Gender Differences in Sorting*

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Abstract

In this paper we investigate gender differences in workers' career developments within and outside the firm in order to explain the existence of gender wage gaps. Using Danish employer-employee matched data, we find that good female workers are more likely to move to better firms than men, while they are less likely to be promoted. Furthermore, these differences in career advancements widen after the first child is born. Our findings suggest that career impediments in some firms cause the most productive female workers to seek better jobs in firms where there are less gender biases.

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1 Introduction

Recent studies take advantage of the availability of matched employees-employer data to report that wage gaps between male and female workers arise as a result of segregation in lower-paying occupations, in less productive establishments and in lower-paying occupations within establishments (Bayard, Hellerstein, Neumark and Troske, 2003; Hellerstein and Neumark, 2008). Card, Cardoso and Kline (forthcoming) find that, while women negotiate lower wages than man with the same employer, they are also less likely to work in firms that pay higher premiums to either gender.

These studies show that wage gaps in the labor market are related to gender differences in the extent to which better workers are employed in better positions, i.e., in the degree of positive assortative matching Becker (1973).

However, when we look at sorting differences across genders for Denmark, surprising patterns emerge. Female workers of good types (proxied by the residual predicted from a Mincerian log-wage regression) are more likely to move to a better firm than similarly ranked male workers conditionally on changing employer. This is quite puzzling given that in Danish labor market there is a significant gender wage gap and the representation of women among legislators, senior officials and managers is particularly low as Denmark is ranked 81 out of 145 countries (2015 Global Gender Gap Report).

We then turn our attention to transitions within the firm to see if there are gender biases in promotions. There, quite a different pattern emerges: male workers of good types are more likely to be promoted than similarly ranked female workers conditionally on not changing employer.

The objective of this paper is to explain this apparently conflicting evidence by taking into account the fact that workers move up the job ladder in two ways: either they are promoted by the current employer, or they find a better employer. Studying career developments within and outside the firm as a unified sorting problem allows us to relate the patterns we observe. Our findings suggest that career impediments in certain firms cause the most productive female workers to seek better jobs in firms with fewer gender biases. In our interpretation, segregation and gender gaps emerge because only the best female workers can pursue career advancements via job-to-job transitions and because significant career advancements occur more slowly for women in all firms.

To detect sorting patterns is not a straightforward task, especially when agents' types are not observable (Filippin and Ours, 2015). To cope with this we apply and extend the methodology proposed by Bartolucci and Devicienti (2013) to study both internal and external promotion patterns across gender. In particular, (i) we exploit within-firm variations in wages to rank workers within firms and conditional on observables. Intuitively, while a worker's type is not observable to the econometrician, it is observable to the firm, that should then pay her/him accordingly. Furthermore, (ii) we use profits to rank firms, since all firms have as an objective to maximize profits. We show in a stylized theoretical framework that this estimation strategy allows us to analyze gender differences in sorting both within and across firms when workers care about wages.

We then use these rankings to predict separately by gender: *(a)* the probability that a worker moves to a better firm, i.e. a firm yielding higher profits, conditional on switching firm (being a *mover*); and, *(b)* the probability to get promoted to a better occupational level conditional on staying employed in a given firm (being a *stayer*).

In our analysis we use Danish employer-employee matched data for two important reasons. First, a representative and large sample of both workers and firms allows us to

trace career developments of workers. Second, Denmark has a very flexible labor market, similar to the one of the U.S.[1] Hence, our analysis is relevant beyond the case of Denmark.

In line with the predictions of our theoretical framework, when we plot the probability of a job transition against a worker's type, we find a U-shaped relationship that is steeper for transitions to a better firm: while bad workers are likely to be replaced, best workers are likely to switch to better firms (Figure 1).

The findings of Figures 2 and 3 that positive sorting is stronger in job-to-job transitions while it is weaker in promotions for female workers with respect to their male counterparts are confirmed by our regression models in which we add several controls. Specifically, a standard deviation increase in the log of lagged wages raises the probability to move to a better firm by 2 percent for female workers and about half as much for male workers, while it raises the probability of promotion by 19 percent for female workers and 31 percent for male workers. These gender differences are sizable, significant and they are stable, as they arise in a number of different specifications and tests.[2]

Note however that if all firms had the same attitude towards female workers, we would observe the same sorting patterns in transitions both within and across firms. So, our findings strongly indicate that female workers face more career impediments in certain firms and that they attempt to overcome these barriers by searching for better jobs in fairer companies. This interpretation is further corroborated by the fact that negligible gender differences arise when we look at promotions to better occupational levels in the firms to which good female workers tend to move. Such firms are also highly profitable, which suggests that the best firms are those with non-discriminatory policies.[3]

Interestingly, we find that gender differences in job-to-job transitions disappear when transitions are not voluntary (e.g., when they are driven by a firm's closure). This confirms our interpretation of the main patterns which are documented by mainly looking at voluntary transitions, i.e. that female and male workers pursue different routes in order to achieve career advancements.

Another interesting result is that gender differences in promotions appear to emerge especially after workers become parents, a fact that is not related to firms' observable characteristics such as sector or size.

Our analysis is relates to the work by Card et al. (forthcoming). The authors decompose firm-specific pay differentials into a combination of sorting and bargaining effects using the methodology proposed by Abowd, Kramarz and Margolis (1999), that we will discuss more in Section 2. We view our paper as complementary to theirs: the interplay of career paths within and outside firms studied here can be interpreted as corroborative evidence in favor to the gender differences in bargaining power documented by Card et al. (forthcoming).

Groes, Kircher and Manovskii (2015) show that both low and high wage earners within an occupation are more likely to leave their occupation, and that the high earners tend to switch to new occupations with higher average wages. Interestingly, we find similar patterns when we look at workers switching firms. In addition, we focus on how the

[1] Groes (2010) documents that the relationship between occupational tenure and wages and the hazard rates of leaving an occupation in Denmark are similar to those estimated for the U.S.

[2] Most importantly, since wages might be noisy measures of workers' quality, let us stress that the same patterns emerge when we rank workers using other methodologies that do not depend on wages. We present these methodologies in Section 2.

[3] Less profitable discriminatory firms may survive competition from non-discriminatory firms for several reasons. First, social enforcement may result in less lost profit in discriminatory firms. Second, there may be clients with discriminatory tastes. Third, search frictions may facilitate social enforcement.

strength of this phenomenon differs across genders.

Our insights on promotions are also consistent with Booth, Francesconi and Frank (2003). They find that men and women are equally likely to be promoted but women receive lower wage increases. This is the *sticky floor* phenomenon. Yet, Booth et al. (2003) do not look at transitions across employers. Hence, our study represents a significant advancement with respect to theirs.

Furthermore our finding that career impediments for women emerge after motherhood is in line with the evidence presented by Smith, Smith and Verner (2013) for CEO's, and with the one of Kleven, Landais and Søgaard (2015), who show that motherhood is a career impediment in certain firms but not in others. In particular Kleven et al. (2015) find that most of the gender wage gap can be explained by a penalty that is related to having children that affects women but not men within the household. In our study we focus on the link between gender biases in promotions in some firms and job-to-job transitions. Hence, we restrict our attention to sorting patterns of full-time workers and we therefore model only one of the dynamic effects of having children on career developments.

The structure of the article is as follows. Section 2 describes the econometric routes that we follow to measure gender-based differences in sorting. Section 2.2 briefly describes the data and the institutional background. Section 3 includes the main results. Section 4 reports robustness checks and additional results. Section 5 offers concluding remarks.

2 The Estimation Strategy

There are different approaches to detect sorting patterns. Abowd et al. (1999), henceforth AKM, use the correlation between workers' and firms' fixed effects derived from wage equations. Identification of the individual fixed effects relies upon the assumption that workers' movements between firms are conditionally random. In other words, after conditioning upon the observable worker and firm effects, when a worker moves to a new firm she draws at random from the existing firms in the economy. Theoretically the assumption has been challenged because of on-the-job search (Eeckhout and Kircher, 2011). Intuitively, when workers voluntarily move to another firm, their compensation should improve.

Bartolucci and Devicienti (2013) address this issue by developing a methodology that exploits within-firm variations in wages to rank worker types (within firms) and profits to rank firms. All firms share the objective to maximize profits, so it is natural to consider profits as a measure of firm "quality". Workers instead might care about many job characteristics beyond wages. Hence, wages might be a noisy measure of workers' quality.

While Card, Heining and Kline (2013) and Card et al. (forthcoming) proposed tests to check the conditional exogenous mobility assumption of the original AKM method, Bartolucci, Devicienti and Monzón (2015) designed a method that does not rely on wages: they measure the variance of firm ranking (proxied by the arrival firm's profits per worker) that can be explained by the movers' types (proxied by the sending firm's profits per worker). The smaller the variance of firm's types for a given worker type relative to the unconditional variance of firm types, the more intensively workers sort into firms. Yet, this method cannot be used to assess sorting in promotions.

In this paper, we use the methodology of Bartolucci and Devicienti (2013) to rank

workers' and firms because it allows us to analyze gender differences in sorting both within and across firms under the assumption that workers care mostly about wages. In Section 4, we show that our results do not depend on this assumption and we provide more details on how we implement these methodologies in our setup.

Our baseline empirical strategy is rooted in a simple theoretical framework with learning, job search and a production technology in which skills and capital are complements, i.e., that induces positive assortative matching. While the model is formally presented in the Appendix, we now present the main mechanisms it embeds.

In the model, there is a unit mass of workers and firms, whose type is indexed respectively by e and f. The productivity of the match is increasing in both the type of the worker and of the firm, and we consider a super-modular production function that induces positive assortative matching (Becker, 1973).

At first, workers are randomly matched to firms. This assumption captures the idea that workers have little information regarding the type of the employers at the beginning of their careers. As they acquire experience, workers might learn the characteristics of all firms in the market, but also they might become more productive.

We introduce learning by doing in the following way: during period 0, workers acquire relevant experience that improves their skills as long as $e \geq f$. In other words, there are skill requirements: only agents that are sufficiently qualified understand the technology enough to improve their productivity. As a result, in the second period some workers are more productive, i.e., they increase their type. Hence, a worker e in a match in period 0 with a firm f such that $e \geq f$ becomes of type τe in period 1.

However, some firms do not allow female workers that learned to express their acquired potential: for example, the suggestions they make to improve the productivity of the current match are not implemented, or they are not assigned to better tasks. Hence, good male workers are more likely to be promoted in the firm where they are currently employed than female workers of similar type.

Subsequently, each pair can decide whether to stay together or to search for a better partner. Quite naturally (Atakan, 2006), we assume that search is costly, so that only agents that are sufficiently mismatched will change employer. Once the search cost is paid, workers are matched to their best partner available.

In equilibrium, female workers that *(a)* improve their type through learning but *(b)* are not promoted by the current employer, are more likely to move to better firms with fairer promotion policies than male workers of similar type. More formally:

Empirical Predictions. *Consider e_m and e_f such that e_m is male, e_f is female and $e_m = e_f = e$. Then,*
(i) the higher e in a given firm, the higher the probability of moving to a better firm;
(ii) the probability of moving to a better firm from a given firm for e_f with respect to $e_f - \Delta$ is higher than for e_m with respect to $e_m - \Delta$, for $\Delta > 0$;
(iii) the probability of being promoted in a given firm for e_m with respect to $e_m - \Delta$ is higher than for e_f with respect to $e_f - \Delta$, for $\Delta > 0$.

While wages are non-monotonic in firm type, in this model wages and (both total and average) profits are increasing in own type, as in Eeckhout and Kircher (2011). Hence, *we can use within-firm variations in wages to rank workers and profits to rank firms.* In our analysis we therefore use these rankings to test the empirical predictions above.

The theoretical framework explicitly shows that if female workers were to have the same career prospects in all firms, it would not be necessary to study gender differences

in sorting within and across firms separately, since these should be comparable. This is true even if female workers types are drawn from a worse distribution, since in that case the outside option is relatively more attractive for them than for men.

If instead firms are heterogeneous in the gender bias in promotions, female workers that learn but are not promoted in non-female friendly firms are more likely to move to better firms that are female friendly. On the contrary, good male workers are more likely to be promoted in the firm where they are currently employed. Hence, the association between the probability of moving to a better firm and wages should be higher for female workers, while the association between the probability of being promoted and wages should be stronger for male workers.

Let us stress that our estimation strategy is grounded on the presence of some mismatches between workers and firms in the equilibrium distribution. Indeed, perfect sorting would make both sources of heterogeneity empirically indistinguishable because no transitions would be observed. Yet, even in a flexible labor market, such as the Danish one, mismatches and frictions are likely to arise for a variety of reasons, such as commuting distances or non-monetary factors (Manning, 2011).

2.1 Empirical Approach

Based on this theoretical framework, we estimate the following linear probability model, which is conditional on workers' movements (i.e., for the sample of movers), separately for each gender:

$$move\_up_{ef't} = \alpha_0 + \alpha_1 wage_{t-1}(e,f) + x'_{et-1}\beta + z'_{ft-1}\gamma_1 + z'_{f't}\gamma_2 + z_t + u_f + \epsilon_{et} \quad (1)$$

where $move\_up_{ef't}$ is a dummy variable that is equal to 1 if an employee of type e, who has worked in a sending firm of type f, moves to a "better" receiving firm of type $f' > f$ at time t. All agents are indexed by their type. The term $wage_{t-1}(e,f)$ is the log of the wage earned in sending firm f by employee e. As there are many worker characteristics that may influence wages and mobility, such as demographic characteristics, and it is unclear to what extent the monotonicity assumption on payoffs is fulfilled when comparing coworkers in different occupations, we augment equation (1) with the vector x_e. The latter consists of relevant worker characteristics, such as age, tenure, work experience, ethnicity, marital status, parental status, education, occupation and a family network dummy (i.e., a dummy that records whether a worker has had at least one parent employed as a manager). The vectors z_f and $z'_{f'}$ include respectively the share of white-collar women, and the size of the sending and receiving firm, while the vector z_t represents time fixed effects. Finally, u_f captures the fixed effects of firm f and ϵ_{et} is a mean zero error term.[4]

The extent and sign of sorting in job transitions are tested by investigating whether coefficient α_1 is different from zero. More specifically, if $\alpha_1 > 0$, better workers (i.e.,

[4]We estimate equation 1 with OLS after we have centered both the dependent and independent variable using a within-firm transformation, to control for firm fixed effects. While such an approach is not obviously inferior to a logit model, at least if the "right" non-linear model is unknown (Angrist and Krueger, 2001), its results are straightforward to interpret, it eases the comparability of the coefficients and it allows an easy implementation of hypothesis testing on the difference between coefficients estimated across sub-samples. Specifically, we estimate the following demeaned equation:

$$\tilde{move\_up}_{ef't} = \tilde{\alpha}_0 + \alpha_1 \tilde{wage}_{t-1}(e,f) + \tilde{x}'_{et-1}\beta + \tilde{z}'_{ft-1}\gamma_1 + \tilde{z}'_{f't}\gamma_2 + \tilde{z}_t + \tilde{\epsilon}_{et}$$

where the *tilde* reflects the within-firm transformed data in which the firm mean has been removed from each individual observation and which removes the term u_f.

those workers who receive higher wages in a given firm after controlling for observables) are more likely to move to firms that earn higher profits, i.e., there is positive sorting. Furthermore, a more positive coefficient indicates a relatively stronger tendency towards positive assortative matching.

The focus of this paper is to test whether the degree and sign of sorting in job transitions vary according to gender by estimating equation (1) separately by gender and testing whether α_1 significantly varies across the female and male sub-samples. We test sorting differences between men and women by comparing estimations from each sub-sample since within-firm rankings are highly gender-specific.

With regard to the sample of stayers and their probability of being promoted, a similar model is implemented separately by gender:

$$prom_{eft} = \alpha_0 + \alpha_1 wage_{t-1}(e,f) + x'_{it-1}\beta + z'_{ft}\gamma + z_t + v_{et} \quad (2)$$

where $prom_{eft}$ is a dummy variable that is equal to 1 if employee e, who has worked within a specific occupation in firm f, is promoted to a higher occupational level. Because of data constraints, we consider three main occupational groups: managers, middle managers and other white collar positions, and blue-collar workers. The term u_f captures within firm fixed effects. As in the previous model, the vector x_{et-1} and z_{ft} include worker and firm characteristics while the vectors z_t are time dummies and v_{et} is an error term.[5]

2.2 Data

The data set, provided by Statistics Denmark, is a merged employer-employee panel sample of Danish firms observed over the 1996-2005 period.

The firm-level data includes sales, employment, value added, materials, profits, fixed assets and a two-digit NACE identifier (more details are provided in section A-1 of the online appendix). All companies in the sample have more than 20 employees and are in the private sector.[6] All firms with imputed accounting variables are omitted from the analysis.[7]

The individual-level data, available from 1980 onward, cover the working age population. These data include wage, age, gender, marital status, the number of children, experience, tenure, highest completed education, occupation and information on the family background characteristics. Apart from deaths and permanent migration, there is no attrition in the data set. The labor market status of each person as of the last week in November is recorded as the relevant datum for each person for that year. Therefore, if a worker changes main job, then we observe only the year in which this change occurred. However, we observe whether a worker experiences unemployment and its duration (in weeks) in a given calendar year.

In the analysis that follows, we include only individuals with a positive annual salary[8]

[5] As in equation 1, we estimate equation 2 with OLS on the transformed data.

[6] We exclude firms with less than 20 employees, as they do not have the sufficient number of transitions to compare male and female movers as required by our empirical strategy. Furthermore, because we rank firms based on their profits, we exclude public firms for which profits are not a stated objective.

[7] We believe that these selection criteria don't harm the representativeness of the final sample. The descriptive statistics of the population of movers and stayers before merging to the firm-level statistics and including firms with less than 20 employees are fairly comparable with those of our sub-samples; see table A2 of the online appendix. In particular, the size and share of white female employees are similar.

[8] We exclude from the sample the extreme observations of the annual salary, i.e., those lower than the

and individuals younger than 60. Furthermore, apprentices and part-time employees are excluded from the main analyses.

Most of the empirical estimations are based on two samples. The first sample considers only those workers who, within the 1996-2005 period, switched at least once from one firm (the sending firm, according to our terminology) to another firm (the current or receiving firm) in the data set within the 1996-2005 period.[9] An important challenge regarding this data set is that, because of changes of firms' ownership, there appears to be some false transitions in the data. To minimize miscoded switchers, transitions involving more than 50 percent of the size of the same sending firm are excluded from the final sample. Furthermore, we exclude from the sample of switchers those workers who changed jobs after a firm closure. In total, our sample includes 479,161 yearly observations of 357,487 job switchers (i.e., 10 percent of the original sample) and approximately 17,000 firms. The second sample excludes the switchers and consists of 4,658,374 observations, 617,513 "stayers" and nearly 18,000 firms.

2.3 Descriptive Analysis

Table 1 lists the descriptive statistics for both samples separately according to gender, measured at both worker and firm level.

The average male job switcher is 39 years of age and has 16 years of experience, whereas the average female job switcher is 38 years of age and has 14 years of experience. The average tenure for both women and men is approximately three years. The majority of workers have secondary or post-secondary diplomas, and 6 percent of male job changers have at least a university degree, whereas 30 percent have completed only primary education. In addition, 7 percent of female job changers have at least a university degree, and 37 percent have a primary education. Most men and women are classified as blue-collar workers (72 percent), followed by middle managers (24-26 percent). Significantly more male switchers have managerial jobs compared with their female counterparts (4 percent versus 2 percent, respectively). For both genders, approximately 5 percent are foreigners, nearly 15 percent have at least one child at 0-3 years of age, and approximately 4 percent have at least one parent working as a manager at the time of the job transition or before. Hence, 4-5 percent of job switchers have what we refer to as a "family network" (i.e., having at least one parent employed as a manager). In comparison, the average stayer is approximately two years older and has two more years of tenure, with a slightly lower educational and occupational level. The average stayer is also more likely to be married and less likely to have a child between 0 and 3 years of age, regardless of the gender of the individual. The percentage of foreigners is reasonably comparable across the two samples. During the period covered by our sample, the wage of an average male and female job switcher was approximately 250 and 200 thousand Danish Krones, respectively, or approximately 40 and 30 thousands USD per annum, respectively. The salary of an average stayer was approximately 10 percent above that figure. Turning to the firm-level characteristics, we find that the average firm size is fairly similar across the two samples, although the share of white-collar women and profits per worker are higher in the sample

$1th$ percentile and higher than the $99th$ percentile of the salary distribution. Annual salary is adjusted for possible unemployment spells during the year. We address the issue of measurement error related to the use of annual data on wages in one of our robustness checks in Section 4.1.

[9] We allow periods of unemployment between the previous and the current job. In one of our robustness checks we focus on job transitions without periods of unemployment between jobs.

of switchers, regardless of the gender of the employee.

The bottom part of Table 1 includes the mean of the main outcome-dependent variables used in our empirical analysis. For the sample of job switchers, we calculate an indicator function that takes the value of one (zero) if a worker moves to a receiving firm that is of higher (lower) quality than the sending firm. Firms' type is defined in terms of their profits. Given that the measure of profits is firm specific and might be affected by measurement error, we calculate a set of indicator variables that are based on alternative improvements in profits (i.e., the profit differential between sending and receiving firms is at least either 5 or 10 percent). The means of these outcome variables, also reported in Table 1, allow us to conclude that women have higher probabilities of moving to a receiving firm of higher quality, regardless of the definition of firm quality that we use.[10] In addition, for the sample of stayers, we also examine the probability of promotion to a higher occupational level and to a managerial position. It turns out that women are generally less likely to be promoted than men.

As we report in figures A3-A5 of the online Appendix, whereas a somehow decreasing gender wage gap characterizes workers who changed employer, stayers present a stable wage differential between men and women over time. More importantly, the wage developments have almost identical slopes across gender, suggesting that career profiles of men and women are very likely to start with very similar initial conditions and quality of matches. Women earn substantially less than their male peers, but differences are particularly marked for the sample of stayers. This descriptive evidence seems to suggest that more productive women are very likely to switch workplaces to achieve higher wages and promotion rates.[11]

2.4 Institutional Background

As institutional constraints may hamper the degree of assortativeness in the labor market, we hereby outline the main features of the Danish labor market, which are represented by the combination of high flexibility and social security ("flexicurity"), the role of family-friendly policies and decentralized wage settings.

Cornerstones of the Danish model are a high level of labor mobility and generous social security schemes. The absence of severance pay lowers hiring and firing costs, reduces labor market frictions and facilitates firms to adjust the quality and size of their workforce. Moreover, although workers are not protected by stringent employment rules, they bear relatively low costs of changing employers and have easy access to unemployment or social assistance benefits. In fact, Danish replacement ratios are among the most generous in the world. Therefore, a notable part of the observed labor mobility is also associated with wage mobility (Eriksson and Westergaard-Nielsen, 2009).

A further key feature of the Danish labor market is the wide coverage of publicly provided childcare, which, combined with the length and flexibility of parental leave schemes, has favored female labor market participation and full-time employment without dramatic consequences on the fertility rate (OECD, 2005). While initially many of the

[10] We calculate alternative indicators based on past average profitability, profit measures per worker, firms' value added in levels and per worker and firms' total factor productivity (TFP) estimated separately by industry as in Parrotta and Pozzoli (2012). The results obtained from these alternative outcome-dependent variables are reported in table A4 of the online appendix.

[11] This evidence is not driven by educational and occupational levels nor by the gender composition of the workforce since it is fairly stable for differently aged workers and increases over time.

jobs held by women have been part-time occupations in the public sector, today a notable proportion of women is employed in the private sector and works full-time. Nonetheless, descriptive statistics show that women in the private sector earn a 5 percent higher wage and are slightly more educated compared to their counterparts in the public sector. These statistics may suggest that the sample used in this study is a relatively selected one, consisting of slightly more motivated and career-oriented women. Yet, we will see that even this sample of female workers encounters significant career impediments in certain firms.

For the purposes of our analysis, a brief description of wage bargaining in the Danish private sector is also important. Denmark experienced a shift in wage bargaining from a highly centralized system to a considerably decentralized system. Since the early 1980s, an increasing share of wage bargaining descended to the firm (individual employee) level, which increased the weight of employer and employee roles in the resulting internal firm wage structure. Today, the within-firm wage variability in Denmark represents more than 80 percent of the total variability observed among all workers (Shaw and Lazear, 2008).

Given the key characteristics of the Danish labor market, the evidence of gender gaps arising from our empirical analysis may be generalized to other labor markets with similar degree of flexibility.

3 Results

Given the large volume of results, we discuss them in two separate sub-sections. The first sub-section describes the main results of sorting in job transitions and promotions, while the second one discusses some additional analysis and alternative specifications.

3.1 Main Results

We first analyze the main patterns present in the data using some intuitive figures that concisely describe the sorting patterns of workers of different types.

According to our theoretical framework, conditional on observables, the probability of leaving the current firm should be high for workers with low and high wages, while it should be lower for workers that are ranked neither too high nor too low in the wage distribution of the firm. Furthermore, such probability should be higher for women, for whom outside options are more attractive.

In Figure 1 we plot the probability of leaving the current firm for men and women as a function of their type, proxied by the residual predicted from a Mincerian log-wage regression, where we control for both observable individual characteristics and firm fixed effects. We find that indeed high wages increase the probability of leaving the firm to a higher extent than low wages, and this is particularly true for female workers.

In order to further understand such mobility patterns, we now investigate which workers are more likely to move to a better firm conditional on leaving the firm, and which workers are more likely to be promoted conditional on not leaving, again depending on the residuals of a mincerian log-wage equation.

Figure 2 shows that workers that switch firm are more likely to move to a better firm the higher their rank in the sending firm. Furthermore, good female workers are generally more likely to leave the current firm, expect maybe for very high types for whom there are fewer gender differences.

Similar results are valid for promotions, as shown in Figure 3, although in this case male workers of good types are more likely to be promoted than similarly ranked female workers.

This suggests that women switch firms because they are less likely to pursue career advancements in the current firm. In order to better understand these patterns, we now present the results of the estimation of linear probability model (1). This approach has the advantage to allow for an analysis of the different factors driving gender differences in sorting and how they change for different sub-samples of the population.

The main results pertaining to transitions to better firms are reported in the first two columns of Table 2. For both men and women, there is a significantly positive elasticity of the probability of moving to a better firm with respect to the logarithm of the wage earned in the previous firm. Our results are consistent with the findings of Bagger, Sørensen and Vejlin (2013), who document strong positive sorting in Denmark, largely driven by the fact that a rising share of high-wage earners is matched to high wage firms. Card et al. (2013) document a similar trend for Germany. These results confirm the appropriateness of our theoretical framework in which we assumed a production function that induces positive assortative matching.

Interestingly, female workers display a substantially stronger tendency toward positive sorting in job transitions compared to men. Specifically a standard deviation increase in the log of lagged wages raises female workers' probability to move to a better firm by 2 percent. The same increase has half as much of an effect on the male workers' probability.[12]

Hypothesis testing, reported at the bottom of Table 2, confirms that the coefficient estimated on women's lagged wages is statistically higher than the one associated with men's wages. These empirical associations suggest that better ranked women are more likely to move to companies of higher profits compared to men.[13]

Interestingly, the share of white-collar women in the sending firms has opposite effects on sorting in the two sub-samples: this share decreases the probability of moving for female workers, whereas it increases the corresponding probability for men. Overall, there appears to be little support for the classical version of the glass ceiling hypothesis, which would imply that positive sorting is weaker for women than for men in all transitions.

Let us now turn our attention to promotions, that we use as a proxy of career advancements within firms (columns 3-4 of Table 2). Again, we find a general positive relationship between the lagged wage of a stayer and the probability of being promoted for both genders.[14]

However, this association is stronger for men, as confirmed by the hypothesis tests reported at the bottom of Table 2. A standard deviation increase in the log of lagged

[12]Those figures are obtained from the average sample probabilities to move to a better firms. From Table 1 this average probability is approximately 40 per cent for female workers. Therefore, the change in the corresponding probability in percentage terms that results from a increase of the log of the lagged wages by one standard deviation (0.506 for female workers) is calculated as: $(0.016 \cdot 0.506/0.401) \cdot 100 = 2.02$. For male workers the average probability to move to a better firm is 38 percent. The change in the probability to move to a better firms that results from an increase in the log of lagged wages by one standard deviation (0.522 for male workers), in percentage terms, is $(0.007 \cdot 0.522/0.378) \cdot 100 = 0.96$.

[13]Additional results not reported in this table indicate that transitions to better firms are more likely for workers who are married, parents or native citizens, or for those who hold tertiary education. The relationship with age and tenure appears to be weak and insignificant. Finally, having a parent with past managerial experience is not significantly correlated with sorting.

[14]Native and marital status, higher education and family networks are positively associated with the likelihood of being promoted conditional on staying at the same firm. These coefficients are not reported.

wages raises female workers' promotion probability by 19 percent. The same increase triggers a raise in the male workers' promotion probability by 31 percent.[15] A greater share of white-collar women is now associated with a higher conditional probability for both women and men. Hence, the share of female workers *per se* is not an indication of unbiased promotion policies. Gender differences in favor of men persist when we focus on large career advancements, i.e., promotions to positions at the managerial level (last two columns of Table 2).[16]

These results pertaining to promotions possibly qualify the findings according to which the share of white-collar women in sending firms has a negative correlation with the probability of moving to a better firm for women. Given that women are more likely to be promoted in female-friendly firms, i.e., firms with many white-collar female workers, they are less likely to seek a job elsewhere if the sending firm is female-friendly. Furthermore, men have fewer incentives to seek a job outside of their current firm, especially in non-female-friendly firms, implying a stronger positive sorting for women in job transitions.

This explanation makes sense if certain firms that have no, or smaller, gender biases in promotions, as presumed in our theoretical framework. We will now investigate if such firms exist.

To do so, we define female-friendly firms as companies characterized by a share of women in white-collar positions higher than the industrial median. Furthermore, we define "female-sought" firms as the female-friendly firms that are destinations in the job transition of at least one female worker coming form a worse firm.

The first sub-panel of Table 3 shows that the sorting parameter in job transitions to female friendly firms is larger. Hence, the stronger positive sorting for female job switchers is mainly due to transitions to female-friendly firms while there are smaller and less significant differences between genders in terms of transitions to firms that are not female-friendly.

Positive sorting in promotions turns out to be stronger for women when we examine promotions in female-friendly and female-sought firms (second sub-panel of Table 3). On the contrary, the difference is consistent with the baseline results, but stronger, in firms that are not sought after by females.

Hence, these findings strongly indicate that good female workers seek career advancements in female-friendly firms because promotion opportunities in these firms do not depend on gender.

Nonetheless, gender differences in favor of men for promotions to managerial positions seems to emerge in all firms (the last sub-panel of Table 3). Hence, only the very best female workers make it to the managerial positions. These results nicely complement those of Gayle, Golan and Miller (2012) who focus on CEOs of publicly listed firms to trace the careers of top CEOs. They find that women are more likely to exit their occupations but more likely to become CEOs when they have not exited. Since, we do not restrict our attention to CEOs, our findings stress that women who pursue career advancements are a very selected sample.

According to our empirical strategy, female-friendly and female-sought firms perform by construction better than sending firms. In table A3 of the online Appendix, we explic-

[15]Those figures are obtained from the average sample promotion probabilities reported in Table 1. The standard deviation of the log of lagged wages in the sample of stayers is respectively equal to 0.429 and 0.426 for female and male workers.

[16]In this case, a standard deviation increase in the log of lagged wages raises the promotion probability at the managerial level by 2.6 percent and 8.5 percent respectively for male and female workers.

itly test the correlation between firm performance and female-friendliness by estimating a set of firm performance equations with several control variables and an indicator variable for female-friendliness, which is alternatively measured with either a "female-friendly firm" or "female-sought firm" dummy. We find a positive and significant correlation between being either a "female-friendly firm" or a "female-sought firm" and firms' profits per employee, sales per employee and value-added per employee.

Overall, the set of empirical results presented so far are not consistent with the view that women have better non-market opportunities (Lazear and Rosen, 1990). In that case, women would be less likely to be promoted than men in all firms but more likely to receive higher wages if promoted and more likely to quit to pursue non-market opportunities. Instead, female workers are less likely to be promoted and are more likely to move to a better firm when career advancements are not too difficult to achieve. In fact, the evidence on gender differences in promotion strongly suggests that women who cannot climb the occupational ladder within a firm because of discriminating promotion policies attempt to overcome these gender barriers by searching for better jobs offered by fairer firms in which they can pursue small career advancements. By contrast, greater career advancements tend to be easier for men than for women in all firms.

4 Robustness and Additional Results

In this section we provide further evidence of the robustness of gender differences in sorting and of the mechanisms generating them.

4.1 Definitions of Workers' Types

With renegotiation and endogenous search intensity, wages are not necessarily monotone in workers' type within the firm (Bagger and Lentz, 2014). Hence, wages provide a noisy ranking of workers.

To evaluate whether this theoretical problem affects our analysis, we first replace the previous wages as a measure of workers' ranking with employees' fixed effects, that are estimated from a gender-specific wage equation à la AKM, with the belief that this alternative measure may be less affected by non-monotonicity issues. Specifically the individual fixed effects are obtained by estimating the following wage regression:

$$ln\, w_{eft} = \alpha_e + \psi_{f(e,t)} + \beta_1 X_{et} + \beta_2 Z_{ft}, + \varepsilon_{eft} \tag{3}$$

where w_{eft} is the gross annual wage earned by individual e in firm f in year t. X_{et} is a vector of individual specific controls that change overtime. Following Card et al. (2013) and Card et al. (forthcoming), we include in X a set of interactions between year dummies and educational attainments as well as interaction terms between quadratic and cubic terms in age and educational attainments. In addition to those, we also control for other factors that might affect wages such as experience and tenure. The vector Z_{ft} contains firm specific controls, such as value added and capital per employee. The parameters α_e and $\psi_{f(e,t)}$ are respectively the individual and firm specific fixed effects. We estimate this additive "two-way" worker-firm effects model by using the methodology developed in AKM.[17] The findings reported in Table 4 reveal that the conditional probability of working in a better firm (of being promoted) is also positively correlated with worker

[17]This methodology is based on the identification of connected sets of firms. Those consist of firms

fixed effects, and as in the main specification, this correlation is stronger (weaker) for women.

We then measure the strength of sorting in job transitions by the method recently proposed by Bartolucci et al. (2015). While this approach has the drawback that it cannot be used to evaluate sorting in promotions, it does not rely on wages. Indeed it measures the variance of firm ranking (proxied by the arrival or current firm's profits per worker) that can be explained by the movers' types (proxied by the sending firm's profits per worker). The smaller the variance of (firm) partner's types for a given worker type relative to the unconditional variance of firm types, the more intensively workers sort into firms. Specifically the strength of sorting is defined by the following correlation ratio:

$$\eta = \sqrt{var[E[f|e]]/\sigma_f^2} \tag{4}$$

where $var[E[f|e]]$ represents the partners' variance for a given worker of type e whereas σ_f^2 is the variance of firm types, f. We then estimate the correlation ratio η as the mean of the correlation between the type of the sending firm f and the arrival firm f' for all worker types e (represented by the firm's profit per worker):

$$\rho(f, f'|e) = \frac{cov(f, f'|e)}{var(f)} \tag{5}$$

As suggested in Bartolucci et al. (2015) we estimate ρ by using only transitions mediated by an interim unemployment spell to make (f, e) and (f', e) independent conditional on worker type e. With exogenous job destruction and no on-the-job search, (f, e) and (f', e) are random draws from the steady state distribution of matches. The strength of sorting η provides a measure of the association between firm type f and worker type e. However, η cannot reveal the sign of sorting. Bartolucci et al. (2015) estimate the sign of sorting by looking at the empirical association between the sending firm's ranking and the movers' wage earned in the current employment or alternatively between the receiving firm's ranking and the movers' wage earned in the previous employment. When we implement these methodologies on job transitions, we find that the results are consistent with our baseline findings, as the estimated parameter η is larger for women than for men and the sign of sorting is for both genders positive, as reported in Table 5.[18]

Wage data could be noisy also because of measurement error since we use yearly observations of labor income. To check whether this affects our main results, we use the wages of the November spell and for those employees who work for fewer than 365 days at the firm corresponding to the November spell (around 35 percent), we annualize their wages by using information on the duration of the same spell. The results obtained from this spell-specific measure for wages are reported in Table 6 and are similar to those of

that have movers in common. Due to the high mobility that characterizes the Danish labor market and the relatively long time period considered, the largest connected set contains more than 99% of the workers and firms in the sample. Moreover this methodology relies on the assumption of "conditional exogenous mobility". As suggested in Card et al. (2013) and Card et al. (forthcoming), we empirically assess its plausibility by considering all possible cases in which this assumption may be violated. Our findings reported in figures A1 and A2 of the online appendix support the idea that the worker-firm matching is based on a combination of permanent firm and individual characteristics that do not create major concerns for the estimation of the wage equation above.

[18] Another solution would be to estimate the average wage for a worker estimated in a sample over all job spells (Hagedorn, Law and Manovskii, 2012). However, average wages per worker cannot be precisely estimated since workers are normally matched with one firm per spell and they change few firms.

the main analysis.[19]

4.1.1 Definitions of Firms' Types

Profits are the objective of all firms. Furthermore, a precise estimate of mean profits for every single firm can be recovered as long as there are a large number of workers per firm. However, our results for job transitions could be sensitive to the particular definition of firm quality we use (i.e., a firm is better than another when it has at least 5 percent higher profits). Another reason why it's important to try other ranking measures for firm types than profits is that these may be also determined by monopoly power or taxation.

We address this issue in different ways. First, we strengthen the conditions on profits by defining a transition to a better firm as a transition to a firm whose profits are at least 10 percent higher than profits of the sending enterprise. This stronger requirement mitigates eventual measurement errors and it corroborates the findings of the main specification (upper panel of Table 7).

Insofar we have ranked firms using total profits. This may be inappropriate if it is easier or more difficult to find a suitable firm for better types. For this reason, we run the estimation of linear probability model (1) using alternative methods to rank firms. As reported in tables A4 and A5 of the online appendix, qualitatively similar results are obtained using: average profits over the sample period; past profits that were made before the job transition occurred; total factor productivity; profits per worker; and value added.

4.1.2 Definitions of Job Transitions

Jobs differ in many dimensions beyond the type of the firm that offers them, and workers may take into considerations these other characteristics when deciding whether to change job. In order to control for this, we restrict the definition of job transitions to a better firm. Specifically, we impose the condition that switchers earn higher wages or that they are employed in a better occupational level after a transition to a better firm.

Using these restrictive definitions of career improvements in job-to-job transitions, we find strong gender differences in sorting in line with the baseline results (first two columns of the lower panel of Table 7). This corroborates the appropriateness of our theoretical framework.

4.1.3 Firm Exit

Our results could be due to the fact that women are more skilled in finding a job outside the current firm. This could be because of a lower search cost, c, or because of a higher investment in general versus specific human capital with respect to men, although such difference between men and women would still be induced by different career prospects in different firms.

We test these hypotheses by focusing solely on transitions from a firm's closure (last two bottom columns of Table 7) since these mobility patterns do not stem from the voluntary choices and career concerns of employees. Indeed, in that situation, all workers, including men, are forced to seek jobs outside of their current firms.

[19]The sample sizes of Table 6 are lower because spell-level information is not available for the whole sample unfortunately.

Interestingly, we find gender differences in sorting in favor of men in these job transitions (although not always significant). These results lend additional support to the fact that positive sorting in job transitions is stronger for women because of voluntary transitions triggered by gender biases in promotions in the sending firm.

4.1.4 Results by Cohort

The sorting patterns we document could be due to a worse initial allocation of women to firms with respect to men. This would imply that positive sorting in job transitions should be stronger for women especially for younger female workers. Furthermore, wage increases should be steeper for women.

Alternatively, there could be intrinsic biological differences (Ichino and Moretti, 2009): since women rate of absenteeism is generally higher than that of men, the former are less productive (or, their productivity is less observable) at the beginning of their careers. In that case, gender gaps in sorting should be smaller for older workers, if not in favor of women, in all transitions.

Finally, it could be that female workers learn more slowly than men. Then, females would be less likely to be promoted in all firms and to move to better firms.

To check the relevance of these hypothesis in our context, we analyze gender differences in sorting selecting workers aged 25-30, 30-40, 40-50, or 50-60 in 1995 and follow them separately along the sample period.

In the first sub-panel of Table 8 we present results by cohorts for job transitions. We find strong positive sorting parameters for women and large gender differences for younger cohorts (25-20; 30-40), and weak evidence of sorting for workers 40-50 years old. Sorting is negative or negligible for women and men in the oldest age cohorts. These results, together with the gender-specific wage developments, allow us to rule out the surmise that the gender differences in sorting patterns are merely driven by a gap in the initial conditions across gender, due to a higher extent of initial mismatches for women with respect to men. However, the case of switchers aged 50-60 is a very peculiar one because a large share of these workers was likely approaching early-retirement, which at that time was strongly supported by generous public programs.

The second sub-panel of Table 8 instead investigates the promotion probability of stayers by cohorts. We find that coefficients on the previous wage are similar between men and women for the youngest cohort but they start diverging and enlarging sensibly with the individuals' cohort ages: the coefficient for males is twice (one and a half) larger than the one for females for the cohort 50-60 (40-50). The last sub-panel of Table 8 looks at promotions to managerial level: gender differences are significant in all cohorts, although the probability of better workers getting promoted is much higher for men when we look at older cohorts. Hence, contrary to the biological differences hypothesis, gender differences in promotions in favor of men are stronger for middle aged workers.

The discrepancies between men and women in job transitions are confirmed also in the sub-samples that refer to three age groups: under 35, between 35 and 50, and above 50 (see table A8 of the online Appendix). Sorting in job transitions is more positive for women and the gender difference seems to enlarge with age. Consistently with the analysis by cohort, the results on promotions by age group reveal that the gender gap in the sorting parameter increases with workers' age. Since this difference is in favor of men, this pattern appears to be consistent with the idea that women tend to climb the career ladder at a slower pace than men; hence, women exhibit an increasing gap with

respect to men. This lowers a woman's probability of reaching top-level positions at a given age.

Overall, the analysis by age groups and cohorts yields limited support to the hypothesis that biological differences explain gender gaps. Indeed, while gender differences are more important when career advancements mostly take place, i.e., for workers aged between 35 and 50 years, in line with our baseline results, such differences are in favor of women in job transitions, and in favor of men in promotions.

4.1.5 Parenthood

Several studies suggest that career advancements are more difficult for women due to motherhood (Datta Gupta, Smith and Verner, 2008; Smith, Smith and Verner, 2011; Smith et al., 2013; Kleven et al., 2015). We test this hypothesis with our methodology.

While parenthood *per se* does not appear to be relevant to job transitions,[20] the impact of parenthood on career advancements varies substantially across firms.

Indeed, Table 9 reports the results by firm type (female-, not female-friendly, female- and not female-sought companies) for the sub-samples before and after the first child is born. Interestingly, female-friendly firms show no gender differences for promotions to better occupations before the first child is born, while a small bias in favor of females emerge after the first child is born. However, women who work in other firms encounter a significant penalty in promotions, especially after bearing a child. Looking at promotions to managerial positions, again gender differences appear in all firms independently on parenthood. However, the penalty of parenthood seems to be harsher in not female-sought and not female-friendly after the first child is born.

These findings are related to those of Kleven et al. (2015). They look at the careers developments of the mother and the father within the same household. They find that while the parents' career patterns are very similar before the first child is born, they diverge substantially thereafter. This penalty emerges for many reasons, including an adjustment of labor supply at the intensive margin. Since we focus on full time workers, our analysis captures only one aspect of this penalty. Hence, the gender biases in sorting that we estimate are likely to be downward biased.

Overall, this set of results provides evidence of interplay between motherhood and the glass ceiling phenomenon in certain firms.

4.1.6 Further Checks

Our results could be due to a different distribution of skills, endowments and impediments across genders. Alternatively, they may find good jobs in specific occupations or sectors where their skills are more valued. Yet, in Tables A6 and A11 of the online appendix, we show that our results are robust even when we account for such considerations.

Specifically, we show that gender gaps in job transitions emerge also when we subsample by occupation and by education: men generally show weaker positive sorting patterns in job transitions, and the difference between genders is larger for blue-collar workers and for workers with primary education, whereas it weakens for more educated workers or for those with better occupations. The latter result is fairly consistent with

[20] In tables A9 and A10 of the online appendix, we show that, not only do gender differences in sorting emerge for both workers with and without children and for workers both before and after the first child is born, but the coefficients are also similar in all these sub-samples.

Card et al. (forthcoming), who conclude that sorting differences across gender are less important for highly educated workers and managers.

Manning (2003), Ch. 7, documents that women in the UK are more constrained in their opportunities to change job. We test whether the costs associated with job mobility affect our results focusing on transitions without change of residence and for single women, since for these samples we expect such costs to be lower. There we find that sorting in job transitions is stronger for women although slightly less than in baseline regression. This suggests that our main results do not entirely depend on the costs associated with switching employer, but rather on career concerns. Conversely, the reductions in the labor supply that are represented by shifts from full-time to part-time employment are not associated with positive sorting, as changes in the number of hours worked are likely to be triggered by family considerations. Further, the finding that the sorting coefficient in job transitions is significantly higher for women with a family network might reflect the importance of having good job contact networks for women.

It does not appear to be relevant whether switching workers find a job in the same industry or in a different industry, stressing that the results are not driven by women self-selecting themselves in particular industries. Consistently with this view, our results on job transitions do not depend on firm size.

Regarding promotions, estimations conducted separately by education show that gender differences in promotion are lower for workers with mandatory and tertiary educations compared to workers with secondary education. Results by industry indicate that the same pattern generally emerges in all sectors.

5 Conclusions

In this paper, we measure gender differences in sorting by using Danish employer-employee matched data to study gaps in labor market outcomes. Our methodology is centered on the relationship between workers ability, measured by their position in the wage hierarchy in a given firm, and the probability of moving to a better firm or the probability of being promoted. We find that the degree of positive sorting is higher for women than for men in voluntary job transitions, while it is higher for men than for women in promotions, especially in firms that have fewer female workers in white collar positions than their respective industry mean.

Our detailed account of gender differences provides support to the hypothesis that female workers encounter glass ceilings in some firms. This obstacle is likely to lead good female workers to seek firms that will reward their talents in a fair manner. As a result, good female workers are more mobile than male workers in the direction of better firms, while it is easier for good male workers to be promoted. Nonetheless, gender differences in promotion persist and are similar in all firms when we focus on large career advancements.

The gender differences in sorting we document are widely consistent with an overall gender gap in labor market outcomes and an under representation of women in top positions, as observed in the case of Denmark. Since mobility is a way to circumvent gender biased promotion policies in certain firms, we expect gender gaps should be even more severe in countries with less flexible labor markets.

Furthermore, our findings suggest that women who become mothers have difficulties to advance in their careers in certain firms. These hurdles may be associated with the significant generosity of parental leave policies, as suggested by Datta Gupta et al. (2008)

and Smith et al. (2011). Thus, it is important to conduct further research to determine why these effects emerge and why only in some firms.

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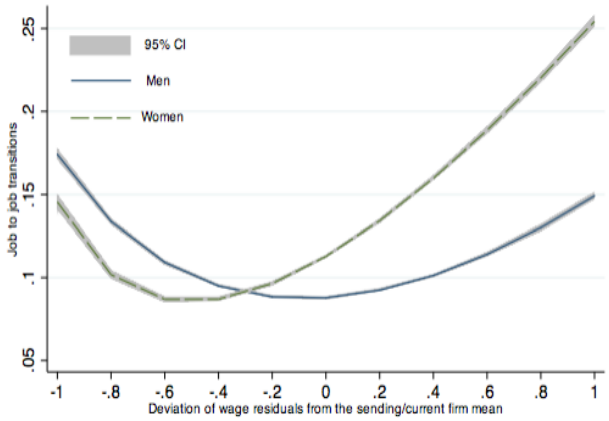

Figure 1: Probability of switching firm against the deviation of estimated residual wages earned in the sending firm. Residual wages are predicted from a standard mincerian regression in which we include the following variables: age and age squared, tenure and tenure squared, marital status, a dummy for having children, education level, family network, a dummy for foreigners, experience and experience squared, occupational dummies, sending firm's size dummies, share of white collar women employed in the sending firm, individual fixed effects and year dummies.

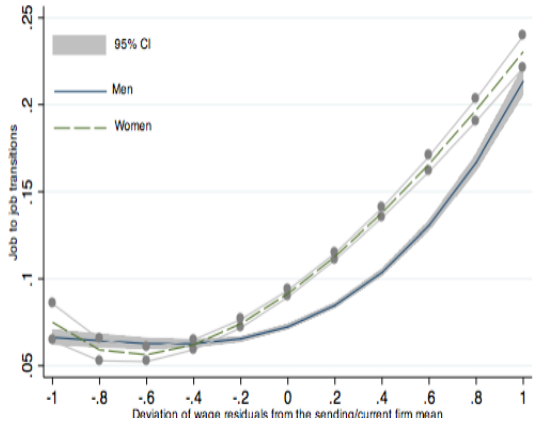

Figure 2: Conditional probability of moving to a better firm against the deviation of estimated residual wages earned in the sending firm. Residual wages are predicted from a standard mincerian regression in which we include the following variables: age and age squared, tenure and tenure squared, marital status, a dummy for having children, education level, family network, a dummy for foreigners, experience and experience squared, occupational dummies, sending firm's size dummies, share of white collar women employed in the sending firm, individual fixed effects and year dummies.

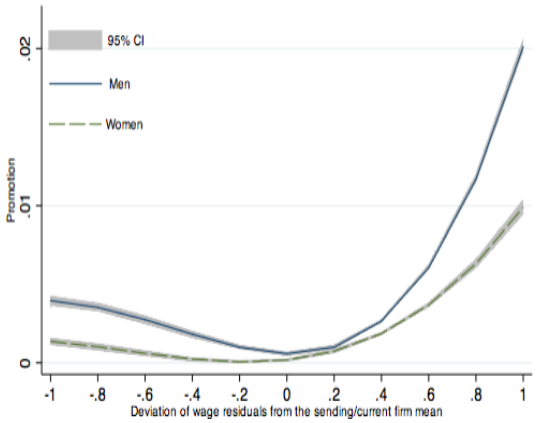

Figure 3: Probability of promotion against the deviation against the deviation of estimated residual wages earned in the current firm. Residual wages are predicted from a standard mincerian regression in which we include the following variables: age and age squared, tenure and tenure squared, marital status, a dummy for having children, education level, family network, a dummy for foreigners, experience and experience squared, occupational dummies, current firm's size dummies, share of white collar women employed in the current firm, individual fixed effects and year dummies.

Table 1: Descriptive statistics

Variables	**Sample of switchers**				**Sample of stayers**			
	Women		**Men**		**Women**		**Men**	
	Mean	*S.d.*	*Mean*	*S.d.*	*Mean*	*S.d.*	*Mean*	*S.d.*
log(wage_sending)	12.206	0.506	12.430	0.522	12.293	0.429	12.542	0.426
age	37.748	9.055	38.594	9.345	39.819	9.281	40.983	9.554
tenure	3.561	3.795	3.487	3.809	5.567	4.877	5.931	5.126
labor market experience	14.118	8.358	16.602	9.152	15.638	8.278	18.884	9.161
manager	0.024	0.155	0.041	0.199	0.018	0.131	0.046	0.208
middle manager	0.260	0.438	0.239	0.427	0.299	0.458	0.258	0.437
blue collar	0.716	0.451	0.719	0.449	0.683	0.465	0.697	0.460
with at least a child (0-3)	0.149	0.356	0.148	0.355	0.125	0.331	0.125	0.331
primary (1, if with primary education)	0.366	0.482	0.300	0.458	0.380	0.485	0.292	0.455
secondary (1, if with secondary and post-secondary education)	0.561	0.496	0.644	0.479	0.552	0.497	0.650	0.477
tertiary (1, if with tertiary education)	0.073	0.260	0.056	0.230	0.068	0.252	0.058	0.233
foreigner	0.051	0.220	0.049	0.216	0.048	0.213	0.046	0.209
family network (1, if one parent is manager)	0.050	0.217	0.041	0.198	0.049	0.217	0.041	0.199
married or cohabiting	0.740	0.439	0.732	0.443	0.783	0.412	0.767	0.423
share of white-collar women in the sending firm	0.091	1.772	0.065	1.637	-	-	-	-
share of white-collar women in the current firm	0.186	2.864	0.109	1.617	0.031	0.050	0.017	0.036
sending firm size less than 50 employees	0.118	0.323	0.166	0.372	-	-	-	-
sending firm size between 51 and 100 employees	0.102	0.303	0.131	0.338	-	-	-	-
sending firm size more than 100 employees	0.780	0.415	0.703	0.457	-	-	-	-
current firm size less than 50 employees	0.140	0.347	0.188	0.391	0.147	0.354	0.194	0.395
current firm size between 51 and 100 employees	0.112	0.315	0.139	0.346	0.117	0.321	0.144	0.351
current firm size more than 100 employees	0.748	0.434	0.673	0.469	0.736	0.441	0.662	0.473
sending firm accounting profit before taxes per worker	86.292	288.338	87.682	278.075	-	-	-	-
current firm accounting profit before taxes per worker	100.746	482.845	96.862	440.232	71.103	3288.197	87.630	2311.018
Mean of the main dependent variables	**Sample of switchers**				**Sample of stayers**			
Prob(profits of current firm >profits of previous firm by 5%)	0.401	-	0.378	- -	-	-	-	-
Prob(profits of current firm) >profits of previous firm by 10%)	0.356	-	0.349	- -	-	-	-	-
Promotion (better occupation)-	-	-	-	-	0.030	-	0.032	-
Promotion (manager) -	-	-	-	-	0.033	-	0.035	-
Obs	126,676		294,073		1,329,800		2,773,928	
Number of individuals	97,502		218,542		368,810		663,237	
Number of firms	16,764				18,034			

Notes: All the variables are averages from 1995 to 2005.

Table 2: Gender differences in sorting and promotions, main results

	Sorting in job transitions		**Promotions**		**Promotions to manager**	
	Women	Men	Women	Men	Women	Men
log(wage_sending)	0.016***	0.007***	0.013***	0.023***	0.002***	0.007***
	(0.000)	(0.001)	(0.002)	(0.003)	(0.000)	(0.001)
percentage of white-collar women in sending firm	-0.078***	0.097***	-	-	-	-
	(0.000)	(0.000)	-	-	-	-
percentage of white-collar women in receiving firm	0.062***	0.091***	-	-	-	-
	(0.000)	(0.000)	-	-	-	-
share of white-collar women in the firm	-	-	0.780***	0.676***	0.017***	0.041***
	-	-	(0.039)	(0.021)	(0.003)	(0.004)
N	126,676	294,073	1,329,800	2,773,928	1,329,800	2,773,928
R^2	0.124	0.130	0.019	0.021	0.004	0.011
Hypothesis test [χ^2; p-value]**:** $\alpha_1^{women} = \alpha_1^{men}$	149.50; 0.000		110.78; 0.000		323.27; 0.000	

Notes: For job transitions, the dependent variable is a dummy that is 1 if the worker moves to a firm whose profits are at least 5% higher than those of the previous firm. For promotions, the dependent variable is a dummy that is 1 if the worker is, within the same firm, promoted to a better occupational level. For promotions to managerial positions, the dependent variable is a dummy that takes the value of one, if the worker is, within the same firm, promoted to a managerial occupational level. All specifications include age and age squared, tenure and tenure squared, marital status, having children, education level, family network, a dummy for foreigners, experience and experience squared, firm fixed effects, firm size dummies (both receiving and sending firm in the regressions regarding job transitions), year and occupational dummies. The standard errors, reported in parentheses, are clustered at the sending firm level and at the individual level. *Statistically significant at the .10 level, **at the .05 level, and ***at the .01 level.

Table 3: Gender differences in sorting and promotions, results based on female friendliness of firms

	Sorting in job transitions	
	Transition to female-friendly firms	**Transition not to female-friendly firms**
	Women	
log(wage_sending)	0.023***	0.006***
	(0.003)	(0.002)
N	77,383	49,293
R^2	0.098	0.165
	Men	
log(wage_sending)	0.005***	0.007***
	(0.000)	(0.002)
N	157,585	136,488
R^2	0.109	0.150
Hypothesis test [χ^2; p-value]: $\alpha_1^{women} = \alpha_1^{men}$	27.51; 0.000	0.02; 0.897

	Promotions		
	Female-friendly firms	**Non-female-friendly firms**	**Female-sought firms**
	Women		
log(wage_sending)	0.015***	0.011**	0.014***
	(0.003)	(0.001)	(0.003)
N	459,405	870,395	391,628
R^2	0.019	0.009	0.027
	Men		
log(wage_sending)	0.012***	0.025***	0.009***
	(0.003)	(0.003)	(0.002)
N	574,378	2,199,550	449,077
R^2	0.023	0.022	0.033
Hypothesis test [χ^2; p-value]: $\alpha_1^{women} = \alpha_1^{men}$	31.57; 0.000	134.60; 0.000	62.82; 0.000

	Promotions to managerial occupation		
	Female-friendly firms	**Not female-friendly firms**	**Female-sought firms**
	Women		
log(wage_sending)	0.003***	0.002***	0.003***
	(0.000)	(0.000)	(0.000)
N	459,405	870,395	391,628
R^2	0.005	0.003	0.005
	Men		
log(wage_sending)	0.007***	0.007***	0.006***
	(0.000)	(0.000)	(0.000)
N	574,378	2,199,550	449,077
R^2	0.009	0.012	0.009
Hypothesis test [χ^2; p-value]: $\alpha_1^{women} = \alpha_1^{men}$	69.26; 0.000	376.79; 0.000	93.37; 0.000

Notes: For promotions, the dependent variable is a dummy that takes value 1 if the worker is promoted to a better occupation in the same firm, or if the worker is promoted to a managerial occupational level in the same firm, respectively. All specifications include the same controls as the regressions in Table 2. The standard errors reported in parentheses are clustered at the sending firm level and at the individual level. *Statistically significant at the .10 level, **at the .05 level, and ***at the .01 level.

Table 4: Gender differences in sorting and promotions, results with individual fixed effects

	Sorting in job transitions		**Promotions**		**Promotions to manager**	
	Women	Men	Women	Men	Women	Men
Individual fixed effects	0.032***	0.011***	0.038***	0.065***	0.005***	0.020***
	(0.002)	(0.001)	(0.003)	(0.001)	(0.000)	(0.001)
N	123,154	287,100	1,310,132	2,735,987	1,310,132	2,735,987
R^2	0.126	0.130	0.023	0.032	0.005	0.017
Hypothesis test [χ^2; p-value]: $\alpha_1^{women} = \alpha_1^{men}$	1201.36; 0.000		146.55; 0.000		160.28; 0.000	

Notes: For job transitions, the dependent variable is a dummy that is 1 if the worker moves to a firm with profits at least 5% higher than those of the previous firm. For promotions, the dependent variable is a dummy that is 1 if the worker is promoted to a better occupation in the same firm. All specifications include the same controls as the regressions in Table 2. The standard errors reported in parentheses are clustered at the sending firm and at the individual level. *Statistically significant at the .10 level, **at the .05 level, and ***at the .01 level.

Table 5: Gender differences in sorting, results with the methodology from BDM

	Strength of sorting		**Sign of sorting (1)**		**Sign of sorting (2)**	
	Women	Men	Women	Men	Women	Men
Sending firm's profits per worker	0.345***	0.253***				
	(0.003)	(0.002)				
η	0.587	0.503				
log(wage_current)			0.173***	0.094***		
			(0.011)	(0.007)		
log(wage_sending)					0.039***	0.010***
					(0.006)	(0.003)
N	78,842	199,233	78,842	199,233	78,842	199,233
R^2	0.464	0.359	0.146	0.063	0.693	0.625
Hypothesis test [χ^2; p-value]: $\alpha_1^{women} = \alpha_1^{men}$	777.86; 0.000					

Notes: In the first and last two columns, the dependent variable is the current firm's profits per worker. In the third and fourth columns, the dependent variable is the sending firm's profits per worker. *Statistically significant at the .10 level, **at the .05 level, and ***at the .01 level.

Table 6: Gender differences in sorting and promotions, results with annualized wage

	Sorting in job transitions		**Promotions**		**Promotions to manager**	
	Women	Men	Women	Men	Women	Men
log(wage_sending)	0.021***	0.007***	0.033***	0.058***	0.005***	0.018***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.000)	(0.001)
N	124,366	290,030	1,314,255	2,753,592	1,314,255	2,753,592
R^2	0.126	0.130	0.023	0.030	0.005	0.017
Hypothesis test [χ^2; p-value]: $\alpha_1^{women} = \alpha_1^{men}$	353.72; 0.000		555.31; 0.000		289.52; 0.000	

Notes: For job transitions, the dependent variable is a dummy whose value is 1 if a worker moves to a firm with profits at least 5% higher than those of the previous firm. For promotions, the dependent variable is a dummy that takes value 1 if a worker is promoted to a better occupation in the same firm. All specifications include the same controls as the regressions in Table 2. The standard errors, reported in parentheses, are clustered at the sending firm and at the individual level. *Statistically significant at the .10 level, **at the .05 level, and ***at the .01 level.

Table 7: Sorting in job transitions estimated separately for men and women, results by type of transitions

		Profits $> 10\%$	
	All	*Women*	*Men*
log(wage_sending)	0.007***	0.014***	0.005***
	(0.001)	(0.000)	(0.001)
female	-0.002		
	(0.001)		
log(wage_sending)*female	0.003***		
	(0.001)		
N	420,749	126,676	294,073
R^2	0.127	0.122	0.130
Hypothesis test [χ^2; p-value]: $\alpha_1^{women} = \alpha_1^{men}$	-	67.72; 0.000	
	Wage improvement	**Better occupational level**	**Transitions from firm exit**
		Women	
log(wage_sending)	0.020***	0.017***	0.009***
	(0.003)	(0.001)	(0.000)
N	50,943	17,520	26,083
R^2	0.204	0.112	0.084
		Men	
log(wage_sending)	0.009***	0.003***	0.011***
	(0.002)	(0.001)	(0.000)
N	97,662	39,878	57,820
R^2	0.169	0.118	0.117
Hypothesis test [χ^2; p-value]: $\alpha_1^{women} = \alpha_1^{men}$	47.08; 0.000	250.99; 0.000	11.05; 0.000

Notes: All specifications include the same controls as the regressions in Table 2. The standard errors, reported in parentheses, are clustered at the sending firm level and at the individual level. *Statistically significant at the .10 level, **at the .05 level, and ***at the .01 level.

Table 8: Gender differences in sorting and promotions, results by cohort

	Sorting in job transitions			
	Cohort 25-30	**Cohort 30-40**	**Cohort 40-50**	**Cohort 50-60**
		Women		
log(wage_sending)	0.026***	0.029***	0.005***	-0.020***
	(0.001)	(0.004)	(0.001)	(0.000)
N	2,876	3,679	1,945	630
R^2	0.143	0.142	0.134	0.211
		Men		
log(wage_sending)	0.002***	0.009***	-0.001	-0.001***
	(0.001)	(0.002)	(0.001))	(0.000)
N	11,124	16,982	9,133	4,027
R^2	0.153	0.142	0.129	0.123
Hypothesis test [χ^2; p-value]: $\alpha_1^{women} = \alpha_1^{men}$	1046.97; 0.000	92.37; 0.000	8.49; 0.000	683.65; 0.000
	Promotions			
	Cohort 25-30	**Cohort 30-40**	**Cohort 40-50**	**Cohort 50-60**
		Women		
log(wage_sending)	0.018***	0.029***	0.039***	0.044***
	(0.001)	(0.002)	(0.002)	(0.002)
N	121,018	199,285	175,239	52,682
R^2	0.025	0.030	0.033	0.032
		Men		
log(wage_sending)	0.018***	0.041***	0.059***	0.091***
	(0.002)	(0.001)	(0.002)	(0.003)
N	271,866	477,224	451,131	169,002
R^2	0.024	0.037	0.047	0.062
Hypothesis test [χ^2; p-value]: $\alpha_1^{women} = \alpha_1^{men}$	0.01; 0.90	25.50; 0.000	34.18; 0.000	102.02; 0.000
	Promotions to managerial occupations			
	Cohort 20-30	**Cohort 30-40**	**Cohort 40-50**	**Cohort 50-60**
		Women		
log(wage_sending)	0.002***	0.005***	0.007***	0.007***
	(0.000)	(0.000)	(0.000)	(0.001)
N	121,018	199,285	175,239	52,682
R^2	0.004	0.015	0.011	0.007
		Men		
log(wage_sending)	0.003***	0.013***	0.019***	0.038***
	(0.000)	(0.000)	(0.000)	(0.003)
N	271,866	477,224	451,131	169,002
R^2	0.005	0.025	0.024	0.035
Hypothesis test [χ^2; p-value]: $\alpha_1^{women} = \alpha_1^{men}$	15.09; 0.000	169.49; 0.000	123.23; 0.000	72.21; 0.000

Notes: For job transitions, the dependent variable is a dummy that takes the value of one, if the worker moves to a firm whose profits are at least 5% higher than those of the previous firm. For promotions, the dependent variable is a dummy that takes the value of one, if the worker is, within the same firm, promoted to a better occupational level. For promotions to managerial positions, the dependent variable is a dummy that takes the value of one, if the worker is, within the same firm, promoted to a managerial occupational level. All specifications include the same controls as the regressions in Table 2. The standard errors are reported in parentheses and are clustered at the sending firm level and at the individual level. *Statistically significant at the 0.10 level, **at the 0.05 level, and ***at the 0.01 level.

Table 9: Promotion models estimated separately for men and women, results by female friendliness of firms before and after children

	Promotion to better occupation			
	Before Child		**After Child**	
	Female-friendly firms	Not female-friendly firms	Female-friendly firms	Not female-friendly firms
	Women			
log(wage_sending)	0.001	0.007***	0.016***	0.008***
	(0.002)	(0.002)	(0.003)	(0.000)
N	26,911	45,141	50,562	85,368
R^2	0.036	0.010	0.024	0.010
	Men			
log(wage_sending)	-0.002	0.016***	0.014***	0.019***
	(0.003)	(0.001)	(0.004)	(0.003)
N	35,508	117,046	64,697	210,860
R^2	0.043	0.020	0.010	0.011
Hypothesis test [χ^2; p-value]: $\alpha_1^{women} = \alpha_1^{men}$	1.36; 0.243	23.75; 0.000	3.61; 0.091	27.12; 0.000
	Before Child		**After Child**	
	Female-sought Firms	Not female-sought firms	Female-sought Firms	Not female-sought firms
	Women			
log(wage_sending)	0.004	0.008***	0.027***	0.009
	(0.004)	(0.003)	(0.006)	(0.001)
N	6,134	13,525	10,123	22,970
R^2	0.026	0.020	0.009	0.007
	Men			
log(wage_sending)	0.013***	0.015***	0.021***	0.018***
	(0.003)	(0.005)	(0.007)	(0.003)
N	15,652	57,017	26,358	94,273
R^2	0.033	0.014	0.023	0.012
Hypothesis test [χ^2; p-value]: $\alpha_1^{women} = \alpha_1^{men}$	5.92; 0.014	7.18; 0.007	6.59; 0.012	14.80; 0.000
	Promotion to managerial occupation			
	Before Child		**After Child**	
	Female-friendly firms	Not female-friendly firms	Female-friendly firms	Not female-friendly firms
	Women			
log(wage_sending)	0.003***	0.001***	0.002***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
N	26,911	45,141	50,562	85,368
R^2	0.004	0.001	0.003	0.002
	Men			
log(wage_sending)	0.004***	0.004***	0.005***	0.004***
	(0.000)	(0.000)	(0.001)	(0.000)
N	35,508	117,046	64,697	210,860
R^2	0.007	0.009	0.004	0.004
Hypothesis test [χ^2; p-value]: $\alpha_1^{women} = \alpha_1^{men}$	2.74; 0.098	18.72; 0.000	4.77; 0.029	26.30; 0.000
	Before Child		**After Child**	
	Female-sought Firms	Not female-sought firms	Female-sought Firms	Not female-sought firms
	Women			
log(wage_sending)	0.004**	0.001***	0.004**	0.001**
	(0.002)	(0.000)	(0.001)	(0.000)
N	6,134	13,525	10,123	22,970
R^2	0.009	0.003	0.008	0.003
	Men			
log(wage_sending)	0.008***	0.004***	0.003**	0.003***
	(0.001)	(0.000)	(0.001)	(0.000)
N	15,652	57,017	26,358	94,273
R^2	0.011	0.008	0.004	0.005
Hypothesis test [χ^2; p-value]: $\alpha_1^{women} = \alpha_1^{men}$	3.29; 0.069	51.43; 0.000	0.25; 0.61	8.90; 0.002

Notes:The dependent variable is a dummy that takes value 1 if the worker is promoted to a better occupation in the same firm. All specifications include the same controls as the regressions in Table 2. Standard errors reported in parentheses are clustered at the sending firm level and at the individual level. Female-friendly firms are those with a share of white-collar women higher than the industrial mean. Female-sought firms only include the destination firms of the job-to-job transitions model whose share of white-collar women is higher than the industrial mean that hired at least a woman in the sorting model. *Statistically significant at the .10 level, **at the .05 level, ***at the .01 level.

Appendix: Theoretical Framework

There is a unit mass of workers, half of which are males and the rest females, and a unit mass of firms offering one job.[21] A share $\delta \in (0,1)$ of firms are female-friendly—it will be explained shortly in which sense. There are three periods—0, 1 and 2,—and there is no discounting across periods. Workers and firms are heterogeneous in terms of their productivity. Workers at time 0 draw their type e_0 independently of their gender, from a distribution $\Gamma_0(e)$ with smooth density $\gamma_0(e)$ on $(0, 1/\tau]$, $\tau > 1$. Firms draw their type f from distribution $\Upsilon(f)$ independently of their female-friendliness, with a smooth density $\nu(f)$ on $[0,1]$.

When types e ad f form a match, they produce an output $Y(e,f)$. Unmatched agents obtain a payoff of zero. We assume the following production function in each period:

$$Y(e,f) \quad = \quad \alpha e^{\theta} f^{\theta} + h(e) + g(f), \tag{A-1}$$

where $h(\cdot)$ and $g(\cdot)$ are increasing functions such that $h(0) = g(0) = 0$ while $\alpha > 0$ and $\theta > 0$ are parameters that indicate the strength of the complemetarities. We denote an assignment of workers to firms as μ. Since $Y_{ef} > 0$, this production function induces positive assortative matching in a frictionless economy, i.e., $\mu(e) = f$ (Becker, 1973).[22]

Wages are determined by bargaining with workers' bargaining power equal to 1/2. Unemployment benefits are normalized to zero.

At time 0, workers and firms are randomly matched after their respective types have been realized. As of now, they cannot search for another match. Production takes place and wages are paid. Since output is non-negative and agents cannot search, all agents will prefer to match and there is no outside option. Hence, wages are determined by bargaining with inside options and with disagreement payoffs equal to zero (Muthoo, 1999). Hence, the worker and the firm both get half of the output.[23]

A worker e_0 in a match in period 0 with a firm f such that $e_0 \geq f$ becomes of type τe_0 in period 1. This can be interpreted as learning by doing: during period 0, workers acquire relevant experience that improves their skills as long as $e_0 \geq f$. As a result, in the second period workers are more productive, i.e., they increase their type. We denote by $\Gamma_1(e)$ the new distribution of types, which, given the random allocation in period 0, is a smooth distribution on $(0,1]$.

However, not female-friendly firms do not allow female workers that learned to express their acquired potential. Formally, the output of such match in the first period stays $Y(e,f)$, while if such female workers were to move to a female-friendly firm f' they would produce $Y(\tau e, f')$. We label with P those matches in which promotions could take place, that is, all matches but those in which a female worker is employed in a not female-friendly firm.

[21] It is possible to assume a measure $M \in (0,1) \cap \mathbb{Q}$ of firms each posting $1/M$ jobs, and the same results would go through since there would still be a job for each worker.

[22] While we assume a particular production function, we refer the reader to Eeckhout and Kircher (2011) for a more general formulation, although in a model without promotions. If $Y^{-}(e,f) = \alpha e^{\theta}(1-f)^{\theta} + h(e) + g(f)$, then $Y_{ef} < 0$: this would induce negative sorting and reverse the predictions below.

[23] Assuming no asymmetric information, wages could be derived using Nash bargaining—such solution concept is not axiomatically justified when there is asymmetric information. Since agents cannot search but in period 2, wages would then be given by $Y_0(e,f)/2 + S(e,f)/2 + w^*(e) + c$ if there is no learning, where $S(e,f)$ is the surplus of the match in period 1 and the wage in the frictionless allocation. A similar expression would arise if there is learning. Even in that case, wages in period 0 would be increasing in own type in a given firm conditional on gender. This is all our identification strategy requires.

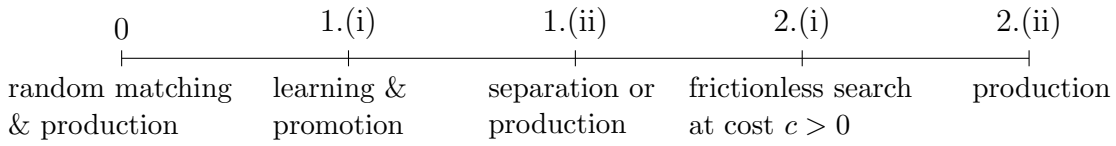

Figure 4: The timing of the model

In period 1, each pair can decide whether to stay together or to search for a better partner. Those pairs that decide not to stay together do not produce but search at a constant cost of c, as in Atakan (2006). They are then matched in period 2 according to the frictionless allocation. Wages in period 1 are determined by Nash bargaining.

In period 2, given e, which is equal to e_0 or τe_0 depending on whether the worker learned or not, wages in the frictionless allocation are given by

$$\max_e Y(e,f) - w_2(e). \tag{A-2}$$

Since $Y_e > 0$ and $Y_f > 0$, workers and firms can be ranked according to their productivity. Then, it is without loss of generality to index a worker by its *rank* in terms of productivity, i.e., by the fraction of workers that are less productive than her. Similarly, we can identify each firm by its rank in the distribution of firm productivity. This means that the distributions $\Gamma_1(\cdot)$ and $\Upsilon(\cdot)$ in the second period are both uniform on $(0,1)$.

The timing of the model is summarized in Figure 4.
The maximization problem in (A-2) yields[24]

$$w^\star(e) \;=\; \int_0^e \frac{\partial Y(\tilde{e},\mu(\tilde{e}))}{\partial e} d\Gamma_1(\tilde{e}) = \frac{\alpha}{2} e^{2\theta} + h(e), \tag{A-3}$$

and

$$\pi^\star(f) = \int_0^f \frac{\partial Y(\mu^{-1}(\tilde{f}),\tilde{f})}{\partial \tilde{f}} d\Upsilon(\tilde{f}) = \frac{\alpha}{2} f^{2\theta} + g(f).$$

A worker e who stays matched with a firm f receives in period 1 a wage equal to half of the surplus generated by the match, denoted by $S(e,f)$, plus his outside option, that is, the match in the instantaneous frictionless allocation net of the search cost. Hence,

$$w_1(e,f) \;=\; \frac{1}{2} S(e,f) + w^\star(e) - c \tag{A-4}$$

A pair will remain matched in period 1 if both the worker and the firm involved in the match prefer to stay together rather than face an holdout period, pay c and get matched with their optimal type in the frictionless allocation in period 2. In other words, the worker or the firm will not sever the match if the surplus generated $S(e,f)$ is positive.

[24]Since in period 2 firms' gender biases are realized, in the frictionless allocation female workers will get matched with female-friendly firms. The symmetry in the model ensures that there are always enough female friendly firms so that female workers who decide to search can always find such a firm.

This implies that match $(e,f) \in P$ will not be destroyed if $e \in A_1^P(f)$ where[25]

$$A_1^P(f) = \left[\left(f^\theta - 2\sqrt{\frac{c}{\alpha}} \right)^{1/\theta}, \bar{\bar{e}} \right], \tag{A-5}$$

and $\bar{\bar{e}} = \left(f^\theta + 2\sqrt{c/\alpha} \right)^{1/\theta} / \tau$. Hence it is more likely that a firm and worker do not leave their match if they are not too mismatched. A match $(e,f) \notin P$ denotes instead female workers employed in not female-friendly firms. Such matches will not be destroyed if $e \in A_1^{\neg P}$, where

$$A_1^{\neg P}(f) = \left[\left(f^\theta - 2\sqrt{\frac{c}{\alpha}} \right)^{1/\theta}, \bar{e} \right], \tag{A-6}$$

and $\bar{e} = \left[\alpha f^b + \sqrt{4\alpha c\tau + \alpha f^{2\theta}(1-\tau^2)} \right] / (\alpha\tau)$. Clearly $\bar{e} < \bar{\bar{e}}$: since female workers employed in not female-friendly firms do not get promoted, they are more likely to search due to more attractive outside options. Then, these observations immediately follow.

Remark 1 *Wages and (total or average) profits in period 1 are increasing in own type. Wages are non-monotonic in firm type.*

Proof of Remark 1 The surplus of a match (e,f) is

$$S(e,f) = \begin{cases} \alpha(\tau e)^\theta f^\theta - \frac{\alpha}{2}(\tau e)^{2\theta} - \frac{\alpha}{2} f^{2\theta} + 2c & \text{if } e \geq f \text{ and } (e,f) \in P, \\ \alpha e^\theta f^\theta - \frac{\alpha}{2}(\tau e)^{2\theta} - \frac{\alpha}{2} f^{2\theta} + 2c & \text{if } e \geq f \text{ and } (e,f) \notin P, \\ \alpha e^\theta f^\theta - \frac{\alpha}{2}(e)^{2\theta} - \frac{\alpha}{2} f^{2\theta} + 2c & \text{otherwise.} \end{cases} \tag{A-7}$$

Substituting (A-3) and (A-7) into (A-4), the following wage rate in period 1 results:

$$w_1(e,f) = \begin{cases} \frac{\alpha}{2}(\tau e)^\theta f^\theta + \frac{\alpha}{4}(\tau e)^{2\theta} - \frac{\alpha}{4} f^{2\theta} + h(e) + 2c & \text{if } e \geq f \text{ and } (e,f) \in P, \\ \frac{\alpha}{2} e^\theta f^\theta + \frac{\alpha}{4}(\tau e)^{2\theta} - \frac{\alpha}{4} f^{2\theta} + h(e) + 2c & \text{if } e \geq f \text{ and } (e,f) \notin P, \\ \frac{\alpha}{2}(e)^\theta f^\theta + \frac{\alpha}{4}(e)^{2\theta} - \frac{\alpha}{4} f^{2\theta} + h(e) + 2c & \text{otherwise,} \end{cases}$$

which is increasing in e and non-monotone in f. Then, since profits are what is left from production after paying the wage, we get

$$\pi_1(e,f) = \begin{cases} \frac{\alpha}{2}(\tau e)^\theta f^\theta - \frac{\alpha}{4}(\tau e)^{2\theta} + \frac{\alpha}{4} f^{2\theta} + g(f) + 2c & \text{if } e \geq f \text{ and } (e,f) \in P, \\ \frac{\alpha}{2} e^\theta f^\theta - \frac{\alpha}{4}(\tau e)^{2\theta} + \frac{\alpha}{4} f^{2\theta} + g(f) + 2c & \text{if } e \geq f \text{ and } (e,f) \notin P, \\ \frac{\alpha}{2}(e)^\theta f^\theta - \frac{\alpha}{4}(e)^{2\theta} + \frac{\alpha}{4} f^{2\theta} + g(f) + 2c & \text{otherwise,} \end{cases}$$

which is increasing in f. Since the boundaries of the acceptance set are increasing in firm's type, also mean payoffs conditional on being matched are increasing in agents' own types in the case of multi-worker firms. This concludes the proof of Remark 1. ■

Remark 1 implies that we can rank workers using their position in the wage distribution in a given firm. However, since wages are non-monotonic in firm type, it is not

[25] For sake of brevity, we are abstracting here from boundaries conditions resulting from the fact that for low types surplus might not exceed the total search cost of $2c$. In order to avoid keeping track of endogenous entry, we assume that agents will search even if that is the case.

possible from wage data alone to detect sorting (Eeckhout and Kircher, 2011).

On average, we can rank firms using profits. Since different firms might have different pools of workers, it could be that a good firm matched with bad agents has worse profits than a bad firm matched with a good agent. Nonetheless, the possibility of search puts bounds on the degree of mismatch that can arise, allowing for a correct ranking of firms. Hence, looking at job transitions it is possible to identify the sign and strength of sorting.

Given the acceptance sets of the different types of firms, we can now state the empirical predictions of the theoretical framework with regard to gender differences in sorting.

Proposition 1 *Assume production is given by (A-1), $\delta \in (\bar{\delta}, 1)$ and $\tau \in (1, \bar{\tau})$. Consider e_m and e_f such that e_m is male, e_f is female and $e_m = e_f = e$. Then,*
(i) the higher e in a given firm, the higher the probability of moving to a better firm;
(ii) the probability of moving to a better firm from a given firm for e_f with respect to $e_f - \Delta$ is higher than for e_m with respect to $e_m - \Delta$, for $\Delta > 0$;
(iii) the probability of being promoted in a given firm for e_m with respect to $e_m - \Delta$ is higher than for e_f with respect to $e_f - \Delta$, for $\Delta > 0$.

Proof of Proposition 1. The measure of workers that move from female friendly firms is given by

$$\int_0^1 \int_{e \notin A_1^P(f)} \delta \Gamma(e) d\Upsilon(f), \tag{A-8}$$

while the measure of female workers that move from not female-friendly firms is

$$\int_0^1 \int_{e \notin A_1^{\neg P}(f)} \frac{1}{2}(1-\delta) d\Gamma(e) d\Upsilon(f). \tag{A-9}$$

Since (A-8) is increasing in δ while (A-9) is decreasing in δ, there exist a $\bar{\delta}$ such that for all $\delta > \bar{\delta}$ all female workers moving from a not female-friendly firms can match with a female-friendly firm in the frictionless market.
Furthermore, it is easy to see from (A-5) that $\bar{\bar{e}}$ is always bigger than f, i.e., there will be some promotions, if $\tau < \bar{\tau}$, where $\bar{\tau} = \left(2\sqrt{c/\alpha}\right)^{1/\theta}$.
Inspecting (A-5) and (A-6), a worker moves to a better firm if $e > \bar{e}$ of $e > \bar{\bar{e}}$ depending on the firm type. So, result (i) follows. Furthermore, $\bar{e} < \bar{\bar{e}}$, so that (ii) and (iii) also follow. This concludes the proof. ■

In other words, female workers that improve their type through learning but are not promoted are more likely to move to better firms, while good male workers are more likely to be promoted in the firm where they are currently employed.