

Gender wage gap and the glass ceiling effect: A firm-level investigation

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Research paper

Abstract

Purpose

To assess the relevance of the glass ceiling effect, according to which the gender log wage gap accelerates in the upper tail of the wage distribution, at the firm level.

Design/methodology/approach

The empirical analysis is based on a sample of 4654 employees, working in a French private company from the Defence and Aerospace sector. Using quantile wage regressions, we study whether there exists a glass ceiling effect at the firm level. The difference between the male and female wage distributions is also decomposed into two components, one due to differences in labour market characteristics between men and women and one due to differences in rewards to these individual characteristics.

Findings

The gender wage gap measured through OLS is rather low, less than 8% when controlling for age, experience, qualification and location. It remains rather flat along the wage distribution, a result which casts doubt on the glass ceiling theory. The gender gap is mainly due to differences in labour market characteristics rather than to differences in the rewards of these characteristics, especially among executives. Finally, women face a lower probability of reaching higher hierarchical positions within the firm.

Research implications

Taking into account firm effects matters when measuring the magnitude of the gender wage throughout the wage gap distribution.

Originality/value

Original estimates of the gender wage gap with an unusual, firm-based sample of workers.

Keywords : Discrimination, gender wage gap, glass ceiling, quantile regression

JEL Classification : J16, J31, J7

1/ Introduction

European countries have passed laws mandating an equal treatment of women and men in the workplace, meaning in particular that both female and male employees should receive equal pay for equal work. In spite of these efforts, there is still a significant gender wage gap in almost every industrialised countries labour market. Over the years 1994-1998, the male-female pay ratio was equal to 23.7 percent in the United-States and 22.2 percent for the other non-US countries (see Blau and Kahn, 2000).

Many explanations have been put forward to find the origin of the gender wage gap, most of them dealing with gender specific factors. These may be for instance a lower level of human capital for women or employer's discrimination against them. When turning to international comparisons, Blau and Kahn (1996) note that countries with high rewards to skill and large sector differentials tend to display larger gender wage gaps. But at the same time, more compressed male wage structures and low female work supply relative to demand tend to reduce the gender wage gap, and the extent of collective bargaining coverage within a country is negatively associated with its gender pay differences (Blau and Kahn, 2003). Importantly, a large part of the variations in the gender gap among the various countries is due to differences in the overall wage structure.

More recently, several studies have shown that the gender wage gap may vary throughout the wage distribution. In Sweden for example, Albrecht et al. (2003) find a sharp acceleration of the gap in the upper tail of the wage distribution and interpret this result as the result of a 'glass ceiling' which prevents women from reaching high wages. Similar results have been found in many European countries (see Arulampalam et al., 2004). Nevertheless, some specific profiles may exist. For instance, the wider unexplained gap at the top of the distribution mainly holds for highly educated workers (de la Rica et al., 2005). Conversely, the wage gap is sometimes larger at the bottom of the distribution for low educated workers, a phenomenon which is interpreted as a 'glass floor'.

It seems difficult to find theoretical explanations to the glass ceiling hypothesis. In their seminal work, Albrecht et al. (2003) identify gender differences in rewards as the primary factor explaining the increase of the wage gap observed at the upper part of the distribution. As a consequence, justifications based on tastes such as women preferring to work in less painful but also less paid jobs are insufficient to rationalize the glass ceiling effect. In the Swedish case, it seems that public policies may play a role in understanding the wage gap pattern. Family-oriented policies encourage women to enter the labour market, but the generous benefits of such policies also tend to lessen their career commitment.

Jellal et al. (2007) suggest that employers may face uncertainty on women's level of productivity. Indeed, women are characterised by more discontinuous careers because of births and specialization in domestic tasks. Then, firms would offer them lower wages since they take the risk of facing their poor productivity. Concerning the lower part of the distribution and the glass floor effect, de la Rica et al. (2005) assume that employers use statistical discrimination resulting in lower female wages for low-qualified jobs¹. Nevertheless, as the job tenure of women expands, women become much more reliable to their employers and their wages tend to converge toward those of men.

While there is a consensus on the fact that men outearn women, several difficulties may prevent from drawing an accurate picture of the gender wage gap and its variations across the wage distribution. A first problem stems from the fact that many women do not take part to the labour market or work full-time. Such a sample selection may be a serious issue (Albrecht et al., 2004). Secondly, the type of sector or of firm may play a major role in explaining variations in individual earnings. Women tend to work in low paying sectors and this may have an impact on the gender wage differential (Bronars and Famulari, 1997). Hence, matched employer-employee data would be needed to study the gender wage gap as in Meng (2004) or Meng and Meurs (2004). These different issues, among others, should a priori be properly treated in empirical analyses. For instance, in their study of the gender wage gap in France, Cavaco and Tournadre (2005) take occupational segregation, information on firms and workers' characteristics and selectivity-corrected wage equations into account.

In this paper, we exploit an unusual data set of 4654 male and female workers employed in a French private company of the Defence and Aerospace industry. Because of the very high technicity of the activity, 70% of the employees are executive and have a very similar educational path. Data on monthly wages assessed on a full time basis, along with individual characteristics like age, experience, qualification, and hierarchical position, are available. The data set is hence particularly adequate to assess the magnitude of the gender wage gap along the wage distribution at the firm level, and we rely for that purpose on quantile regressions. Although the gender wage gap is much narrower in France than in the United States, it is still wider at the upper tail of the distribution (Jellal et al., 2007)².

By focusing on individuals who all work in the same firm, this excludes the possibility that differences in male-female wages stem from the sector and environment in which they operate. Our results are twofold. First, we find that the raw gender gap is very similar to the French average gender gap (16.7% versus 17.5% for France on a full time basis, see Ponthieux et al., 2006). Second, with basic controls of age, experience, education and location, we can explain

about 70% of the raw gender gap, and 7.6 percentage points of these gender differences remain unexplained at the mean level. However, within this given firm, we do not observe any increase in the gender wage gap along the wage distribution.

The remainder of this paper is organised as follows. In Section 2, we briefly review the recent empirical literature focusing on the gender gap along the wage distribution. In Section 3, we describe our firm-based sample of 4654 French employees and add some descriptive statistics on the wage gap. In Section 4, we perform quantile regressions along with a Machado-Mata decomposition to assess the relevance of the glass ceiling hypothesis. We also investigate gender differences in occupations. Finally, section 5 concludes.

2/ Literature review

The seminal study on the glass ceiling effect is due to Albrecht et al. (2003), who use Swedish data from 1998 to show that the gender log wage gap accelerates in the upper tail of the wage distribution. While a similar pattern is found at the beginning of the 1990s, no evidence on gender differences across the wage distribution has been found in the prior two decades. Results from quantile regressions show substantial differences between genders for the explanatory variables coefficients at various points of the wage distribution. Furthermore, an Oaxaca-Blinder type decomposition using quantile methods indicates that the wage pattern is mainly due to gender differences in labour market characteristics rewards, more than to gender differences in the characteristics themselves³.

There is also evidence of differences in the gender wage gap throughout the wage distribution in other European countries. In West Germany, Fitzenberg and Wunderlich (2001) provide some stylized facts of the dynamics of the gender wage gap from 1975 to 1995. Interestingly, the gender wage gap has narrowed substantially in the lower part of the wage distribution, while this is not the case in its upper part. In the case of Denmark, the wage gap exhibits an insignificant narrowing at the bottom of the wage distribution, then a small and significant increase at the mean, finally a large and significant rise at the top, over the period 1983-1995 (Datta Gupta et al., 2006). Gardeazabal and Ugidos (2005) find that gender wage differences increase with the quantile index in Spain, the gender wage gap reaching a maximum at the 90th percentile.

De la Rica et al. (2005) also analyse gender wage gaps by education throughout the wage distribution in Spain. Estimates from quantile regressions show a much flatter evolution of the gap in this country than in Sweden, but the gender gap at the mean is very different from the gap at the various percentiles. Furthermore, the gender wage gap profile is strongly affected by

education. On the one hand, the gap is wider at the top than at the bottom for workers with high education (college or tertiary). But on the other hand, the gap appears much narrower at the top than at the bottom of the distribution for low education employees. This glass floor pattern is interpreted as a statistical discrimination exerted by employers.

Arulampalam et al. (2004) propose a more general analysis of the gender pay gap across the wage distribution in Europe. Drawing on a sample of eleven countries, these authors use quantile regression techniques to investigate how gender affects the shape of the conditional wage distribution, respectively for the private and the public sectors. Results from the ECHP data set indicate that gender pay gaps are larger at the top of the wage distribution in four countries (Denmark, Finland, Italy and the Netherlands), a result in favour of the glass ceiling hypothesis. At the same time, gender pay gaps are wider at the bottom of the distribution than at the top in Austria, Belgium, France and Spain.

Whatever their discrepancies, these results deserve attention. First, an international comparison needs several selections to get a homogeneous sample. Early entries or late withdrawals of the labour force have different frequencies in the various European countries. Moreover, Arulampalam et al. (2004) drop individuals who work less than 15 hours or those who are employed in the agricultural sector. Although this issue is not really clear, these different selections may bear an impact on the magnitude of the gender wage gap. Second, the gender pay gap differs significantly across the public and private sector wage distributions, and this finding holds for each of the European countries. In contrast to the public sector, data show that the private sector exhibits very large wage gaps and a glass ceiling is observed in Denmark, France, Italy and the Netherlands.

As these different studies highlight the potential role of firm's characteristics, the wage differential depending on the type of sector for instance, it may be important to take firm characteristics into account in the gender wage gap analysis⁴. Using a French employer-employee matched data set, Jellal et al. (2007) provide quantile estimates of the magnitude of the glass ceiling effect, with controls of the firms' features in the various earnings equations. The results are twofold. On the one hand, there exists a glass ceiling effect in France, with a strong increase in the gender earnings gap above the 75th percentile of the distribution. On the other hand, the magnitude of the gender wage gap is significantly overstated at the top of the distribution when the impact of the firms' qualitative aspects is omitted into the earnings equations.

Some technical problems occur when investigating the existence of a glass ceiling. A first one comes from selection issues, as many women do not necessarily work full time. It is the case in the Netherlands, a country where part-time work is widespread among women. Albrecht et al.

(2004) find a strong glass ceiling effect in this country after taking selectivity bias into account. They produce evidence of a positive selection of women into full-time work. Also, a quantile decomposition procedure indicates that the bulk of the gender wage gap is due to differences in returns to labour market characteristics between men and women rather than to differences in these characteristics. A second difficulty lies in the limitations of distributional approaches for the analysis of wage discrimination. Decomposition based on quantile regressions does not always allow considering the individual discriminatory experience (Del Rio et al., 2005).

However, it should be noted that there is no evidence of the existence of a glass ceiling effect in all countries. In particular, in the United States, Albrecht et al. (2003) find that although the average gender gap is larger than in Sweden, the gender gap at the top of the US wage distribution is much narrower. Datta Gupta et al. (2006) reach a similar conclusion using the PSID longitudinal data set, the highest decile displaying the narrower wage gap. In Switzerland, a look at the distribution of the gender gap does not support the glass-ceiling hypothesis. Bonjour and Gerfin (2001) find that at low wages, an overproportional part of the wage gap may be explained by low education.

To summarize, this review of the literature reveals the existence of a glass ceiling in several countries. However, it varies strongly according to the type of sector, firm and workers characteristics. So, an accurate description of the gender wage gap requires homogeneous data.

3/ Data and descriptive statistics

The data set is drawn from the employees' file of a high technology firm belonging to the Defence and Aerospace sector. This firm is divided up among four geographical sites in France, some located around Paris, others in the provinces.

Among the 4700 persons working in this company, we have excluded the top management (about 50 persons) and concentrate ourselves on the rest of the population. The selected sample comprises 1372 non-executives and 3282 executives. This last group is a very homogenous population of engineers, essentially performing highly technical activities, but including as well managers belonging to various hierarchical levels. They all have high school or university degrees (postgraduate, PhD). Among that subsample of executives, the number of men is much higher than that of women (respectively 2691 and 591)⁵. They are paid on a monthly basis, and their work time is not strictly determined. Their wages are thus fixed. The wages reported in the data are calculated on a full time basis.

In Table 1, we describe the main variables of the whole sample. A first look at the wage distribution indicates that the raw average gender wage gap is equal to 16.7%, which is very

comparable to the national estimate observed by Ponthieux and Meurs (2006)⁶. We note that the wage gap remains rather constant throughout the wage distribution, although it is much smaller at its lower part. Calculations show that the gender wage gap is approximately equal to 10% at the first decile (9.7%), but it amounts to nearly 20% at the first, second and third quartiles of the wage distribution according to Table 1.

Insert Table 1 here

This is illustrated in part A of Figure 1, which plots differences in log wage between men and women at each decile of their respective distributions⁷. Female wages are significantly lower than male wages, and the gap widens from the lower part of the distribution to the third decile and stays still around 20% for higher wages. There is another increase in the gender gap at the very end of the distribution, after the 90th percentile. Executives are characterized by a specific profile. As shown in part B of Figure 1, the wage gap seems to be much lower on average (about 10%) and it widens uniformly along the distribution. It exceeds 15% above the 80th percentile.

Insert Figure 1 here

Let us now turn to the factors that affect the gender wage gap. Clearly, male and female characteristics are significantly different (Table 1). Men are in average one year older than women, and have therefore more professional experience (nearly one year). Since wages increase with age and experience, older male workers are more likely to be better paid than younger females. When turning to the education level, men and women do not face the same qualification pattern. Low levels of education are more feminine (Baccalaureate, undergraduate, graduate), while women are rarely postgraduated. Because wages are tightly related to the education attainment, two levels have been distinguished for postgraduate studies: level I for high engineering or commercial schools along with PhD, and level II for the most reputed high schools. Men are overrepresented in those categories.

A last variable that we use in our analysis is the hierarchical position, which is measured by seven positions. Non-executives (operators, technicians, administrative agents) occupy the lowest stages of the ladder, respectively position 1, 2 and 3. Executives can belong to position 4 to position 7, the last one being the highest. According to the data, women on average hold lower positions than men since 42.4% of them are non-executives, while only 25.8% of men are in this situation. Only 7.6% women are classified in position 6 or 7, against 21.6% of men. This could as well explain the gender gap, but it should be noted that these differences in occupations may also stem from a kind of discrimination against women.

Hence, we do not simultaneously consider gender effects on wage and position in our empirical analysis. In so doing, we follow the suggestion of Albrecht et al. (2003) who claim that

“to ascribe the glass ceiling effect to occupational segregation is in our view simply a relabeling; that is, occupational segregation is the way in which the glass ceiling is manifested”. When turning to the regressions, we first consider wage equations without controls for occupations and then analyse whether women face a higher probability to be in lower-paying occupations.

4/ Econometric results

4.1/ *Quantile regressions estimates*

We now investigate how the relationship between the log wage and individual observable characteristics differ between male and female workers at various quantiles of the wage distribution. For that purpose, we estimate a set of quantile regressions following Koenker and Bassett (1978) and Buchinsky (1998). These quantile regressions allow us to estimate the marginal effect of the selected covariates at various points of the wage distribution.

For the notation, let w_i be the log of the wage of individual i and x_i be a vector of explanatory variables excluding gender. We define g_i as a dummy variable being equal to one when the worker is a woman, and to zero otherwise. Under the assumption of a linear specification, the model that we seek to estimate may be expressed as:

$$q_{\theta}(w_i|x_i, g_i) = x_i' \beta(\theta) + g_i \gamma(\theta) \quad (1)$$

in which $q_{\theta}(w_i|x_i, g_i)$ is the θ^{th} conditional quantile of w_i ⁸. In (1), the set of coefficients provides the estimated returns to the covariates at the θ^{th} quantile of the log wage distribution, and the coefficient $\gamma(\theta)$ measures the intercept shift due to gender differences. As we pool the data to estimate equation (1), the underlying assumption is that the returns to the labour market characteristics are the same at the various quantiles for both men and women. In what follows, we also study whether this assumption is relevant.

According to the descriptive statistics reported in Table 1, the gap between the male and female log wage distribution is likely to be linked to differences in men’s and women’s labour market characteristics (age, experience, qualification, location). In addition to the gender dummy, we introduce into the quantile regressions a quadratic profile for age, a quadratic profile for years of tenure within the firm, six dummies corresponding to the levels of education, and three dummy variables for the workplace location. As we carry out quantile regressions on the pooled male and female data sets, the following interpretation can be given to the gender dummy coefficient $\gamma(\theta)$. It measures the extent to which the gender wage gap remains unexplained at the various quantiles after controlling for age, experience, education and job location.

Without any control variables, the coefficient estimate for the gender dummy is equal to the difference between the male and female wage value at a given point of the distribution, as shown in Figure 1. For the sake of comparison, we begin with an analysis of the average log wage gap. When estimating an OLS model, the coefficient for the female dummy is equal to -0.076 , significant at the 1 percent level (Table 2). This means that once controlling for individual characteristics, women earn on average 7.6% less than men. Estimates from a robust regression (not reported), which allows reducing the impact of outliers through biweight iterations, lead to very similar results, the estimated gender gap being equal to 5.8%.

Insert Table 2 here

In Table 2, we further investigate the gender wage gap throughout the wage distribution. We present the quantile regressions respectively at the 10th, 25th, 50th, 75th and 90th percentiles. Our results are not in favour of the glass ceiling hypothesis for women. Indeed, we find a value comprised between 5 and 6 points of percentage for the gender gap over the whole distribution. At the bottom of the distribution (1st decile), the unexplained gap is equal to 5.8%. Then, it is slightly lower at the 25th and 50th deciles, respectively 4.8% and 5.3%. Finally, the gender wage gap is equal to 5.8% at the 3rd quartile and to 5% at the 9th decile. At the various percentiles, the gender gap is significant at the 1 percent level.

These results are very different from those reported in Albrecht et al. (2003), Arulampalam et al. (2004), de la Rica et al. (2005) and Jellal et al. (2007). All these studies exhibit a sharp acceleration of the gender gap in the upper part of the distribution. Here, we find instead a flat profile. Furthermore, the gender gap is much lower when being measured with our firm-level data than with a heterogeneous population of employees. These findings clearly shed light on the important role of firms' characteristics. As suggested in Jellal et al. (2007), the omission of firm specific factors may be harmful when estimating the magnitude of the wage gap and assessing the relevance of the glass ceiling effect.

Let us briefly describe the influence of the other explanatory variables. When working on the pooled sample, age is characterized by an inverted U-shaped profile, while years of tenure in the firm remain insignificant. The magnitude of the educational levels is large and highly significant. Returns for Baccalaureate, Undergraduate, Graduate, Postgraduate I and II are respectively equal to 20.5%, 38.9%, 72.9%, 77.9% and 87.2%. These rewards increase sharply along the distribution, especially for low levels of education.

For the sake of robustness, we have performed several additional quantile regressions on specific subsamples⁹. As a 9% bonus is added for executives (and 20% for the top executives) with no consideration of the gender, we first exclude bonuses from the definition of wage and

find no clear difference with respect to the initial estimates. Accounting for occupation in the estimation strongly reduces the wage coefficient, whatever the position in the distribution. However, hierarchical level and wages may be jointly negotiated by the firm and the employee, so that his specification is likely to underestimate gender estimates. A breakdown according to the status (executives versus non executives) brings interesting elements. The inclusion of a dummy for executives lowers the gender coefficients of about a quarter. Separate regressions for those two sub-groups show that the gender gap is much lower for executives, around 3.5%. Again, in both groups, gender coefficients remain constant along the wage distribution and no glass ceiling effect is observable. Furthermore, the existence of such a phenomenon would yet imply a greater gender wage gap among executives, a finding which is not borne out by the data.

4.2/ *A quantile decomposition analysis*

When estimating the different models reported in Table 2, we have assumed that the returns of the different exogenous factors were the same for both men and women. To assess the relevance of this assumption, we have estimated quantile regression models (not reported) in which the covariates are interacted with the gender dummy. These crossed terms indicate whether age, years of tenure, education and location are more or less important for men and for women. With respect to the model with no interaction terms, we find that the null hypothesis of crossed effects is always rejected at the 1 percent level¹⁰.

As we find unequal returns to the observable characteristics, we now turn to a decomposition of the gender gap. The underlying idea is to decompose the difference between the male and female wage distribution into two components. The first one is due to differences in labour market characteristics between men and women, while the second is related to differences in rewards to these individual characteristics. Drawing on Oaxaca and Ramson (1994), we first perform the decomposition at the mean of the sample. We also implement the decomposition at each quantile of the wage distribution following the method recently proposed by Machado and Mata (2005).

For the presentation, we denote by β^m and β^f respectively the male and female estimates associated to the individual characteristics x^m or x^f . Our aim is to estimate a counterfactual density indicating the wages that women endowed with their own characteristics x^f would received if they were paid according to male returns β^m . Without discrimination, wages should be equal for men and for these fictitious women. Formally, the decomposition of the difference between male and female wages can be expressed as:

$$x^m \beta^m(\theta) - x^f \beta^f(\theta) = (x^m - x^f) \beta^m(\theta) + x^f (\beta^m(\theta) - \beta^f(\theta)) \quad (2)$$

The first term on the right hand side measures the part of the gender gap due to differences in labour market characteristics, while the second term measures the part of the gender gap stemming from variations in the rewards to these individual characteristics. We perform the decomposition first at the mean of the sample using OLS regressions, i.e. a standard Oaxaca-Blinder decomposition, and then at the 10th, 25th, 50th, 75th and 90th percentiles of the distribution following Machado and Mata (2005).

The three following steps have to be fulfilled to construct the counterfactual density. First, we draw a sample of 200 numbers from a standard uniform distribution, which we denote by θ_j ($j = 1, \dots, 200$). Then, using these different numbers θ_j , we estimate quantile regressions on the male sample and obtain a set of coefficient vectors $\beta^m(\theta_j)$. Finally, for each value of j , we take a draw with replacement from the female data set and generate the predicted wage $x^f \beta^m(\theta_j)$. We then have $x^m \beta^m(\theta)$, $x^f \beta^f(\theta)$, and $x^f \beta^m(\theta)$ from which we deduce the overall gap $x^m \beta^m(\theta) - x^f \beta^f(\theta)$, the gap due to differences in characteristics $(x^m - x^f) \beta^m(\theta)$ and the gap due to differences in returns to these covariates $x^f (\beta^m(\theta) - \beta^f(\theta))$. In order to get standard errors for the decomposition, we have replicated the whole procedure 50 times.

Results from decompositions, respectively on the whole sample and on the subsample of executives, are displayed in Table 3. At the mean of the sample, the estimated gender gap is equal to 18.4%. The gap due to differences in observed characteristics is equal to 10.5%, the part due to discrimination being equal to 7.9%. Several comments are in order when considering the wage distribution. First, the gender gap is slightly increasing as one moves up along the wage distribution. For instance, it is equal to 17% at the 1st decile, 19% at the median and 20% at the top of the distribution. Second, this gap mainly stems from differences in characteristics in the lower part of the distribution. In the upper part, the component due to differences in returns (which may be seen as a measure of discrimination) is relatively more important.

Insert Table 3 here

As we do not control for occupations in the results described above, we then turn to the subsample of executives, which is a much more homogeneous population. At the mean of the sample, we find a much lower value for the gender gap since it is equal to 11.1% instead of 18.4%. Interestingly, the gender gap is mainly due to differences in observable covariates, this component being equal to 8.1%. The rest of the gap (i.e. 3%) is unexplained, and might be due to discrimination. Among executives, we find that the gender gap is rather increasing along the wage distribution, but again very moderately. It is rather flat till the median, equal to 10%, and is about 3 points of percentage higher at the 75th and 90th percentiles. Furthermore, the component

associated to discrimination remains almost constant across the distribution. This means that the gender wage gap is essentially due to the fact that women and men among the executive population are endowed with different characteristics.

4.3/ Hierarchical gender division

As argued in Albrecht et al. (2003), the gender gap is likely to be due to the fact that men and women have different jobs, so that hierarchical position division would be the way in which the glass ceiling appears. So far, we did not take information related to position into account in our quantile regressions, as position was likely to be determined simultaneously with wages. As the data include the type of position for each executive, we further investigate how gender affects the position pattern.

According to the data, there exist seven main hierarchical levels within the firm: operators (level 1, 4.2%), technicians (level 2, 11.7%), administrative agents (level 3, 13.5%), low executives (level 4, 19.8%), medium executives (level 5, 32.3%), high executives (level 6, 12.9%) and top executives (level 7, 5.5%). As discussed in Section 3, there exist differences between men and women concerning these positions, men being overrepresented in the highest positions. In order to know whether being a woman reduces the probability from achieving high levels, we estimate the following econometric model:

$$\begin{cases} y_i^* = x_i \delta + g_i \xi + \varepsilon_i \\ y_i = n \quad \text{if} \quad \mu_n < y_i^* \leq \mu_{n+1} \end{cases} \quad (3)$$

in which $n \in \{1;2;3;4;5;6;7\}$, the different μ_n are threshold levels to be estimated with $\mu_1 = -\infty$, $\mu_2 = 0$ and $\mu_8 = +\infty$, y_i^* is the latent variable associated to the position within the firm, and ε_i is a normally distributed residual. We have $n = 1$ for levels 1, $n = 2$ for level 2, etc. The regression is an ordered Probit model, whose estimates are reported in Table 4.

Insert Table 4 here

The main result of interest for our study concerns the effect of the female dummy. We find that being a woman reduces the probability of reaching a higher position, and this effect is significant at the 1 percent level. At the mean of the sample characteristics, the estimated probability of being executive is equal to 74% for men, but only 56% for women. The gap is large (18 points of percentage) and highly significant. We hence observe that women are in lower-paying positions, which in turn explains why on average they are paid less than men. Similar findings hold when turning to the subsample of executives. The coefficient associated to the gender dummy is again negative and significant, meaning that women are less likely to reach high and top positions among executives. Other results are fully in line with expectations. The

probability of reaching a top position is higher when individuals are older and have more seniority. It is an increasing function of the educational level, especially with postgraduate studies.

5/ Concluding comments

The purpose of this paper was twofold. First, it was to analyse the gender wage gap within a unique firm, in order to suppress a source of discrepancy in wages due the fact that men and women do not work in the same sectors. Second, we wanted to study the evolution of the gender gap along the wage distribution, in the line of several studies using European data, which have found significant differences in the gender gap at different percentiles. Specifically, we assess the relevance of the glass ceiling effect using data on a unique French firm. In so doing, we perfectly control unobserved firm specific factors which are likely to affect the magnitude of the gender wage gap along the wage distribution. When men and women have very similar jobs with a same employer, they are expected to receive almost the same wage, as found in Sweden (see Meyersson et al., 2003).

On average, the wage gender gap is around 17.5% in France when work time is controlled for (Ponthieux and Meurs, 2006). According to our data, the gender wage within the firm is very similar to this overall proportion, without any individual characteristic control. With the mere control of age, experience, qualification and location, the gap measured through OLS falls to 7.6%. We do not find evidence in favour of a glass ceiling effect with our data. The gender gap is almost constant throughout the wage distribution and equal to 5%. Results from a quantile decomposition indicate that the gender gap is mainly due to differences in characteristics in the lower part of the distribution, while there is perhaps more discrimination in the upper part.

A break up of the data between non executives and executives shows that the gender gap is much wider for the former than for the later. Among the homogenous group of executives, differences in pay between men and women are essentially explained by the fact that both groups have different observable characteristics, discrimination playing a very minor role. More broadly, we evidence large gender differences in hierarchical positions within the firm. Occupations may themselves be the result of some kind of discrimination from the employer, and we find that women are less likely to reach top positions. This result holds not only for the whole sample, but also for the subsample of executives.

As it stands, it is important to note that our analysis remains merely descriptive, as the various regressions do not really shed light on the phenomenon which can explain the gender wage gap. On the one hand, it could be the result of a discrimination strategy operated by the firm. On the other, differences in pay may be the result of individual preferences and personal

choices. Imagine that women prefer not being highly involved within the firm, for instance because they want to spend enough time with their children. In that case, they would not try to improve their hierarchical position and would instead refuse promotions at top positions. Such a setting would lead to gender differences in pay, albeit undesired by the firm, but rather stemming from individual workers decisions.

If such reasoning is exact, some hiring selection problems might occur. When new executives are recruited and if the employer knows that women will refuse in the future to take part in more time-consuming management roles, then he will favour men when searching for such competences. Technical abilities could on the contrary be more often sought after when hiring women. The observed gender pay gap would then follow from gender specific hiring profiles, and not from any discriminatory policy. Unfortunately, the data at hand do not allow us performing more structural, causal work.

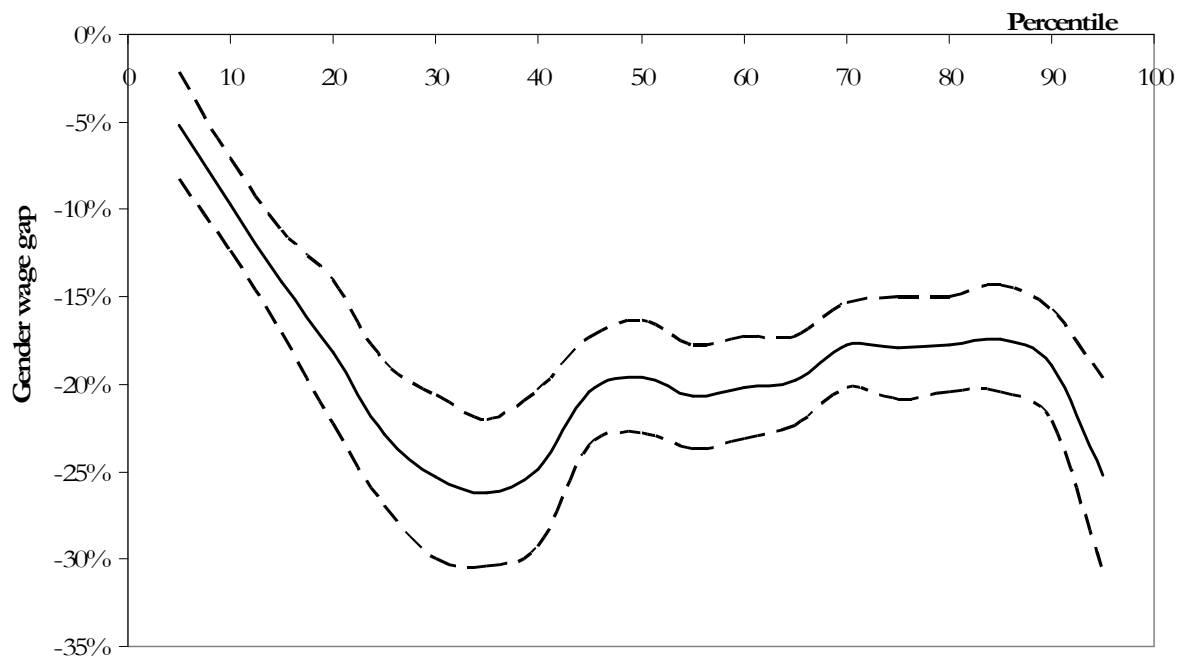
Understanding the causes of the glass ceiling phenomenon still remains an open question. Despite of the quality of the data, another shortcoming is that part of the observed gender wage gap may be due to poor information on individual characteristics. For instance, we do not know previous working experience outside the firm and there is no information on breakdown within current employment owing to maternity. These additional factors are likely to reduce the unobserved part of the wage gap, but this would of course require additional data. Whatsoever, we have shown that a firm level analysis leads to a much lower gender wage gap, even when differences along the wage distribution are investigated.

References

- Albrecht, J., Björklund, A. and Vroman, S. (2003), "Is there a glass ceiling in Sweden?", *Journal of Labor Economics*, vol. 21, pp. 145-177.
- Albrecht, J., van Vuuren, A. and Vroman, S. (2004), "Decomposing the gender wage gap in the Netherlands with sample selection adjustments", *IZA Discussion Paper*, n° 1400.
- Arulampalam, W., Booth, A.L. and Bryan, M.L. (2004), "Is there a glass ceiling over Europe? Exploring the gender pay gap across the wages distribution", *IZA Discussion Paper*, n° 1373.
- Blau, F.D. and Kahn, L.M. (1996), "Wage structure and gender earnings differentials: An international comparison", *Economica*, vol. 63, pp. S29-S62.
- Blau, F.D. and Kahn, L.M. (2000), "Gender differences in pay", *Journal of Economic Perspectives*, vol. 15, pp. 75-99.
- Blau, F.D. and Kahn, L.M. (2003), "Understanding international differences in the gender pay gap", *Journal of Labor Economics*, vol. 21, pp. 106-144.
- Bonjour, D. and Gerfin, M. (2001), "The unequal distribution of unequal pay. An empirical analysis of the gender wage gap in Switzerland", *Empirical Economics*, vol. 26, pp. 407-427.
- Bronars, S. and Famulari, M. (1997), "Wage, tenure and wage growth variation within and across establishments", *Journal of Labor Economics*, vol. 15, pp. 285-317.
- Buchinsky, M. (1998), "Recent advances in quantile regression models: A practical guideline for empirical research", *Journal of Human Resources*, vol. 33, pp. 88-126.
- Cavaco, S. and Tournadre, F. (2005), "Pay equity illusion: Discrimination against women in France", *Mimeographed*, Aarhus School of Business.
- Datta Gupta, N., Oaxaca, R.L. and Smith, N. (2006), "Swimming upstream, floating downstream: Comparing women's relative wage positions in the US and Denmark", *Industrial and Labor Relations Review*, vol. 59, pp. 243-266.
- De la Rica, S., Dolado, J.J. and Llorens, S. (2005), "Ceiling and floors: Gender wage gaps by education in Spain", *IZA Discussion Paper*, n° 1483.
- Del Rio, C., Gradin, C. and Canto, O. (2005), "The measurement of gender wage discrimination: The distributional approach revisited", *Mimeographed*, Universidad de Vigo.
- Fitzenberger, B. and Wunderlich, G. (2002), "Gender wage differences in West Germany: A cohort analysis", *German Economic Review*, vol. 3, pp. 379-414.
- Gardeazabal, J. and Ugidos, A. (2005), "Gender wage discrimination at quantiles", *Journal of Population Economics*, vol. 18, pp. 165-179.
- Jellal, M., Nordman, C. and Wolff, F.C. (2007), "Evidence on the glass ceiling effect using matched worker-firm data", *Applied Economics*, forthcoming.
- Koenker, R. and Bassett, G. (1978), "Regression quantiles", *Econometrica*, vol. 46, pp. 33-50.
- Machado, J. and Mata, J. (2005), "Counterfactual decomposition of changes in wage distribution using quantile regression", *Journal of Applied Econometrics*, vol. 20, pp. 445-465.
- Meng, X. (2004), "Gender earnings gap: The role of firm specific effects", *Labour Economics*, vol. 11, pp. 555-573.
- Meng, X. and Meurs, D. (2004), "The gender earnings gap: Effects of institutions and firms. A comparative study of French and Australian private firms", *Oxford Economic Papers*, vol. 56, pp. 189-208.
- Meyersson, E.M. and Petersen, T. (2005), "Is there a glass ceiling for women in Sweden? Life cycle and/or cohort effects 1970-1990", in Blau, F., Brinton, M. and Grusky, D. (eds.), *The Declining Significance of Gender?*, Russel Sage.
- Meyersson, E.M., Petersen, T. and Snartland, V. (2003), "The within-job gender wage gap, Sweden 1970-1990", in Buskens, V., Raub, W. and Snijders C. (eds.), *Research in the Sociology of Organizations. The Governance of Relations in Market and Organizations*.
- Oaxaca, R.L. and Ramson, M.R. (1994), "Identification and the decomposition of wage differentials", *Journal of Econometrics*, vol. 61, pp. 5-21.
- Ponthieux, S. and Meurs, D. (2006), "L'écart des salaires entre les femmes et les hommes peut-il encore baisser?", *Economie et Statistique*, n° 398-399, pp. 99-129.

Figure 1. The gender log wage gap across the distribution

A. All (N=4654)



B. Executives (N=3282)

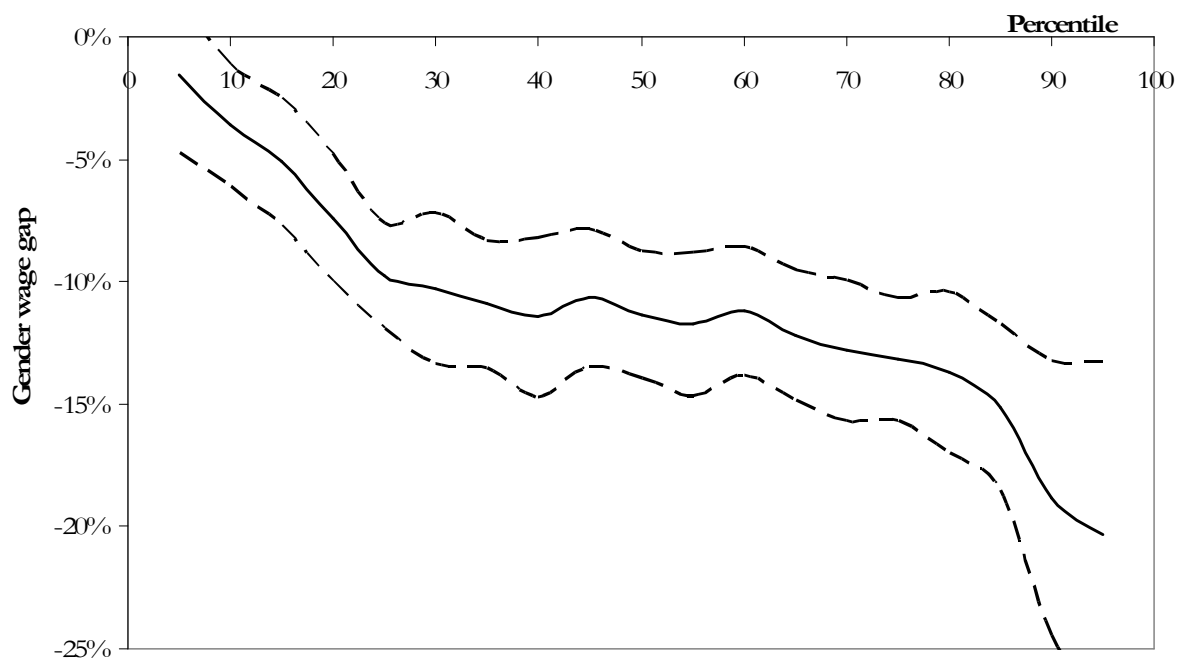


Table 1. Descriptive statistics of the sample

| Variables | | Male | Female | All |
|------------------------|-----------------------|--------|--------|--------|
| Wage (log) | Mean | 8.183 | 8.016 | 8.146 |
| | Decile 1 | 7.743 | 7.646 | 7.702 |
| | Quartile 1 | 7.944 | 7.758 | 7.898 |
| | Quartile 2 | 8.207 | 8.019 | 8.161 |
| | Quartile 3 | 8.417 | 8.237 | 8.383 |
| | Decile 9 | 8.588 | 8.400 | 8.560 |
| Hierarchical position | Operators | 0.028 | 0.093 | 0.042 |
| | Technicians | 0.101 | 0.174 | 0.117 |
| | Administrative agents | 0.129 | 0.157 | 0.135 |
| | Executives – low | 0.187 | 0.236 | 0.198 |
| | Executives – medium | 0.339 | 0.264 | 0.323 |
| | Executives – high | 0.149 | 0.061 | 0.129 |
| | Executives – top | 0.067 | 0.015 | 0.055 |
| Age | | 43.818 | 42.759 | 43.585 |
| Years of tenure | | 16.521 | 15.793 | 16.360 |
| Diploma: | Less than Bac. | 0.166 | 0.196 | 0.173 |
| | Baccalaureate | 0.049 | 0.107 | 0.062 |
| | Undergraduate | 0.157 | 0.205 | 0.168 |
| | Graduate | 0.244 | 0.270 | 0.249 |
| | Postgraduate I | 0.241 | 0.173 | 0.226 |
| | Postgraduate II | 0.143 | 0.049 | 0.122 |
| Location: | Plant 1 | 0.209 | 0.173 | 0.201 |
| | Plant 2 | 0.333 | 0.318 | 0.330 |
| | Plant 3 | 0.383 | 0.422 | 0.391 |
| | Plant 4 | 0.076 | 0.087 | 0.078 |
| Number of observations | | 3628 | 1026 | 4654 |

Table 2. Quantile and OLS estimates of the log wage

| Variables | Percentile | | | | | OLS |
|--|----------------------|----------------------|----------------------|---------------------|---------------------|----------------------|
| | 10 | 25 | 50 | 75 | 90 | |
| Constant | 6.271*** (102.16) | 6.258*** (129.87) | 6.117*** (114.13) | 6.291*** (87.52) | 6.233*** (43.03) | 6.101*** (90.25) |
| Female | -0.058*** (9.34) | -0.048*** (10.33) | -0.053*** (10.69) | -0.058*** (8.99) | -0.050*** (4.06) | -0.076*** (12.17) |
| Age | 0.043*** (14.09) | 0.045*** (18.65) | 0.051*** (19.09) | 0.043*** (12.11) | 0.048*** (6.84) | 0.053*** (15.58) |
| Age ² (/100) | -0.031*** (8.41) | -0.031*** (10.95) | -0.035*** (11.15) | -0.021*** (4.98) | -0.020** (2.44) | -0.034*** (8.69) |
| Years of tenure | -0.000 (0.33) | 0.001 (0.92) | -0.000 (0.32) | 0.001 (0.63) | -0.005* (1.82) | -0.002* (1.92) |
| Years of tenure ² (/100) | -0.002 (0.50) | -0.003 (1.15) | 0.002 (0.57) | -0.009** (2.30) | 0.004 (0.52) | 0.002 (0.70) |
| Diploma: | | | | | | |
| Baccalaureate (ref: Less than Bac.) | 0.080*** (6.75) | 0.091*** (9.86) | 0.141*** (14.46) | 0.287*** (22.36) | 0.349*** (14.24) | 0.205*** (16.71) |
| Undergraduate | 0.229*** (24.71) | 0.267*** (37.80) | 0.393*** (53.22) | 0.499*** (51.18) | 0.500*** (26.98) | 0.389*** (41.78) |
| Graduate | 0.698*** (74.46) | 0.720*** (104.59) | 0.760*** (105.24) | 0.737*** (76.49) | 0.720*** (38.38) | 0.729*** (80.11) |
| Postgraduate I | 0.759*** (83.46) | 0.765*** (111.44) | 0.797*** (109.28) | 0.779*** (79.21) | 0.752*** (38.77) | 0.779*** (84.79) |
| Postgraduate II | 0.831*** (81.29) | 0.837*** (107.46) | 0.870*** (104.05) | 0.867*** (76.82) | 0.885*** (39.37) | 0.872*** (82.78) |
| Location: | | | | | | |
| Plant 1 (ref: Plant 4) | 0.041*** (3.88) | 0.016** (2.03) | 0.012 (1.40) | 0.004 (0.35) | 0.006 (0.28) | 0.013 (1.25) |
| Plant 2 | 0.052*** (5.21) | 0.046*** (5.97) | 0.038*** (4.71) | 0.045*** (4.30) | 0.066*** (3.32) | 0.058*** (5.74) |
| Plant 3 | -0.018* (1.75) | -0.031*** (4.03) | -0.048*** (5.95) | -0.052*** (5.03) | -0.058*** (2.92) | -0.045*** (4.45) |
| Observations | 4654 | 4654 | 4654 | 4654 | 4654 | 4654 |
| Pseudo R ² | 0.608 | 0.626 | 0.581 | 0.516 | 0.464 | 0.772 |

Absolute values of t statistics are in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*).

Table 3. Quantile decomposition of the gender wage gap

| Percentile | Difference in characteristics | | Difference in returns | | Total difference | |
|------------|-------------------------------|-------------------|-----------------------|-------------------|-------------------|-------------------|
| | All | Executives | All | Executives | All | Executives |
| 10 | -0.112 (0.004) | -0.064 (0.003) | -0.058 (0.004) | -0.032 (0.004) | -0.170 (0.002) | -0.096 (0.002) |
| 25 | -0.112 (0.003) | -0.069 (0.002) | -0.057 (0.003) | -0.024 (0.002) | -0.169 (0.001) | -0.093 (0.001) |
| 50 | -0.106 (0.004) | -0.075 (0.003) | -0.086 (0.007) | -0.029 (0.003) | -0.191 (0.004) | -0.104 (0.002) |
| 75 | -0.095 (0.004) | -0.089 (0.004) | -0.094 (0.005) | -0.040 (0.003) | -0.189 (0.003) | -0.129 (0.004) |
| 90 | -0.099 (0.004) | -0.102 (0.005) | -0.102 (0.006) | -0.030 (0.009) | -0.202 (0.005) | -0.133 (0.008) |
| Mean | -0.105 (0.010) | 0.081 (0.006) | -0.079 (0.007) | 0.030 (0.009) | -0.184 (0.011) | 0.111 (0.010) |

Standard errors with 50 replications of the decomposition are in parentheses.

Table 4. Ordered Probit estimates of position within the firm

| Variables | All (7 positions) | Executives (4 positions) |
|--|----------------------|-----------------------------|
| Female | -0.506*** (12.70) | -0.312*** (5.31) |
| Age | 0.243*** (11.17) | 0.670*** (17.82) |
| Age ² (/100) | -0.181*** (7.17) | -0.627*** (14.96) |
| Years of tenure | 0.020** (2.47) | 0.021* (1.80) |
| Years of tenure ² (/100) | -0.037* (1.68) | -0.026 (0.80) |
| Diploma: | | |
| Baccalaureate (ref: Less than Bac.) | 1.270*** (16.09) | 0.834*** (3.82) |
| Undergraduate | 2.468*** (36.75) | 0.893*** (4.71) |
| Graduate | 4.251*** (53.77) | 1.890*** (10.05) |
| Postgraduate I | 4.497*** (55.46) | 2.206*** (11.67) |
| Postgraduate II | 4.906*** (54.69) | 2.712*** (14.01) |
| Location: | | |
| Plant 1 (ref: Plant 4) | 0.190*** (2.80) | 0.354*** (3.55) |
| Plant 2 | 0.410*** (6.40) | 0.463*** (5.07) |
| Plant 3 | 0.012 (0.19) | 0.142 (1.58) |
| Observations | 4654 | 3282 |
| Pseudo R ² | 0.351 | 0.324 |
| Log likelihood | -5332.6 | -2718.6 |

Absolute values of t statistics are in parentheses. Significance levels are respectively 1% (***) , 5% (**) and 10% (*).

¹ Statistical discrimination is a difference of treatment of men and women which arises from the average differences between the two groups in the expected value of productivity, which lead employers to discriminate on the basis of that average.

² The female-male ratio of median earnings of full-time workers is approximately equal to 0.9 and the gender gap is evaluated at 12% when hourly wage rate is considered. For further detail, see Cavaco and Tournadre (2005).

³ For further evidence on the Swedish case, see Meyersson and Petersen (2005).

⁴ Even among the numerous empirical studies which have focused on the average log wage gap between men and women, firm specific effects are most often neglected. Meng (2004), Meng and Meurs (2004), and Cavaco and Tournadre (2005) are interesting exceptions.

⁵ The proportion of women is equal to 22.1% in the whole sample, while it only amounts to 18% among executives.

⁶ The gender wage gap is about 16% when work time is being controlled.

⁷ We also add to this figure confidence intervals measured at the 95 percent level.

⁸ In a quantile regression, the distribution of the error term is left unspecified (Koenker and Bassett, 1978).

⁹ These regressions are not reported here, but an appendix with the detailed results is available upon request.

¹⁰ The different values for the corresponding Wald test are respectively equal to 7.77 at the 10th percentile, 8.86 at the 25th percentile, 17.26 at the 50th percentile, 20.49 at the 75th percentile, and 11.88 at the 90th percentile (with 12 degrees of freedom).

Appendix, not for publication

Table A. Quantile estimates of the log wage – additional results

| Gender coefficient | Percentile | | | | | OLS |
|---|----------------------|----------------------|----------------------|---------------------|---------------------|----------------------|
| | 10 | 25 | 50 | 75 | 90 | |
| (1) Wages without bonus (N=4654) | -0.058*** (9.34) | -0.048*** (10.34) | -0.050*** (9.60) | -0.055*** (7.72) | -0.048*** (4.38) | -0.069*** (12.53) |
| (2) With a dummy for executives (N=4654) | -0.042*** (7.47) | -0.040*** (7.94) | -0.041*** (8.39) | -0.050*** (8.41) | -0.036*** (2.95) | -0.046*** (9.66) |
| (3) With controls for occupations (N=4654) | -0.010** (2.19) | -0.011** (2.55) | -0.012*** (4.18) | -0.011*** (3.09) | -0.010** (1.96) | -0.011*** (3.88) |
| (4) By status: Non-executives (N=1372) | -0.043*** (3.95) | -0.050*** (6.17) | -0.047*** (7.01) | -0.049*** (5.90) | -0.036*** (3.30) | -0.048*** (7.75) |
| Executives (N=3282) | -0.034*** (4.86) | -0.027*** (4.02) | -0.024*** (4.37) | -0.030*** (3.72) | -0.024** (2.15) | -0.034*** (5.27) |
| (5) By location: Plant 1 (N=935) | -0.042*** (3.03) | -0.032*** (2.61) | -0.057*** (5.40) | -0.048*** (2.67) | -0.039* (1.76) | -0.059*** (4.13) |
| Plant 2 (N=1534) | -0.048*** (4.42) | -0.045*** (5.74) | -0.044*** (4.84) | -0.055*** (5.68) | -0.040 (1.37) | -0.052*** (4.48) |
| Plant 3 (N=1821) | -0.100*** (10.06) | -0.066*** (8.39) | -0.0a54*** (8.04) | -0.049*** (4.88) | -0.064*** (3.87) | -0.100*** (10.82) |
| Plant 4 (N=364) | 0.005 (0.20) | -0.050*** (2.68) | -0.049*** (2.81) | -0.055** (2.00) | -0.109 (1.40) | -0.073*** (3.06) |

Absolute values of t statistics in parentheses. Significance levels are respectively 1% (***), 5% (**) and 10% (*).