\theta^m$ and the female value $\hat{\beta}_\theta^f$.
Given the estimated coefficients, we derive the marginal distributions of the predicted (theoretical) and the counterfactual female wages by applying the Albrecht et al (2003)

[3] The bootstrapping procedure allows us to test whether coefficients of different quantile regressions are significantly different.

methodology[4]. Female predicted wages are the theoretical wages that female workers can earn given their characteristics and the estimated rewards recognised to those characteristics, $\hat{\beta}_{\theta}^{f}$; female counterfactual wages are wages that women would be paid if female characteristics were rewarded at the male returns, $\hat{\beta}_{\theta}^{m}$.

In order to construct the marginal distributions, we proceed as follows:

- We take a draw from the female database and construct a predicted wage by multiplying the characteristics z_f of every chosen individual by $\hat{\beta}_{\theta}^{f}$, for a given quantile θ. We repeat that operation N=100 times for all quantiles, ending up with the estimated marginal distribution of female predicted wages.

- We repeat the operation described above but using male coefficients, $\hat{\beta}_{\theta}^{m}$. We derive the estimated marginal distribution of female counterfactual wages.

- We use the two generated wage distributions, $z_f'\hat{\beta}_{\theta}^{m}$ and $z_f'\hat{\beta}_{\theta}^{f}$ to evaluate the part of the "raw" wage gap due to different gender rewards of the characteristics.

4. Data

We estimate the gender wage gap in Italy on a sample of employed workers aged 15 to 65 selected from the 8th wave (year 2001) of the European Community Household Panel (ECHP); the low reliability of information on self-employed workers suggests us to exclude that category from the analysis. Sample descriptive statistics are included in the Appendix (Table A1).

The model we estimate assumes that the wage level is mainly affected by individual human capital characteristics. The information provided by the ECHP dataset allows to control for the educational level and for the level of both general experience accumulated in the labour market and specific experience accumulated inside the firm. Regarding the educational level, we control for the levels specified in the ECHP survey; we construct two dummies capturing the effect of a "Second stage of secondary level education (ISCED 3)" and of a "Recognised third level education (ISCED 5-7)" with respect to an education lower than the second stage of secondary education.

The ECHP provides information on the total period the individual has spent in the firm where he is working at the present. However, the survey provides the exact number of years only up to 15 years spent in the same firm, longer years of specific experience cannot be exactly observed. Therefore we control for specific experience by defining different dummies of "tenure" with reference to the following periods of specific

[4] Albrecht et al. (2003) adopt a simplified version of the methodology proposed by J.A.F. Machado and J. Mata in a mimeo that was later published in the Journal of Applied Econometrics (Machado and Mata, 2005).

experience: less than five years (used as reference in the estimation), from 6 to 10 years, from 11 to 15 years, more than 15 years.

Turning to general experience, the ECHP survey does not contain precise information on the individual whole working experience. Then we compute a proxy of general experience by making the difference between the individual age and her age of entry into the labour market. That proxy of general experience could overestimate the period actually worked by women when experiencing some motherhood periods. In order to reduce this measurement problem we add a variable interacting experience with the number of children.

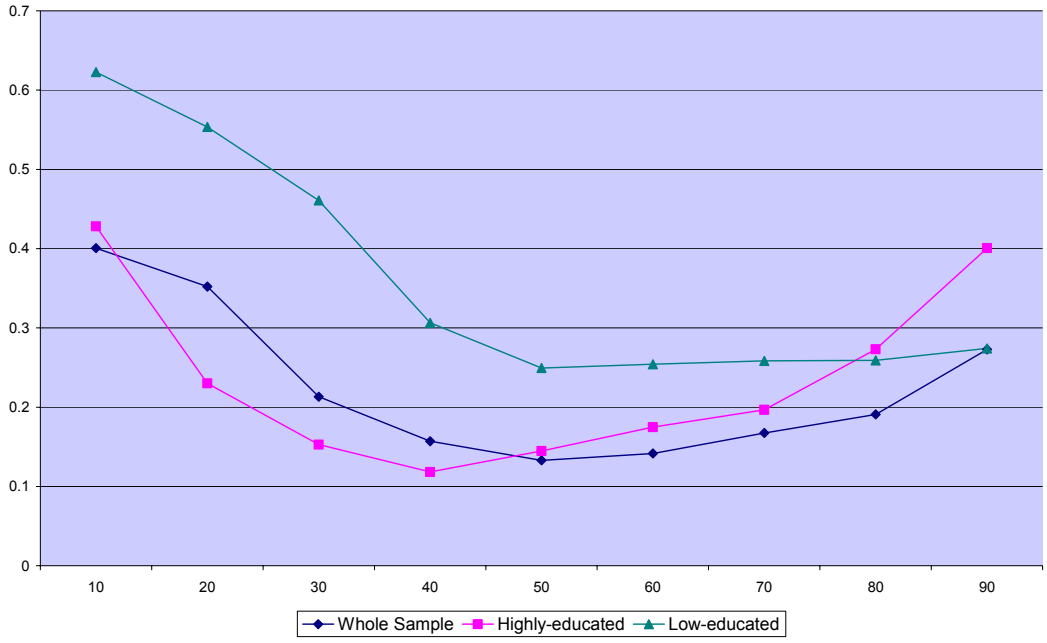
The ECHP contains some information also on the supervisory role carried out by the individual in his job; the survey questionnaire asks individuals in paid employment whether they have either a supervisory role or some intermediate supervisory role or none supervisor role in the firm. The disadvantage of women in having a supervisory role is clear from the data (Table A1 in Appendix); 16% of men have jobs with an average supervisory level against 11% of women; moreover 11% of men against 6% of women have jobs with a high supervisory role. We therefore include in the estimates two dummies capturing the level of supervision.

With regard to the distribution of workers by sector, types of contracts and size of firms we find some evidence on a gender argument. As far as the distribution by industry is concerned women are more concentrated in the Public Sector (43% of them are employed in this sector whereas 32% of men are to be found in the Public sector). More women than men are in the Service Sector (79% of women against 56% of working men) whereas 19% of women are in manufacturing against 40% of men. Working women are more likely than men to be employed in firms with less than 20 employees. In Italy part-time share of employment is much lower than in other European countries, its share is higher for women (9% of working women are employed in part-time jobs against 2% of working men). Also temporary employment is more spread amongst women. Given these descriptive statistics we include in the model some dummies controlling for the sector of activity, the type of contract (we control for the atypical categories, such as part-time, fixed-term or short-term contracts and other types of contracts different from the permanent typology) and the size of the firm together with macro-region dummies.

5. The wage gap across the distribution of wages

Recent analyses on gender wage differentials emphasize the different incidence of the wage gap at different points of earnings distributions and its dependence on the characteristics of female workers, in particular on their human capital endowment. Following the hints of this research, we will proceed in evaluating the wage gap between our sample female and male workers at different points of the distributions and will then focus on its incidence conditional on different educational levels.
In Figure 2 we plot the "raw" wage gap measured at any decile of the distributions, both for the whole samples and for the two subsamples of low-educated (triangle) and highly-educated (square) female and male workers. The "raw" wage gap is defined as the difference between male and female yearly working incomes unadjusted for individual characteristics; indeed, its level can depend both on a discriminatory behaviour observed against either the group of female workers or the group of male workers and on different characteristics observed between the two genders. Despite that, the "raw" wage gap gives a first interesting representation of how and in which measure gender income differences can vary across the distributions. The line "whole sample" represents the "raw" wage gap measured as the difference between the *i* decile value of the male wage distribution and the correspondent decile value of the female working income distribution. The same "raw" gap is evaluated on the subsample of workers with an educational level higher or equal to a second stage of secondary educational level (highly-educated workers) and on the subsample of individuals with an educational level lower than a second stage of secondary educational level (low-educated workers). A positive wage gap highlights an income differential in favour of male workers; on the contrary, a negative wage gap represents a wage advantage for women.

Figure 2. The log wage gap. Whole sample and subsamples conditioned on educational levels



As Figure 2 shows, the "raw" gap is always positive, at all points of the distributions and independently of the educational levels, meaning a wage differential constantly in favour of male workers. However, quite relevant differences emerge from a more deep analysis of the levels of the gap and of the trends characterising the different samples.
The wage gap measured between the whole female and male samples reaches higher values in correspondence of the first deciles of the distributions. The maximum wage gap amounts to 40 percentage points at the very first decile; it decreases across the lower tail of the distributions and reaches its minimum level at around the median point. Afterwards it steadily recovers up till 28 percentage points in the 90^{th} percentile. The U-shape path of the gap across the wage distribution deciles is confirmed in the highly-educated worker subsample. However, the decreasing trend up till the median value and the afterwards recovering path are much steeper than in the whole sample.
The worse wage gap levels are registered for low-educated women; they can experience till 60 percentage points of income disadvantage compared to their male colleagues in the first decile of the correspondent distribution. This is consistent with the hypothesis of sticky floor for the lower educated women. The gap falls by more than 30 percentage points before reaching the median wage value; from that point onwards it keeps stable.
It is interesting to notice that highly educated women suffer the lowest wage gaps at all wage levels except at the highest deciles of the wage distributions, when their gap overtakes the low-educated wage gap.
As we have already discussed, the "raw" wage gap strictly depends on inter-gender variability of productive characteristics. The wage gap increases in favour of men when female workers have worse productive characteristics than male workers. In order to separate the wage gap components due to differences in gender individual characteristics and to differences in their rewards, we proceed by estimating wage equations for men and women separately, following the quantile regression methodology explained in Section 3. Estimated coefficients are then used for measuring the part of the gap strictly dependent on gender differences in the rewards to the characteristics. More precisely, following the procedure described in Section 3 we construct the marginal distributions of female predicted wages and of counterfactual wages female workers would be paid if their characteristics were rewarded at the male rates. We finally discuss the behaviour of the gap across the wage distributions. In the subsequent section we will focus on the wage gap conditioned on different educational levels. Quantile regressions for the separate samples of women and men are synthesised in Table 2. Figure 3 shows the plots of the marginal predicted and counterfactual distributions of female wages.

Looking at the estimates of the female sample, we do not find any significant effect of marital status on the wage level; the dummy "married/cohabiting" is not statistically significant at any point of the female distribution. Human capital characteristics, in general, have significant and relevant effects on female wages at any point of the distribution. Educational levels higher or equal to a second stage of secondary educational level guarantee significant increases in wages; the wage gain for female workers, compared with their colleagues with a lower educational level, is between 13 and 18 percentage points. The wage gain for workers with a university degree –always compared with individuals with less than a second stage secondary educational level- increases from 25 percentage points at the lowest decile of the distribution up till 40 percentage points at the opposite extreme of the distribution.

General potential work experience accumulated in the labour market positively affects the wage level only for workers at the very lower tail of the distribution; in fact the coefficient is significant only at the first decile and the first quartile of the distribution. However, in correspondence with those wage levels, female workers are penalised in their returns to experience if they have children; the variable "experience*children", capturing the interaction between the number of years of experience and the number of children, is significant and negative.

Table 2a. Quantile regressions – Working women 16-65 years old

Dep. variable: log income from work	Q10	Q25	Q50	Q75	Q90
Log worked months	.984***	1.023***	.963***	.958***	.707***
	(6.86)	(1.05)	(12.42)	(17.34)	(4.46)
Log worked hours	.410***	.161**	.090	.151***	.245***
	(4.55)	(2.10)	(1.65)	(3.09)	(3.95)
Married/cohabitating	-.0067	.017	.008	.006	-.021
	(-.17)	(.66)	(.40)	(.36)	(-.71)
Second stage of secondary level education	.147***	.185***	.150***	.133***	.167***
	(4.44)	(7.44)	(8.33)	(6.11)	(5.07)
Third level education	.253***	.329***	.304***	.305***	.404***
	(5.96)	(9.50)	(8.95)	(7.42)	(10.00)
Experience	.028***	.014***	.007*	.002	-.003
	(4.20)	(2.88)	(1.81)	(.41)	(-.50)
Squared experience	-.001***	-.000***	-.000	.000	.000
	(-3.68)	(-2.55)	(-.71)	(.49)	(.57)
Experience*Children	-.004**	-.002**	-.002*	-.001	.001
	(-2.32)	(-1.9)	(-1.70)	(-.51)	(.60)
Average supervisory level	.136***	.091***	.100***	.080***	.100***
	(4.29)	(3.34)	(4.31)	(2.54)	(2.82)
Supervisory level	.097*	.042	.145***	.225***	.378***
	(2.55)	(.64)	(3.23)	(2.57)	(6.71)
Tenure 6-10 years	.116**	.110***	.086***	.038*	.057*
	(2.29)	(3.67)	(3.20)	(1.78)	(1.73)
Tenure 11-15 years	.128**	.113***	.092***	.054	.136***
	(2.37)	(2.69)	(3.04)	(1.53)	(2.96)
Tenure more than 15 years	.128**	.134***	.106***	.116***	.222***
	(2.31)	(3.38)	(3.92)	(3.63)	(4.50)
Public sector	.237***	.127***	.072***	.027	-.031
	(5.90)	(5.12)	(3.39)	(.95)	(-.85)
Agriculture	-.572	-.393*	-.081	-.023	-.113
	(-1.20)	(-1.68)	(-.46)	(-.25)	(-1.18)
Services	-.0349	-.031	.024	.052**	.101***
	(-.72)	(-.93)	(1.10)	(2.06)	(2.56)
Part-time	-.226***	-.364***	-.368***	-.236***	-.126*
	(-2.78)	(-5.00)	(-7.35)	(-4.36)	(-1.63)
Fixed-term or short-term contract	-.227***	-.128	-.040	-.062*	-.110**
	(-2.44)	(-1.31)	(-1.06)	(-1.68)	(-2.03)
Other type of contract*	-.363***	-.340***	-.209	-.106	-.152*
	(-3.03)	(-2.52)	(-1.46)	(-1.22)	(-1.74)
Firm size: 20-49 employees	.088***	.053**	.032	.038	.060*
	(2.42)	(1.87)	(1.43)	(1.39)	(1.74)
Firm size 50-99 employees	.0726*	.068**	.070***	.043**	.054
	(1.64)	(2.08)	(2.64)	(2.03)	(1.21)
Firm size 100-499 employees	.001	.038	.0290	.057**	.075**
	(.02)	(1.27)	(1.17)	(1.94)	(1.83)
Firm size: more than 500 employees	.075	.099***	.097***	.115***	.154***
	(1.58)	(2.91)	(3.70)	(3.44)	(3.59)
North-west	.035	.058*	.052**	.053	.074*
	(.88)	(1.66)	(2.05)	(1.49)	(1.74)
North-east	.092**	.049*	.047**	.042*	.114**
	(2.18)	(1.69)	(2.24)	(1.60)	(2.13)
South and Islands	-.078**	-.065**	-.033	.003	.029
	(-2.16)	(-2.06)	(-1.30)	(.15)	(1.00)
Constant	5.27***	6.372***	6.970***	6.954***	7.322***
	(1.82)	(17.65)	(22.73)	(26.42)	(15.47)
Observations	1191	1191	1191	1191	1191
R^2	.50	.43	.35	.28	.27

t-values in brackets. *** Significant 1%. ** Significant at 5%. * significant at 10%

Table 2b. Quantile regressions – Working men 16-65 years old

Dep. variable: log income from work	Q10	Q25	Q50	Q75	Q90
Log worked months	1.123***	1.130***	1.051***	.987***	.942***
	(11.95)	(19.95)	(18.38)	(18.68)	(6.00)
Log worked hours	.307***	.225***	.340***	.435***	.466***
	(3.73)	(3.28)	(6.26)	(5.58)	(4.42)
Married/cohabitating	.130***	.065***	.055***	.081***	.077**
	(3.64)	(2.60)	(2.73)	(4.09)	(2.08)
Second stage of secondary level education	.063***	.077***	.071***	.110***	.142***
	(2.55)	(4.77)	(4.87)	(5.83)	(4.76)
Third level education	.255***	.319***	.366***	.497***	.556***
	(5.42)	(9.76)	(11.34)	(1.73)	(9.06)
Experience	.015***	.012***	.010***	.009***	.008
	(2.95)	(3.13)	(3.20)	(2.45)	(1.22)
Squared experience	-.000**	-.000**	-.000**	-.000	-.000
	(-2.39)	(-2.15)	(-2.23)	(-1.07)	(-.26)
Experience*Children	.001	.002*	.001	.002*	.001
	(.87)	(1.80)	(1.26)	(1.78)	(1.04)
Average supervisory level	.127***	.092***	.0970***	.091***	.093***
	(4.81)	(4.89)	(5.58)	(3.76)	(2.57)
Supervisory level	.126***	.189***	.246***	.302***	.473***
	(2.63)	(6.16)	(9.07)	(6.87)	(5.74)
Tenure 6-10 years	.092***	.087***	.065***	.047**	.024
	(2.63)	(3.83)	(3.16)	(2.10)	(.62)
Tenure 11-15 years	.030	.051**	.042*	.036	.069
	(.68)	(2.20)	(1.75)	(1.26)	(1.42)
Tenure more than 15 years	.091**	.096***	.108***	.080***	.088**
	(2.19)	(3.71)	(4.68)	(3.05)	(1.97)
Public sector	.011	.028	.011	.010	-.008
	(.31)	(1.20)	(.53)	(.44)	(-.27)
Agriculture	-.067	-.071	-.072**	-.105***	-.195***
	(-.67)	(-1.26)	(-2.30)	(-2.68)	(-2.83)
Services	-.000	-.005	.021	.045**	.083***
	(-.01)	(-.25)	(1.39)	(2.35)	(3.05)
Part-time	-.276**	-.298**	-.204	.170	.014
	(-1.94)	(-2.27)	(-1.22)	(.81)	(.05)
Fixed-term or short-term contract	-.270***	-.181***	-.042	-.003	.219**
	(-3.53)	(-2.52)	(-1.32)	(-.05)	(2.24)
Other type of contract*	-.361*	-.191***	-.130**	-.111**	.122
	(-1.71)	(-2.50)	(-2.35)	(-1.97)	(.94)
Firm size: 20-49 employees	.089**	.047***	.037*	.038	.012
	(2.30)	(2.45)	(1.68)	(1.50)	(.30)
Firm size 50-99 employees	.136***	.074***	.054***	.058**	.048
	(3.48)	(3.28)	(2.45)	(1.99)	(.90)
Firm size 100-499 employees	.104***	.054**	.095***	.081***	.063*
	(3.57)	(2.07)	(3.90)	(3.07)	(1.60)
Firm size: more than 500 employees	.105***	.094***	.098***	.081***	.056
	(2.75)	(4.89)	(4.63)	(3.27)	(1.50)
North-west	.055	.006	.022	-.006	-.031
	(1.36)	(.22)	(.95)	(-.23)	(-.77)
North-east	.089***	.020	.038	.035	.028
	(2.70)	(.87)	(1.36)	(1.22)	(.53)
South and Islands	-.019	-.043***	-.020	-.038**	-.054**
	(-.55)	(-2.17)	(-1.09)	(-1.95)	(-1.94)
Constant	5.55***	6.075***	5.983***	5.884***	6.00***
	(13.47)	(2.39)	(26.50)	(18.80)	(11.34)
Observations	1822	1822	1822	1822	1822
R^2	.42	.35	.31	.31	.33

t-values in brackets. Significant 1%. ** Significant at 5%. * significant at 10%.

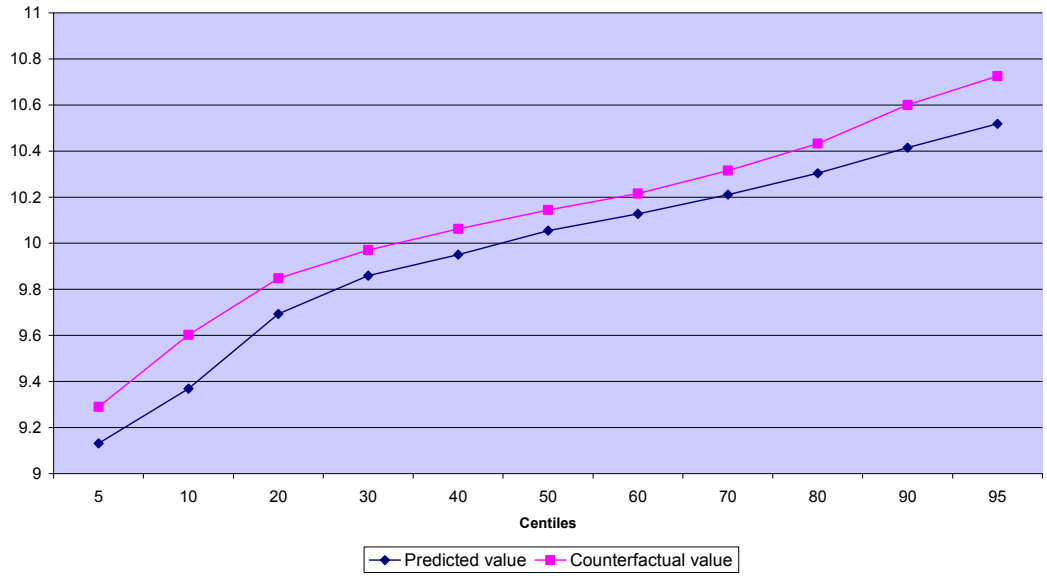
Specific experience accumulated inside the firm (tenure) has a positive and increasing effect on the wage level as the period spent in the firm increases, at any point of the distribution. However, we do not observe a clear monotonous trend as moving from the lowest to the highest deciles of the wage distribution. Trying to generalise, we can say that the economic advantage recognised to long staying workers decreases as wages increase from the first decile to the third quartile of the wage distribution; only at the last decile of the distribution the return to tenure regains some points.
The premium recognised to workers with some supervisory role inside the firm is positive and significant independently of the wage level and oscillating around a 10% higher total wage. The size of the premium is increasing in the wage level when the worker has a relevant supervisory function: in that case the premium rises from 10%, at the lowest decile of the wage distribution, to almost 38% at the last decile of the wage distribution.

A few comments on the estimates obtained for the male sample (Table 2b) in comparison with the female results are worth. In contrast with the results obtained for the female sample, being married or cohabiting with the partner positively affects the wage level. The coefficient of the dummy decreases as wages increase up till the median value of the male wage distribution; thereafter the coefficient tends to slowly increase.
Alike female workers, male workers with better human capital characteristics receive much higher wages than their colleagues, at any point of the distribution. With regard to education, the wage gain for male workers having the highest educational levels, however, is strongly higher than the correspondent female wage gain; male workers with an university degree receive a wage increase of 25% -at the lowest decile- and of 55% -at the last decile- on the wage of male colleagues with less than a second stage secondary educational level (the highest wage gain for females is registered in correspondence of the highest decile of the distribution and amounts to 40%). On the contrary, the wage premium is higher for female than for male workers when the educational level is equal to a second stage secondary educational level; compared with workers with less than a second stage secondary educational level, male workers receive a wage increase of between 6 and 14 percentage points while at the same time female workers gain a wage increase between 15 and 19 percentage points.
Differently from the estimates of the female subsample, general potential work experience has a positive effect on wages across the whole distribution with the only exception of the last decile. The return to general experience decreases as the wage level increases; its level ranges from 0.015 at the first decile to 0.009 at the third quartile. Comparing absolute values across the two distributions, we observe that general experience advantages female more than male workers at low wage levels; on the contrary, as wages increase beyond the median value, the rewards to experience for men overtakes the female value.
Regarding the returns to specific experience, as measured by tenure, we do not observe some of the regularities detected in the female sample. First, many of the coefficients estimated for the dummies capturing the incidence of this covariate are not significant. In addiction to that, the increasing effect on wage due to a raise in the tenure period, found in the female sample, is not detected among male workers. In general, when significant, specific experience has a much higher impact on wages among female workers than among their male colleagues.

Male workers with a supervisory role in the firm ("supervisory" level) are recognised a gain much higher than the premium recognised to females with similar responsibility functions; having a supervisory role in the firm guarantees male workers a 12% higher wage at the lowest decile of the distribution and a 47% higher earning at the 90th centile of the wage range. Having an intermediate supervisory role in the firm positively affects male worker wages as much as their female colleagues.

Given the results of the estimates, we construct the marginal distributions of the predicted values and of the counterfactual values, following the procedure explained in the previous section. Thereafter, we proceed in evaluating the wage gap due to differences in the rewards to the characteristics, as the difference between the counterfactual and the predicted marginal distributions. In Figure 3 we plot the two distributions, evaluated at different points.

Figure 3. Log of wages. Predicted versus counterfactual distribution. Women aged 16-65.



The two lines of Figure 3 represent the logarithm of the marginal distribution of predicted female wages –female characteristics evaluated at the female estimated rewards- and the logarithm of the marginal distribution of counterfactual female wages –female characteristics evaluated at the male estimated rewards-, observed at different deciles of the distributions. In correspondence of any decile we measure the wage gap due to differences in the rewards of female characteristics as the difference between the two lines.

The graph shows that the values of the deciles of the logarithm of the predicted distribution are lower than the values of the logarithm of the counterfactual distribution at any observed decile. This highlights the persistence of wage differentials at any wage level. In addition to that, the wage differential is higher in correspondence of either very

low or very high wage levels, e.g. in correspondence of the tails of the distributions. At the first decile the unexplained wage gap amounts to 23 percentage points of the female wage level. It steadily decreases as the wage level increases up till the sixth decile of the distribution, but from that point onwards it starts increasing reaching 18 percentage points at the upper decile of the distributions.

6. The wage gap by educational level

In this section we discuss the results of the analysis carried out on two different subgroups of the whole sample. We split the sample between workers with an educational level equal or higher than a "Second stage of secondary level education (ISCED 3)" and workers with a lower educational level (low-educated workers). Then we apply the same econometric methodology discussed for the whole sample, based on quantile regressions, and derive the marginal distributions of female predicted and counterfactual wages as described in Section 3.

Comparing the estimated results for the sample of highly-educated female workers (Table 3a) with the sample of low-educated female workers (Table 4a), we find interesting differences, concerning in particular the estimated rewards of different human capital components. First we find a stronger effect of potential human capital accumulated in the labour market for less-educated women than for those highly-educated. General experience significantly affects the whole distribution of wages only in the subsample of low-educated women; on the contrary, in the highly-educated female subsample the reward to general experience is significant only at very low levels of wages and its value is lower than the other subsample correspondent value. In addition to that, the estimated coefficient of the variable "experience*number of children", capturing the measure of penalty in terms of reward to experience that female workers suffer when having children, is not significant for less-educated women. In the highly-educated sample it becomes significant and negative in correspondence of the lower tail of the distribution and at the median wage.

While we found a stronger effect of general potential work experience on wages of less-educated female workers, we detect a higher impact of specific experience accumulated inside the firm (tenure) in the sample of highly-educated women. More precisely, the reward to tenure is generally insignificant in the sample of less-educated females with the exception of the last decile of the distribution; indeed the return to tenure is significant in the sample of highly-educated women and increasing across the wage distribution.

Estimates for the whole female sample show a significant and positive reward, across the whole wage distribution, recognised to workers having in the firm either an "average supervisory role" or a "high supervisory role". In the first case the return is equal to a 10% wage increase; in the latter case the wage gain is increasing from 10% at the lower quantile up till 38% at the last decile of the distribution. Conditioning the estimates to the educational level allows to identify different patterns; the reward for some supervisory role is higher in the sample of low-educated women, amounting to twice the return estimated in the upper-educated female sample. On the other hand, having a relevant supervisory role guarantees a significant and positive reward only to women with a high educational level and belonging to the upper-tail of the distribution.

Table 3a. Quantile regressions – Highly educated women 16-65 years old

Dep. variable: log income from work	Q10	Q25	Q50	Q75	Q90
Log worked months	.994***	1.138***	1.07***	1.049***	1.022***
	(.20)	(.12)	(.10)	(.108)	(.20)
Log worked hours	.358***	.061	.030	.123***	.261***
	(.13)	(.09)	(.05)	(.048)	(.07)
Married/cohabitating	.0143	.008	.003	.002	-.002
	(.05)	(.03)	(.02)	(.02)	(.03)
Third level education	.129***	.136***	.149***	.174***	.259***
	(.04)	(.04)	(.02)	(.03)	(.05)
Experience	.029***	.016***	.004	-.004	-.006
	(.01)	(.00)	(.00)	(.00)	(.00)
Squared experience	-.000	-.000	.000	.000*	.000
	(.00)	(.00)	(.00)	(.00)	(.000)
Experience*Children	-.004*	-.002	-.002*	.000	.003
	(.00)	(.00)	(.00)	(.00)	(.00)
Average supervisory level	.081**	.071**	.091***	.068**	.089*
	(.04)	(.03)	(.02)	(.03)	(.05)
Supervisory level	.049	.052	.151***	.273***	.314***
	(.05)	(.06)	(.05)	(.07)	(.06)
Tenure 6-10 years	.135***	.120***	.092***	.053*	.042
	(.05)	(.04)	(.03)	(.03)	(.04)
Tenure 11-15 years	.090	.132**	.123***	.090**	.153***
	(.09)	(.06)	(.03)	(.04)	(.06)
Tenure more than 15 years	.103	.117**	.096***	.149***	.231***
	(.07)	(.05)	(.03)	(.05)	(.06)
Public sector	.223***	.133***	.104***	.028	.001
	(.05)	(.03)	(.02)	(.03)	(.03)
Agriculture	-.669*	-.982**	-.042	-.033	-.175
	(.38)	(.49)	(.59)	(.59)	(.60)
Services	-.021	-.067*	-.024	.044	.107
	(.07)	(.03)	(.026)	(.03)	(.05)**
Part-time	-.226*	-.435***	-.355***	-.267***	-.007
	(.12)	(.10)	(.06)	(.08)	(.10)
Fixed-term or short-term contract	-.206	-.017	-.026	-.057	-.140***
	(.15)	(.10)	(.04)	(.05)	(.05)
Other type of contract*	-.266	-.233	-.067	-.136	-.110
	(.19)	(.19)	(.14)	(.13)	(.12)
Firm size: 20-49 employees	.089**	.021	.026	.043	.102**
	(.04)	(.03)	(.02)	(.03)	(.04)
Firm size 50-99 employees	.072	.033	.047**	.027	.066
	(.05)	(.03)	(.02)	(.03)	(.05)
Firm size 100-499 employees	.042	-.000	.024	.056*	.081**
	(.05)	(.03)	(.02)	(.03)	(.04)
Firm size: more than 500 employees	.051	.054	.080***	.100***	.163***
	(.057)	(.04)	(.03)	(.04)	(.06)
North-west	.059	.041	.047	.050	.104
	(.057)	(.04)	(.03)	(.04)	(.05) *
North-east	.122***	.090***	.045***	.029	.069
	(.04)	(.02)	(.02)	(.03)	(.06)
South and Islands	-.027	-.052**	-.035	-.003	.010
	(.04)	(.03)	(.02)	(.02)	(.03)
Constant	5.541***	6.643***	7.094***	6.995***	6.601***
	(.70)	(.41)	(.31)	(.31)	(.55)
# Observations	872	872	872	872	872
R^2	.46	.39	.30	.23	.25

Standard errors in brackets.
*** Significant at 1%. ** Significant at 5%. * significant at 10%.

Table 3b. Quantile regressions – Highly educated men 16-65 years old

Dep. variable: log income from work	Q10	Q25	Q50	Q75	Q90
Log worked months	1.339***	1.117***	1.115***	1.075***	.991***
	(.37)	(.12)	(.06)	(.07)	(.26)
Log worked hours	.165	.192**	.365***	.507***	.553***
	(.11)	(.08)	(.08)	(.08)	(.14)
Married/cohabitating	.138***	.064**	.072**	.103**	.108**
	(.05)	(.03)	(.03)	(.04)	(.05)
Third level education	.185***	.236***	.285***	.397***	.408***
	(.05)	(.03)	(.04)	(.04)	(.06)
Experience	.010	.010**	.009*	.000	.005
	(.01)	(.00)	(.00)	(.00)	(.01)
Squared experience	-.000	-.000	-.000	.000	.000
	(.00)	(.00)	(.00)	(.00)	(.00)
Experience*Children	.001	.002*	-.000	.001	.000
	(.00)	(.00)	(.00)	(.00)	(.00)
Average supervisory level	.125***	.090***	.105***	.127***	.120***
	(.03) ***	(.02)	(.02)	(.03)	(.05)
Supervisory level	.165	.226***	.268***	.324***	.472***
	(.05)	(.03)	(.04)	(.05)	(.08)
Tenure 6-10 years	.020	.072**	.067**	.087**	.066
	(.05)	(.03)	(.03)	(.03)	(.05)
Tenure 11-15 years	-.049	.022	.019	.047	.040
	(.07)	(.05)	(.05)	(.05)	(.08)
Tenure more than 15 years	.055	.061**	.075*	.082*	.070
	(.06)	(.03)	(.04)	(.04)	(.06)
Public sector	-.001	.025	.001	.009	.012
	(.04)	(.03)	(.03)	(.03)	(.04)
Agriculture	-.203	-.090	-.096	-.116*	-.188*
	(.14)	(.12)	(.07)	(.07)	(.11)
Services	-.002	.011	.049**	.053*	.100**
	(.04)	(.03)	(.02)	(.03)	(.04)
Part-time	-.144	-.339	.204	.218	.521**
	(.30)	(.30)	(.29)	(.25)	(.23)
Fixed-term or short-term contract	-.200	-.204***	-.067	-.044	-.019
	(.14)	(.08)	(.06)	(.07)	(.13)
Other type of contract*	-.749	-.168	-.036	.086	.266
	(.47)	(.28)	(.12)	(.19)	(.26)
Firm size: 20-49 employees	.092*	.046*	.055**	.042	-.015
	(.05)	(.03)	(.02)	(.04)	(.06)
Firm size 50-99 employees	.148***	.071***	.053*	.016	-.042
	(.06)	(.03)	(.03)	(.04)	(.07)
Firm size 100-499 employees	.129***	.078***	.077***	.052	-.008
	(.04)	(.03)	(.02)	(.03)	(.05)
Firm size: more than 500 employees	.103**	.090***	.096***	.068*	-.011
	(.05)	(.03)	(.03)	(.04)	(.05)
North-west	.006	-.002	-000	-.013	-.008
	(.048)	(.04)	(.03)	(.05)	(.06)
North-east	.071**	.028	-.009	.009	.010
	(.03)	(.02)	(.04)	(.04)	(.07)
South and Islands	-.026	-.041*	-.034	-.058**	-.079**
	(.04)	(.02)	(.03)	(.03)	(.04)
Constant	5.658***	6.310***	5.795***	5.530***	5.691***
	(.91)	(.46)	(.34)	(.33)	(.78)
# Observations	1066	1066	1066	1066	1066
R^2	.38	.32	.30	.33	.37

Standard errors in brackets.
*** Significant at 1%. ** Significant at 5%. * significant at 10%

Comparing the two gender estimates, conditioned on the same educational level, we find some interesting facts.
Tables 3a and 3b summarise the estimates of the quantile regressions carried out only on workers with at least a second stage secondary educational level. The estimates confirm the positive effect of education on wages, both in the female and in the male subsamples; this is true across the whole distributions. In addition to that, the wage increases due to a tertiary education degree at the highest quantiles of the distributions are more than double than the gains registered at the lowest deciles. However, the male reward to the highest educational level is higher than the female reward across the whole distributions and that difference increases as wages rise.
Differently from the results obtained in the male whole sample, general experience loses almost completely any significant effect in the sample of highly-educated men. In the case of female workers, on the contrary, the results for the highly-educated subsample do not substantially differ from the results of the whole sample estimates; general experience has some significant impact only at low wage levels.
Regarding the wage effect of specific experience, different patterns exist by gender. The variable tenure has in general no effect on wages of highly-educated men while it assumes significant and high values in the sample of female workers across the whole distribution.
Both men and women having a supervisory level in the firm are guaranteed a wage premium; however, the positive effect on wage is much higher for men than for women.

As far as the sample of low-educated workers is concerned (Tables 4a and 4b), among the main results we have to mention the strengthening role of general potential work experience in explaining the wages of low-educated females. Unlike the male sample, experience is significant across the whole female subsample; moreover, the coefficient is much higher (when significant) than in the low-educated men subsample. Despite the increasing significance of the characteristic 'general experience' in explaining female low-educated earning capacity, wages of these workers appear not to be affected by the period of permanence inside the same firm; the variable 'tenure' assumes a significant coefficient only in correspondence of the highest decile of that wage distribution and only when the working relationship has been lasting for more than 15 years. Female workers are economically advantaged by having some supervisory role in the firm; the advantage is significant at all levels of wages and is higher than in the subsample of low-educated men. However, having a relevant supervisory role does not significantly affect wages, both in the female and in the male case. In the former case the dummy 'supervisory role' is completely insignificant at any wage level but at the 25^{th} percentile (although with a low significance); in the latter case the dummy is significant with a low marginal effect in correspondence of the median value and at around the third quarter of the distribution.

Table 4a. Quantile regressions – Low educated women 16-65 years old

Dep. variable: log income from work	Q10	Q25	Q50	Q75	Q90
Log worked months	.883	1.012***	.931***	.933***	.583***
	(.14)	(.12)	(.07)	(.15)	(.22)
Log worked hours	.641***	.588***	.606***	.659***	.445*
	(.22)	(.17)	(.11)	(.14)	(.28)
Married/cohabitating	.065	-.006	-.038	-.041	-.020
	(.07)	(.05)	(.03)	(.04)	(.05)
Experience	.031**	.007	.014**	.013*	.017*
	(.01)	(.01)	(.01)	(.01)	(.01)
Squared experience	-.000**	-.000	-.000*	-.000	-.000
	(.00)	(.00)	(.00)	(.00)	(.00)
Experience*Children	-.005	-.002	-.000	-.003	-.004
	(.00)	(.00)	(.00)	(.00)	(.00)
Average supervisory level	.209**	.160***	.152***	.161**	.120
	(.09)	(.05)	(.05)	(.07)	(.09)
Supervisory level	.131	.172*	.127	.280	.306
	(.18)	(.11)	(.14)	(.20)	(.22)
Tenure 6-10 years	-.050	-.059	-.027	.022	.129
	(.12)	(.10)	(.05)	(.06)	(.09)
Tenure 11-15 years	.166	.082	-.041	-.023	.115
	(.11)	(.08)	(.06)	(.07)	(.08)
Tenure more than 15 years	.133	.116	-.010	.034	.169**
	(.11)	(.08)	(.06)	(.06)	(.08)
Public sector	.113	.057	.051	.017	-.095
	(.07)	(.04)	(.04)	(.06)	(.07)
Agriculture	-.468	-.224	-.041	-.016	-.053
	(.51)	(.22)	(.19)	(.15)	(.13)
Services	.052	.089*	.070*	.097**	.137**
	(.079)	(.05)	(.04)	(.05)	(.06)
Part-time	-.224	-.146	-.118	.031	-.008
	(.15)	(.13)	(.10)	(.11)	(.18)
Fixed-term or short-term contract	-.111	-.140	-.146*	-.092	-.053
	(.16)	(.12)	(.09)	(.10)	(.10)
Other type of contract*	-.292*	-.428***	-.344**	-.140	-.186
	(.18)	(.16)	(.16)	(.13)	(.17)
Firm size: 20-49 employees	.114	.106**	.086**	.093**	.027
	(.08)	(.05)	(.04)	(.05)	(.07)
Firm size 50-99 employees	.126	.145*	.227***	.187***	.010
	(.11)	(.08)	(.05)	(.06)	(.08)
Firm size 100-499 employees	.130	.083	.137**	.187***	.146
	(.11)	(.09)	(.06)	(.07)	(.12)
Firm size: more than 500 employees	.289***	.216***	.217***	.166***	.222**
	(.10)	(.06)	(.05)	(.06)	(.09)
North-west	.101	.015	.025	.035	.037
	(.10)	(.06)	(.05)	(.07)	(.09)
North-east	.082	-.006	-.028	.078	.118
	(.09)	(.06)	(.04)	(.07)	(.10)
South and Islands	.-.195	-.108	-.063	.089	.004
	(.13)	(.11)	(.08)	(.07)	(.08)
Constant	4.617	4.951***	5.196***	5.050***	6.730***
	(.95)	(.80)	(.48)	(.68)	(1.20)
# Observations	319	319	319	319	319
R^2	.56	.50	.40	.32	.29

Standard errors in brackets.
*** Significant at 1%. ** Significant at 5%. * significant at 10%.

Table 4b. Quantile regressions – Low-educated men 16-65 years old

Dep. variable: log income from work	Q10	Q25	Q50	Q75	Q90
Log worked months	1.052***	1.106***	1.013***	1.027***	.900***
	(.10)	(.10)	(.07)	(.10)	(.23)
Log worked hours	.365***	.322***	.199*	.354***	.387***
	(.14)	(.10)	(.11)	(.11)	(.13)
Married/cohabitating	.100*	.102***	.062**	.065***	.071
	(.06)	(.04)	(.03)	(.02)	(.06)
Experience	.016***	.011**	.005	.006	.005
	(.00)	(.00)	(.00)	(.00)	(.00)
Squared experience	-.000**	-.000*	-.000	-.000	-.000
	(.00)	(.00)	(.00)	(.00)	(.00)
Experience*Children	.000	.000	.002	.003**	.003
	(.00)	(.00)	(.00)	(.00)	(.00)
Average supervisory level	.150***	.115***	.089***	.078**	.033
	(.05)	(.03)	(.03)	(.03)	(.05)
Supervisory level	-.073	.080	.133**	.136***	.083
	(.45)	(.07)	(.06)	(.04)	(.06)
Tenure 6-10 years	.259***	.123***	.071**	.004	-.061
	(.07)	(.03)	(.03)	(.03)	(.06)
Tenure 11-15 years	.161**	.084	.102***	.056	.024
	(.08)	(.04)	(.03)	(.04)	(.06)
Tenure more than 15 years	.161**	.113***	.143***	.108***	.064
	(.07)	(.03)	(.03)	(.04)	(.06)
Public sector	.010	.066	-.003	.023	.013
	(.05)	(.04)	(.03)	(.04)	(.06)
Agriculture	-.027	-.029	-.066	-.093*	-.082
	(.12)	(.06)	(.04)	(.05)	(.12)
Services	.014	-.034	.000	.023	.085*
	(.04)	(.03)	(.02)	(.03)	(.05)
Part-time	-.187	-.228	-.281	-.301	.131
	(.16)	(.23)	(.18)	(.26)	(.32)
Fixed-term or short-term contract	-.188*	-.122	-.025	.021	.137
	(.11)	(.13)	(.05)	(.08)	(.14)
Other type of contract*	-.380*	-.218***	-.204***	-.156***	-.067
	(.23)	(.08)	(.05)	(.05)	(.27)
Firm size: 20-49 employees	.042	.022	-.008	.019	.017
	(.06)	(.03)	(.03)	(.04)	(.04)
Firm size 50-99 employees	.111*	.065*	.081***	.062	.134
	(.06)	(.03)	(.03)	(.04)	(.08)
Firm size 100-499 employees	.084*	.037	.115***	.108***	.104**
	(.05)	(.03)	(.04)	(.03)	(.05)
Firm size: more than 500 employees	.107	.088**	.116***	.103***	.107*
	(.07)	(.04)	(.04)	(.04)	(.06)
North-west	.015	.031	.017	.025	-.011
	(.06)	(.03)	(.04)	(.04)	(.11)
North-east	.094	.058	.091***	.078**	.026
	(.06)	(.04)	(.04)	(.03)	(.06)
South and Islands	-.026	-.038	-.007	-.002	-.066*
	(.05)	(.03)	(.02)	(.03)	(.03)
Constant	5.438***	5.771***	6.641***	6.140***	6.499***
	(.59)	(.44)	(.40)	(.46)	(.805)
# Observations	756	756	756	756	756
R^2	.45	.38	.30	.25	.17

Standard errors in brackets.
*** Significant at 1%. ** Significant at 5%. * significant at 10%.

Figures 4 and 5 represent the wage levels at different deciles of the marginal predicted and counterfactual distributions, for female highly-educated (Figure 4) and low-educated (Figure 5) workers.
The wage gap due to differences in the rewards of the characteristics, as measured by the distance between the two curves, follows a different trend across the two conditioned subsamples. In Table 5 we show the size of the gap at every decile, for the two groups of women.

Figura 4. Log of wages. Predicted versus counterfactual distribution. Highly-educated workers

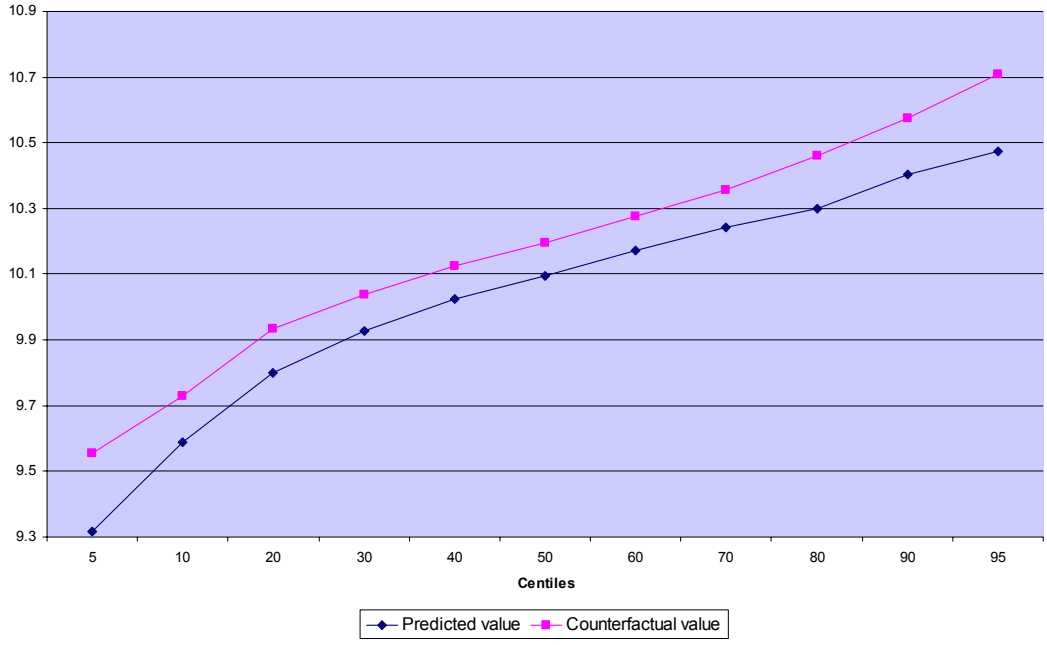


Figura 5. Log of wages. Predicted versus counterfactual distribution. Low-educated workers

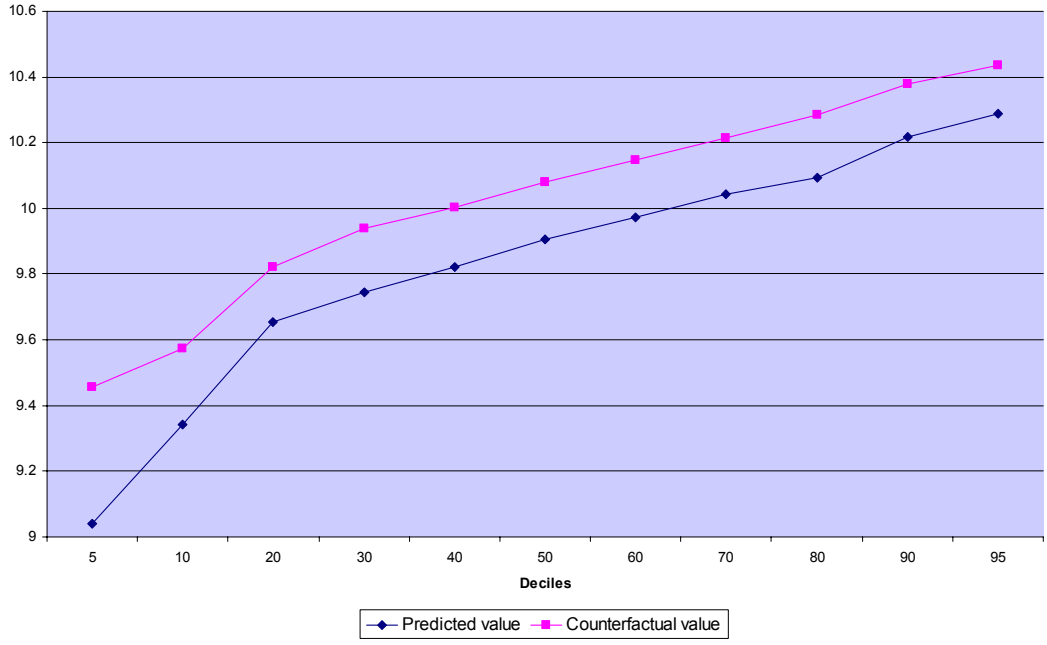


Table 5. Wage gap due to differences in the rewards of the characteristics. $z'_f\hat{\beta}^m_\theta - z'_f\hat{\beta}^f_\theta$

Deciles	Low-educated	Highly-educated
10	0.23	0.14
20	0.17	0.14
30	0.19	0.11
40	0.18	0.10
50	0.17	0.10
60	0.17	0.10
70	0.17	0.11
80	0.19	0.16
90	0.16	0.17

The gap due to differences in the returns to the characteristics is higher in the low-educated female group than in the highly-educated sample, at any decile but the last. At the 90th centile of the two distributions, the more educated women show the high proportion of the wage gap due to different returns. The gap for low-educated women decreases as wage increases, ranging from 23 percentage points (of the female wage) at the lower decile of the female wage distribution to 16 percentage points at the opposite extreme of the distribution. This is consistent with the presence of sticky floor and statistical discrimination hypotheses for the low-educated women. The pattern is completely different when considering the unexplained wage gap across the distribution of highly-educated female workers. In this case the gap steadily decreases from the first decile (14% wage gap) till the 60th centile of the distribution (10% wage gap) and from that point onwards it sharply increases reaching a higher value (17% wage gap) than the gap registered at the lowest decile of the distribution.

7. Concluding remarks

In this paper we have analysed the wage gap between men and women in Italy. The size of the "raw" gap is not evenly distributed among female workers and it is particularly high especially for women with low educational levels.

We have addressed the aim of evaluating the wage gap across the whole distribution of wages and of isolating the component of the gap due to differences in the rewards to individual characteristics, by means of the quantile regression methodology and of the estimation of the marginal distributions of predicted and counterfactual wages by applying a simplified version of the methodology suggested by Machado and Mata (2005).

We find that, in general, unexplained wage differentials persist across the entire distribution of wages; however, the gap is higher in correspondence of either very low or very high wage levels, e.g. in correspondence of the tails of the distributions.

We analyse the wage gap due to gender differences in the rewards to the characteristics also conditioned to high and low educational levels. The results confirm the highest incidence of the gap among low-educated workers. However, while the gap for low-educated women decreases as wages increase, the gap for highly-educated

women initially decreases, across the lower tail of the distribution, and sharply increases across the highest deciles of the distribution. These results are consistent with the existence of statistical discrimination and sticky floors for low-educated women. This requires the implementation of policies to address the problem that may worsen also with the expected increase in women's labour supply in order to meet Lisbon targets. If the employment probability of lower educated women increases this would lead to a widening of the wage gap at the bottom of the distribution. A higher wage gap at the top of the wage distribution is consistent with a glass ceiling effect for highly educated women connected to the observed lower access of women to apical positions and to the lower rewards for women of these positions.

References

Addabbo, T. (1999) 'Labour supply and employment probabilities in Italy: a gender analysis in a regional perspective' *Economia & Lavoro* (XXXIII,n.3-4), pp.189-207.

Addabbo, T. and Favaro, D. (2005) 'Differenziali salariali per sesso in Italia. Problemi di stima ed evidenze empiriche', mimeo.

Addis, E., and Waldmann, R. (1996) 'Struttura salariale e differenziale per sesso in Italia', *Economia e lavoro*, 30(1-2), 87-103.

Albrecht, J., Bjorklund, A. and Vroman, S. (2003) 'Is there a glass ceiling in Sweden?', *Journal of Labor Economics*, 21 (1), 145-177.

Albrecht, J.,Van Vuuren, A. and Vroman, S. (2004) 'Decomposing the gender wage gap in the Netherlands with sample selection adjustments', *IZA DP 1400,* Bonn.

Altonji, J.G. and Blank, R. M. (1999) 'Race and gender in the labor market', Ch. 48, Vol.3, in Ashenfelter, O. and Card, D. (eds) (1999) *Handbook of Labor Economics*, Amsterdam – Oxford, Elsevier.

Arulampalam, W., Booth, A.,L., and Bryan, M.L. (2005) 'Is there a glass ceiling over Europe? Exploring the gender pay gap across the wages distribution', *ISER Working Paper 2005-25*. Colchester: University of Essex.

Beblo, M., Beninger, D., Heinze, A. and Laisney, F. (2003a) 'Methodological issues related to the analysis of gender gaps in employment, earnings and career progression', *Final Report*, European Commission, Employment and social affairs DG.

Beblo, M., Beninger, D., Heinze, A. and Laisney, F. (2003b) 'Measuring selectivity corrected gender wage gaps in the EU', *ZEW Discussion paper No.03-74*.

Bettio, F. (2002) 'The Pros and Cons of occupational gender segregation in Europe' *Canadian Public Policy-Analyse de politiques*, vol XXVII, Supplement, 1, S65-S84.

Bettio, F. and Villa, P. (1999) 'To what extent does it pay to be better educated? Education and market work for women in Italy', *South European Society and Politics,* (4) No 2*,* special issue on "Gender Inequalities in Southern Europe: Women, Work and Welfare in the 1990s".

Blau, F. and Kahn, L. (1996) 'Wage-structure and gender earnings differentials: an international comparison', *Economica*, 63, s29-s62.

Blinder, A. S. (1973), 'Wage discrimination: reduced forms and structural estimates', *The Journal of Human Resources*, 8 (4), 436-55.

Buchinsky M. (1998) 'Recent advances in quantile regression models: a practical guideline for empirical research', *The Journal of Human Resources*, 33, 88-126.

Card, D. (1999) 'The causal effect of education on earnings', in Ashenfelter, O. and Card, D. (eds) (1999) *Handbook of Labor Economics*, Vol. 5, Amsterdam; New York and Oxford, Elsevier Science, North-Holland.

Comitato nazionale parità e pari opportunità (2001) *I differenziali salariali per sesso 1980-2000: l'Italia e l'Europa*, Roma, Istituto Poligrafico dello Stato.

Costa, S. (2003) 'Maternità e partecipazione delle donne al mercato del lavoro tra vincoli e strategie di conciliazione', *Seminario Cnel-Istat*, Roma, 2 dicembre 2003.

Daly, A., Kawaguchi, A., Meng, X. and Mumford, K. (2006) 'The gender wage gap in four countries', *IZA DP 1921, Bonn*.

De La Rica, S., Dolado, J.J. and Llorens, V. (2005) 'Ceiling and Floors: gender wage gaps by education in Spain', *IZA DP 1483*, Bonn.

Del Rìo, C., Gradìn, C. and Cantò, O. (2006) 'The measurement of gender wage discrimination: the distributional approach revisited', *Ecineq WP 2006-25*.

European Commission (2002) *Employment in Europe*, Luxembourg.

Favaro, D. and Magrini, S. (2005) 'Group versus individual discrimination among young workers: a distributional approach', *Working Paper 2005.02, Dipartimento di Scienze Economiche, Università Ca' Foscari di Venezia*.

Flabbi, L (2001) 'La discriminazione: evidenza empirica e teoria economica' in Brucchi Luchino (2001) *Manuale di Economia del Lavoro*, Capitolo 17, Bologna, Il Mulino.

Garcìa, J., Hernandez, P.J. and Lòpez-Nicolàs, A. (2001), 'How wide is the gap? An investigation of gender wage differences using quantile regression', *Empirical Economics*, 26:149-167.

Gardeazàbal, J. and Ugidos, A. (2005), 'Gender wage discrimination at quantiles', *Journal of population economics*, 18: 165-179.

Heckman, J. (1979) 'Sample selection bias as a specification error', *Econometrica*, (47): 153-161.

Heckman, J.A., Lochner, L.J. and Hold, P.E. (2005) 'Earnings functions, rates of return and treatment effects: the Mincer equation and beyond', *IZA DP 1700, Bonn*.

ISTAT (2005) *Rapporto Annuale: la situazione del paese nel 2004*, Roma, Istat.

Istituto degli Innocenti (2002) 'I servizi educativi per la prima infanzia. Indagine sui nidi d'infanzia e sui servizi educativi 0-3 anni integrativi al nido al 30 settembre 2000', *Quaderni del Centro Nazionale di documentazione e analisi per l'infanzia e l'adolescenza*, Firenze, Istituto degli Innocenti, aprile 2002, www.minori.it

Juhn, C., Murphy, K.M. and Pierce, B. (1993) 'Wage inequality and the rise in returns to skill', *Journal of Political Economy*, 101 (3): 410-442.

Koenker R. and Bassett G. (1982) 'Robust tests for heteroskedasticity on regression quantiles', *Econometrica*, 50: 43-61.

Kunze, A. (2000), 'The determination of wages and the gender wage gap: a survey', *IZA DP 193*, Bonn.

Lewbel, A. (2001) 'Selection model and conditional treatment effects, including endogenous regressors', mimeo, Boston College.

Machado, J.A.F. and Mata, J. (2005) 'Counterfactual decomposition of changes in wage distributions using quantile regression', *Journal of Applied Econometrics*, 20 (4): 445-465.

Oaxaca, R. (1973) 'Male-female wage differentials in urban labor markets', *International Economic Review*, 14 (3): 693-709.

OECD (2002) *Employment outlook*, Paris, OECD.

Olivetti, C. and Petrongolo, B. (2005) 'Unequal pay or unequal employment? A cross country analysis of gender gaps', *CEP Discussion paper, 711.*

Pissarides, C., Garibaldi, P., Olivetti C., Petrongolo, B. and Wasmer, E. (2005) 'Wage gaps', Ch.5, Part I in Boeri, T., Del Boca, D., and Pissarides, C. (eds) (2005) *Women at work. An economic perspective*, Oxford University Press.

Rustichelli, E. (2005) 'I differenziali retributivi di genere', Cap.3 in Battistoni, L. (a cura di) (2005), *I numeri delle donne 2005*, Quaderni Spinn, 17.

Appendix

Table A1. Descriptive statistics on the sample. Employees 16-65 years old.

	Women		Men	
	Mean	St.Dev.	Mean	St.Dev.
Log hourly wage	2.5350	0.4655	2.5957	0.4687
Second stage of secondary level education	0.3934	0.4886	0.4210	0,4938
Third level education	0.0842	0.2778	0.1004	0,3005
Potential work experience	17.0862	11.4547	17.3864	11.5100
Potential work experience squared	423.0921	467.0838	434.7138	465.5600
Average level of supervision	0.1099	0.3128	0.1578	0.3646
High level of supervision	0.0559	0.2297	0.1115	0.3148
Tenure 6-10 years	0.1489	0.3561	0.1375	0.3445
Tenure 11-15 years	0.1127	0.3163	0.1033	0.3044
More than 15 years of tenure	0.3219	0.4674	0.3453	0.4756
Public Sector	0.4296	0.4952	0.3188	0.4661
Manufacturing	0.1861	0.3893	0.3958	0,4891
Services	0.7932	0.4051	0.5584	0,4967
Part time	0.0936	0.2914	0.0166	0,1277
Temporary	0.0176	0.1316	0.0050	0.0708
Other contract	0.0714	0.2575	0.0097	0.0980
Firms with 20-49 employees	0.0081	0.0897	0.0208	0.1426
Firms with 50-99 employees	0.0449	0.2072	0.1186	0.3234
Firms with 100-499 employees	0.0299	0.1705	0.1208	0.3259
Firms with more than 500 employees	0.1635	0.3700	0.1628	0.3692
North West	0.1113	0.3146	0.1007	0.3010
North East	0.1340	0.3407	0.1402	0.3472
South	0.0792	0.2702	0.1221	0.3274

Source: *descriptive statistics on ECHP 2001 sample*