ISSN 1651-0852

FIEF Working Paper Series 2002

No. 184

Gender Differences in Job Assignment and Promotion in a Complexity Ladder of Jobs*

by

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Abstract

This paper studies gender differences in the allocation of workers across tasks of different complexity using panel data from a representative sample of Finnish metalworkers during 1990- 2000. Finnish metal industry data provide a continuous measure of the complexity of the worker's tasks that can be used to construct a complexity ladder of jobs. We study whether women have to pass a higher productivity threshold to be promoted to more complex tasks. Gender differences in promotion rates, duration to promotion, and productivity among promoted and not promoted workers are estimated. It is found that women move up the ladder less than men, women have to wait longer to get promoted, and that women are on average more productive than men in the groups of both promoted and not-promoted workers. These productivity differentials are not observed within tasks at the initial task assignment. We interpret this as evidence on higher female promotion thresholds.

Keywords: Careers; Job ladders; Job complexity; Gender and wages
JEL classification: J16; J24; J31

December 16, 2002

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*Work in progress. We thank Mahmood Arai, David Autor, Samuel Bentolila, Orietta Dessy, Andrea Ichino, °Asa Rosen, Corinna Schmidtke, Frank Vella, RudolfWinter-Ebmer as well as seminar participants Labour Institute for Economic Research (Helsinki), FIEF (Stockholm) for helpful comments. Previous versions of this paper were presented at ESPE 2002 Conference in Bilbao and EALE 2002 Conference in Paris.

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1 Introduction

The gender wage gap is a persistent phenomenon. Even in economies where the female participation rate has been relatively high for decades and where the experience on anti-discriminatory legislation is long, women tend to earn lower wages. An important part of the gender wage gap is explained by occupational segregation. It is common to find that when one controls for sufficiently narrow occupational and industrial categories, the gender wage gap is considerably reduced.[1] Hence, one of the key elements in understanding the gender wage gap is the asymmetric allocation of men and women across tasks.

This paper uses panel data on Finnish metalworkers to study gender differences in the allocation of workers across tasks of different complexity. Our aim is to find out whether the productivity thresholds that women need to pass to be promoted are higher than those of men. We address this question by examining how promoted and non-promoted women perform with respect to their male counterparts. This information is then used to infer whether the male and female promotion thresholds are different.

That women should meet higher productivity requirements to be promoted is an old argument and it has been theoretically formulated by Lazear and Rosen (1990). In

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[1]See for example Groshen (1991).

their model, the comparative advantage of women in non-market activities makes them more likely to quit. This means that the promotion of women is costly to the employer. Consequently, women have to be more productive than men to be promoted.

This result has strong implications. First of all, it is obvious that women will be less likely to be promoted than men. But if there are no systematic differences in the distribution of ability between men and women, this asymmetric promotion threshold also implies that, within tasks, women will be on average more productive than men after the promotion decision has taken place. Since the few women who have been promoted to more demanding tasks have passed a higher productivity threshold, they will of course be on average more productive than promoted men. On the other hand, the men that remain in less demanding tasks have failed to meet lower productivity requirements and are therefore on average less productive than the women who remain in the same task.

The previous empirical literature has almost exclusively concentrated on estimating gender differences in the probability of promotion.[2] There are studies that use data from nation-wide surveys like Winter-Ebmer and Zweimüller (1997) with Austrian census data, McCue (1996) with PSID, and Booth et al (2001) with British Household Panel Survey. Other authors have used data from a single industry or firm: Granqvist and Persson (2002) analyze gender differences in career mobility in the Swedish retail trade industry whereas Hersch and Viscusi (1996) focus on one US public utility and Jones and Makepeace (1996) study workers in a British financial institution. A special branch of literature are the studies on the career advancement of academics like Ginther and Hayes (1999) and McDowell et al (1999). The common finding is that women are less likely to be promoted, although some authors fail to find any significant gender differences.

In this paper, we directly address the question whether women have to be more productive than men to be promoted. To our knowledge, this has so far not been studied in the empirical literature. In fact, the productivity implications of the asymmetric promotion thresholds have been seen as an empirically problematic part of the theory. After all, it is very rare to find that women earn higher wages than men, even within narrowly defined tasks.

Our idea is to focus on workers who start their career in similar tasks and examine how the gender productivity differences among these workers are affected by the promotion process. If the promotion threshold really is higher for women, the relative productivity of women should improve as a result of the promotion process - both among workers who were selected to be promoted and among workers who remain in their initial tasks.

We believe that the Finnish metal industry data are exceptionally suitable for this kind of analysis. First of all, they provide a continuous measure of the complexity of the tasks of an individual worker that is valid for both within- and between-firm comparisons. In this industry, all the jobs are evaluated according to their complexity by an outside party, and, on the basis of this evaluation, a minimum wage is attached to each job. We use these minimum wages to construct a complexity ladder of jobs. Second, the panel nature of the data allows us to distinguish between initial task assignments and subsequent promotions. We can therefore compare workers who start their careers in similar kind of tasks. Finally, the data are rich on the information on different compensation schemes and bonuses based on performance evaluations, so that we do not have to rely on final wages only when measuring individual productivity.

The rest of the paper is organized as follows. In the following section, we augment the familiar Lazear and Rosen (1990) model with on-the-job learning in the style of Gibbons and Waldman (1999) and discuss the basic implications regarding probability of promotion, duration to promotion, and the gender productivity differences. In the third section,

[2] Booth et al (2001) and Hersch and Viscusi (1996) also estimate gender differences in the wage growth upon promotion. Both find that women gain less from promotion than men.

we discuss the data and the fourth section explains the construction of the complexity ladder of jobs. We then move on to study the movement of workers on the complexity ladder. In the fifth section we briefly replicate the standard analysis of gender differences in the probability of promotion. The most original analysis is reported in section 6. In that section, we use different measures of individual productivity to evaluate the relative performance of a given group of newly recruited men and women, both before and after the first promotion decisions have taken place. The results are strongly supportive of the asymmetric thresholds hypothesis. The seventh section concludes.

2 Theoretical background

A classic framework in which to think about gender differences in promotion outcomes is the model by Lazear and Rosen (1990). It is a model of optimal promotion decisions where promoted workers undergo costly training to learn the tasks which they are promoted to. Training costs play an important role in this model because workers cannot commit to staying in the firm. After the promotion decision has been taken, workers leave the firm if the value of their outside option exceeds the going wage. The training invested on leaving workers is lost.

Men and women are assumed to differ in their outside options. Because women have a comparative advantage in non-market activities, their outside options are better than those of men. Hence, women are more likely to leave the firm and the risk of losing the investment in training is higher when promoting a woman than when promoting men. This is why the productivity threshold of promotion is higher for women than for men.

Here we will briefly present the basic features of the Lazear and Rosen model allowing for human capital acquisition as in Gibbons and Waldman (1999). We then discuss the implications of the model regarding gender differences in promotion rates, duration to promotion, and productivity within tasks after the promotion decision.

2.1 Efficient promotions

Consider workers who enter the labour market with some level of innate ability. While working, they gradually acquire labour market experience that increases their effective ability. Denote the innate ability of a worker i with δ_i and the labour-market experience prior to period t with x_{it}. Following Gibbons and Waldman (1999), assume that the effective ability, η_{it}, of the worker is a function of innate ability and labour market experience: $\eta_{it} = \delta_i f(x_{it})$, where $f' > 0, f'' \leq 0$. Furthermore, assume that the initial task assignment is done solely on the basis of innate ability so that on average, within tasks, workers have the same ability when starting their career.

There are two tasks, A and B. Task A is more sensitive to worker's effective ability. We focus on workers who have been assigned to task B and assume a 3-period long working life. At period t all the workers are performing task B. At the end of the period the employer observes the effective ability of the workers and decides to select some workers for promotion to task A. In period $t+1$ all the workers remain in task B but the ones that are chosen to be promoted undergo costly training. In period $t+2$ the promoted workers are assigned to task A, while the rest of the workers stay in task B.

The output per worker at period t is $\eta_t = \delta f(x_t)$. At period $t+1$ the output of the workers chosen for training is reduced to $\gamma_1 \eta_{t+1} = \gamma_1 \delta f(x_t + 1)$, where $\gamma_1 < 1$, while the rest of the workers produce $\eta_{t+1} = \delta f(x_t+1)$. Finally, in period $t+2$ the promoted workers are assigned to the more productive task A where they produce $\gamma_2 \eta_{t+2} = \gamma_2 \delta f(x_t + 2)$ with $\gamma_2 > 1$. The workers who remain in task B in period $t+2$ produce $\eta_{t+2} = \delta f(x_t+2)$.

Lazear and Rosen assume that the workers are sure to remain in the firm at periods t and $t+1$. However, at period $t+2$ the workers are free to leave. Denote the value of non-market time with ω and assume that it has a cumulative distribution function $F(\omega)$. Naturally, the worker leaves at $t+2$ if the value of non-market time exceeds the going wage.

An efficient promotion rule should induce workers to remain in the firm if the market value of their output exceeds that of the non-market time. Furthermore, as there are no externalities in this setting, the rule should choose only those workers for promotion whose lifetime output is higher if promoted to more demanding tasks.

Social output for the workers who are chosen to be promoted to task A is equal to:

$$\delta f(x_t) + \gamma_1 \delta f(x_t+1) + \gamma_2 \delta f(x_t+2) \int_0^{\gamma_2 \delta f(x_t+2)} dF + \int_{\gamma_2 \delta f(x_t+2)}^{\infty} \omega dF \quad (1)$$

Correspondingly the social output for workers who remain on task B is:

$$\delta f(x_t) + \delta f(x_t+1) + \delta f(x_t+2) \int_0^{\delta f(x_t+2)} dF + \int_{\delta f(x_t+2)}^{\infty} \omega dF \quad (2)$$

The difference between (1) and (2) can be written as:

$$D(\delta, x_t) = -\delta f(x_t+1)(1-\gamma_1) + \int_{\delta f(x_t+2)}^{\gamma_2 \delta f(x_t+2)} F(\omega) d\omega \quad (3)$$

Workers are promoted to the task A if $D(\delta, x_t) > 0$ and they remain on task B if $D(\delta, x_t) < 0$. Hence, there is a promotion threshold that can be written as:

$$\delta f(x_t+1)(1-\gamma_1) = \int_{\delta f(x_t+2)}^{\gamma_2 \delta f(x_t+2)} F(\omega) d\omega \quad (4)$$

The promotion decision is a function of the effective ability of the worker. Thus for each level of labour-market experience there is an innate ability threshold of promotion, δ^*, and for each level of innate ability there is a labour market experience threshold of promotion, x_t^*.

2.2 Gender differences in outside options

Lazear and Rosen assume that the workers differ in their outside options according to gender so that the female distribution of the value of non-market time, $F_f(\omega)$, stochastically dominates that of men, $F_m(\omega)$. Write the distribution of the value of non-market time as $F(\omega;\alpha)$ where α is a shifter such that $\partial F/\partial \alpha > 0$. Define $F_f(\omega) \equiv F(\omega;\alpha_f)$ and $F_m(\omega) \equiv F(\omega;\alpha_m)$ and assume that $\alpha_m > \alpha_f$, which implies that $F_m(\omega) > F_f(\omega)$.

Differentiating (4) with respect to α at δ^* yields:

$$\frac{d\delta^*}{d\alpha} = \frac{\int_{\delta^* f(x_t+2)}^{\gamma_2 \delta^* f(x_t+2)} \frac{\partial F(\omega;\alpha)}{\partial \alpha} d\omega}{-\partial D(\delta^*, x_t)/\partial \delta}$$

which is negative since $\partial D(\delta^*, x_t)/\partial \delta > 0$. Thus α decreases the promotion threshold value of innate ability δ^* and because $\alpha_m > \alpha_f$ we have that $\delta_m^* < \delta_f^*$. So women need to have a higher level of innate ability than men in order to be promoted.

Similarly, differentiating with respect to α at x_t^* yields:

$$\frac{dx_t^*}{d\alpha} = \frac{\int_{\delta f(x_t^*+2)}^{\gamma_2 \delta f(x_t^*+2)} \frac{\partial F(\omega;\alpha)}{\partial \alpha} d\omega}{-\partial D(\delta, x_t^*)/\partial x_t}$$

which is also negative since $\partial D(\delta, x_t^*)/\partial x_t > 0$. Thus we have that $x_m^* < x_f^*$. Women also need a longer labour-market experience than men to be promoted.

2.3 Implications of gender differences in outside options

Gender differences in promotion thresholds have implications for promotion rates and the distributions of effective ability within tasks. First of all, it is straightforward to see that because women have to meet higher requirements to be promoted, they are on average less likely to be promoted. Thus, we should see that for each value of seniority women are less likely to be promoted and that in order to be promoted women need to acquire more seniority than men.

Second, the differential selection of men and women to promotion means that after the promotion decision has taken place the male and female distributions of effective ability will no longer be identical within tasks. To see this, consider a cohort of workers who are assigned to a given level of complexity and assume that some of them are promoted to a more complex task in the next year by counterfactually applying an identical threshold of effective ability for both men and women. To impose the differential threshold implied by the theory on these workers, we would have to move women from the low ability end of the group of promoted workers to the group of even lower ability workers that were not promoted. It is clear that the average ability of women would increase in both groups whereas the average ability of men would remain unchanged. Thus, the differential promotion threshold implies that women should be on average more productive both in the groups of promoted and not-promoted workers.

In the following sections, we analyze both of these implications with the Finnish metal industry data. We will first briefly replicate the familiar analysis of gender differences in the promotion rates. We then use a set of measures of individual productivity to study how the promotion process affects the gender differences in productivity.

3 The data

The data come from the wage records of the Confederation of Finnish Industry and Employers (*Teollisuus ja työnantajat*). The wage records contain detailed information on the wages and working hours of all the workers who are employed in a firm that is affiliated with the confederation. In the case of metal industry in Finland this covers practically all the firms in the industry.

The wage records' data on wages and working hours can be considered as exceptionally reliable since in principle the information comes directly from the firms' wage accounts. However, the information on the individual characteristics is rather scarce. Basically only age and gender can be identified from the raw data. Perhaps the most disturbing piece of missing information are the variables concerning family status and the number of children.

In the following analysis we will use a cross-sectional sample from 1990, that basically consists of every 15th worker in the 1990 metal industry worker population (5 167 workers), for the descriptive analysis. However, for the most part of the analysis we use a sample of all the observations from 1990-2000 on every 15th worker who was hired in the Finnish metal industry during 1990-1995. We chose to restrict the sample like this because for the analysis of the promotion patterns it is essential to observe the workers at their initial task assignments and follow them for a reasonable amount of years. This newcomer panel has 8 679 employee/year observations on 2 309 workers of whom 603 (26%) are women. We have 5 541 episodes where both current and next year's task are observed and the worker stays within the same firm. These episodes involve 1 482 individuals of whom 392 are women. In table 1 we present the 1990 descriptive statistics on this sample of workers for both men and women and compare them with the cross-section in 1990.

3.1 Wage determination in the Finnish metal industry

We restricted the sample to include only workers from the metal industry because the data on metal industry provide particularly interesting information on the complexity of the tasks of an individual worker. The reason for this is the peculiar wage determination mechanism in the Finnish metal industry. The employers and the trade union of the industry have established a procedure that provides information on the complexity of each job.

The general guidelines of the wage determination are set in the national level collective agreement that is negotiated between the central employer organisation and the trade union of the metal industry. According to the collective agreement wages should be determined by the complexity of the job, individual performance of the worker, and by various individual and firm-specific arrangements that lead to the final hourly wage.

The complexity of the job specifies a job-specific minimum wage for each worker. This minimum wage is called the *occupation-related wage.* Worker's individual performance affects the wage outcome through a *personal bonus* of 2 to 17% on top of the occupation-related wage. An individual firm has considerable scope to choose its wage levels as long as it stays above the minimum levels set by the collective agreement. It can choose from two wage schemes: fixed rates and piece rates.[3]

3.2 Job complexity

The complexity of the tasks is evaluated with a grading system that is similar to the ones used in large establishments in the US. The evaluation of the tasks is carried out by a group of specialists who consider various aspects of the jobs and assign them points according to their complexity. The complexity level is based on three criteria: 1) how long does it take to learn the tasks involved with the job, 2) what is the degree of responsibility involved with the job, and 3) what are the working conditions. The outcome of the evaluation should be independent of the characteristics of the workers performing the job and does not therefore change when the individual on the job changes.

What is special to the grading system used in the Finnish metal industry is the fact that this system is used in order to make the jobs comparable across firms. This is fundamental for the wage determination process since the same rules should be applied in all the firms in the industry.

Based on the evaluation of jobs, an occupation-related wage is determined for each job in the collective agreement. The more demanding the job, that is the more complexity points it gets, the higher is the corresponding occupation-related wage. Basically, there is a one-to-one mapping from the occupation-related wages to the complexity points. The occupation-related wages can therefore be interpreted as a continuous variable measuring the complexity of the job. In our data we cannot observe the original complexity points but for each worker we observe his or her occupation-related wage and we interpret this as a measure of the complexity of his or her tasks in the wage space. There are typically around 50 different levels of occupation-related wages per year.

4 Complexity ladder of jobs

Occupation-related wages order the tasks according to their complexity. In this paper we use this ordering of tasks as a job ladder where the movement from less to more complex tasks within the firm is interpreted as a promotion. Here we provide evidence which in our opinion justifies the use of occupation-related wages as a job ladder.

[3] In reality there is also a third wage scheme, reward rates, which are a combination of fixed and piece rates.

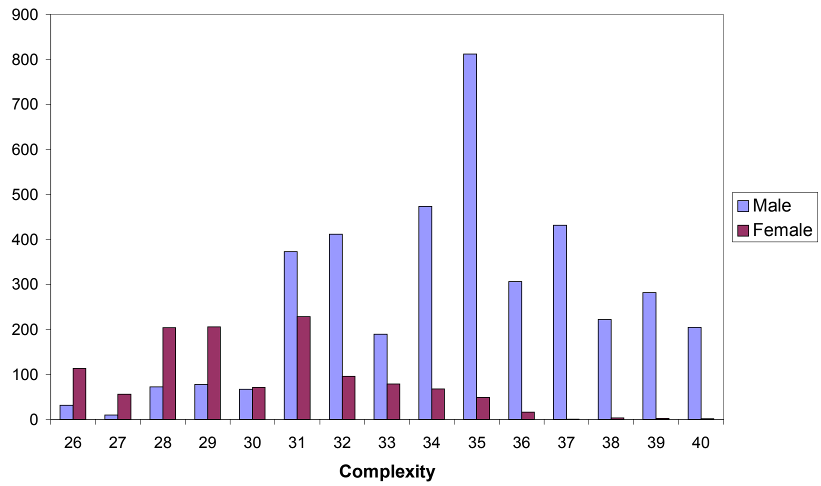

Figure 1: Allocation of workers across tasks of different complexity, 1990 cross-section

First of all, it is important to remember that we measure complexity in the wage space. After all, the occupation-related wages are a component of the final wage of the worker. This complicates the use of occupation-related wages as a measure of complexity. There may be some year-to-year variation in the occupation-related wages that does not reflect any real changes in the complexity of the tasks. All occupation-related wages are increased in the bargaining rounds between the Metalworkers' Union and the Industry's employer association with a general wage increase factor reflecting inflation and productivity growth. By analyzing the dynamics of occupation-related wages we are able to correct for these changes. After this correction the occupation-related wages correspond to real complexity in all the years.[4]

Figure 1 plots the allocation of male and female workers across complexity groups in the 1990 cross-section. The complexity groups were constructed by aggregating the occupation-related wages to integers. The figure reveals some important facts. First of all, it is obvious that this is a male-dominated industry. This makes the generalization of the results presented below somewhat tricky. In particular, we have to worry whether only very "bad" female workers self-select themselves to this industry. Actually, the striking difference between the male and female distributions of complexity seem to indicate that this is the case. Women are concentrated on the low end of the complexity axis while men are dominant in the more complex tasks. This highlights the importance of focusing on workers within similar kind of tasks, when studying gender differences.

Figure 1 is naturally a result of movements along the complexity ladder and initial task assignments. To separate these two factors, the figure 2 plots the distributions of newcomers in the 1990 cross-section. We interpret these observations as the initial task assignments of the workers. The same pattern is repeated here. Women tend to start in jobs of lower complexity than men.

Our aim is to study, whether advancing to more demanding tasks is more difficult for women than for men who start in similar tasks. To study this, we have to be sure that we can interpret the complexity levels as a real job ladder. After all, complexity could be an irrelevant attribute of the job and workers may move between tasks of different complexity

[4]The correction procedure is explained in detail in the appendix.

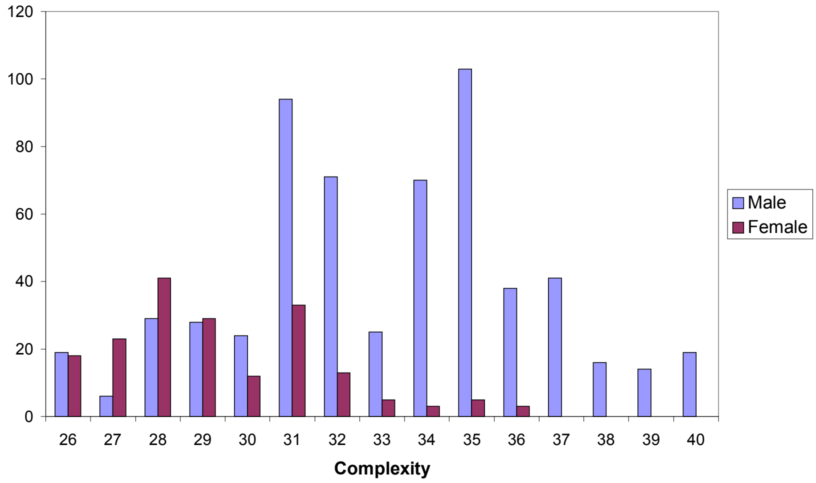

Figure 2: Allocation of workers across tasks of different complexity at the initial assignment, 1990 cross-section

without a clear pattern. This is why it is important to look at the patterns of job-to-job transitions. If complexity levels really are a true job ladder, the movements up and down this ladder should more or less correspond to the stylized facts concerning promotions and demotions. Basically we should see clearly more promotions than demotions and promotions should not to skip many levels.

Table 2 is a job-to-job transition matrix similar to the ones in Baker et al (1994) and in Treble et al (2001). It shows all the within-firm transitions between complexity groups including the entries, exits, and stays as percentages of movements from a complexity group to another between 1990 and 1991 cross-sections. Altogether 3 823 workers remained in the same firm during 1990-1991. In 1990, 782 workers entered the industry and 957 left it.

Shaded areas indicate the levels that were the most frequent destinations of the complexity-level movers. It is clear that most of the workers stay within the level they were assigned to. This is especially true at the higher end of the complexity axis. However, there are a considerable number of upward movements and these rarely leap over many levels. On the other hand, downward movement is rare. All in all, the information in table 2 seems to correspond more or less to the stylized facts regarding promotions and demotions. It seems appropriate to interpret the complexity axis as a job ladder.

5 Gender differences in promotion

We now use this complexity ladder of jobs to study gender differences in promotion patterns. If the promotion threshold is higher for women, we should see less women moving up the job ladder. In this section, we examine gender differences in the change of the complexity of the tasks as well as duration to promotion.

5.1 Change in complexity

An attractive feature of using the occupation-related wage as a measure of the complexity of tasks is that it is a continuous variable. A change in the occupation-related wage conveniently measures a change in the tasks of the worker. We interpret a positive within-firm change in the worker's occupation-related wage as a promotion and a negative change as a demotion. Furthermore, continuity allows us to measure the extent of promotions and demotions which would not be possible with a binary indicator of promotions commonly used in empirical studies.

In table 3 we present regression results that were obtained with our sample of newcomers who entered the metal industry during 1990-1995 and who are followed until 2000. This sample is particularly suitable for the analysis of promotion patterns because the complexity of each worker's initial task assignment can be observed.

In column 1, we simply regress the change in the logarithm of the worker's occupation-related wage on a gender dummy. There are no significant differences between the male and female sample means of change in complexity. The introduction of a set of controls for individual and firm characteristics as well as effort–related variables, in column 2, makes the coefficient on the female dummy slightly more positive. However, as soon as we introduce a control for the complexity of the worker's initial task assignment (i.e. logarithm of the worker's initial occupation-related wage and it's square) in column 3, the coefficient on female dummy is negative, -0.006, and clearly significant.

The results in the third column of table 3 do not account for the endogeneity of the initial task assignment. After all, according to the theoretical discussion above, the initial task assignments are done on the basis of initial ability that we do not observe. In table 4, we report the estimated coefficients of the female dummy from regressions within groups of initial task complexity, using the same set of controls as in the second column of table 3. The groups were constructed by aggregating the occupation-related wages of the initial task assignments to integers. If one is willing to assume that the initial ability is more or less fixed within groups of complexity of the initial task assignment, then the endogeneity problem should be alleviated in these regressions. As can be seen from table 4, the coefficient on the female dummy is negative and significant in almost all the groups where women are usually employed.

5.2 Duration to promotion

In order to study duration to promotion, we defined a promotion indicator that takes a value of one if the individual experienced a positive change in the occupation-related wage within the same firm and zero otherwise. Kaplan-Meier estimates of the survivor function (not reported here) showed that female survivor function was consistently above the male one and a straightforward log-rank test for the equality of the Kaplan-Meier estimates rejected the null with a p-value of 0.029.

In table 5, we present the results from the estimation of Cox proportional-hazards model of promotion, using the same co-variates as in the OLS analysis of the change in occupation-related wages in tables 3 and 4.[5] In column 1 we present results from a model that omits the complexity of the initial task assignment. The estimated coefficient on the female dummy is not significant. This situation changes once we control for the complexity of the initial task assignment in column 2. The coefficient of the female-dummy (-0.4) is clearly significant. In columns 3-5 of table 6 we estimate the proportional hazards model within subsamples where the workers were divided into "low-complexity", "medium-complexity", and "low-complexity" groups according to the complexity of their initial task assignment. Women have clearly lower hazards of promotion in the low and medium groups of initial task complexity.

We interpret the results presented in this section as implying that women are initially assigned to tasks where promotions are more frequent. However, compared to male

[5] We treated each seniority spell prior to promotion as an observation on a separate individual.

workers, who have been assigned to those same tasks, women's opportunities to advance to more complex tasks are clearly worse.[6] Women take, on average, clearly smaller steps on the complexity ladder than men who start in similar tasks. Furthermore, women have to acquire more years of seniority than men to move upwards on the complexity ladder.

6 Promotions and the gender productivity gap

Like many other authors, we find support for the claim that women are less likely to be promoted than men. As was discussed in the second section, there is also another way of looking at the asymmetric promotion threshold hypothesis, namely by comparing the relative performance of identical men and women before and after promotion.

Assuming that the initial ability distributions of newly hired men and women are identical, the asymmetric promotion threshold implies that on average women should be more able than men, both among the workers who are promoted and among those who are not. In the Lazear and Rosen model this means that women should earn higher wages than men in both of these groups. Such a "strong version" of the asymmetric promotion threshold hypothesis has, as far as we know, never been observed. It is easy to imagine that many intervening variables, such as firm-specific wage policies and eventual wage discrimination, make it difficult to design a reliable test for such a hypothesis, at least if inferences are to be made on the basis of wage data alone.[7] Furthermore, it is of course conceivable that the initial ability distributions do differ.

A reasonable but weaker version of the asymmetric promotion threshold hypothesis would say that average performance of women should improve *relatively* with respect to that of men after the promotions have taken place. Thus, if we could measure the productivity of all the new workers at their initial task assignment and then repeat this measurement after some of these workers have been promoted, women should have narrowed the productivity gap with respect to men among the workers that remain in their initial tasks as well as among the workers who have been promoted to new tasks. In this section, we use data on personal bonuses and final wage outcomes to examine these hypotheses.

6.1 Personal bonuses and promotions

In the Finnish metal industry the worker's personal achievement on the task should affect his or her wage through a personal bonus that is one of the components of the final wage. This personal bonus can vary from 2 % to 17 % of the occupation-related wage and it is assigned to the worker by his or her immediate supervisor. According to the collective agreement, the personal bonus should be determined by the worker's ability to cope with the requirements of the task and by the worker's output relative to what is considered ordinary in the task. Here, we use these bonuses as a measure of individual productivity.

Naturally, the use of subjective performance evaluations as productivity measures is problematic. For example, Harris and Holmström (1982) as well as Gibbons and Waldman (1999) criticize the use of such indicators because it is not clear what comparison group supervisor's use when evaluating individual workers. In general, the performance evaluations should always be conditioned on the job category and seniority.

However, we believe that in our case the use of personal bonuses as a productivity

[6]Not surprisingly, also results from more familiar probit-equations of promotion (not presented here) confirm this reasoning.

[7]Lazear and Rosen (1990, pp 120-121) find this particular prediction of their model to be "at odds with available evidence".

measure makes sense.[8] First of all, the spirit of the collective agreement is that personal bonuses should be based on relative comparisons within tasks. The intention is to avoid a situation where high bonuses would be paid only to workers in some tasks, such as high-complexity jobs where the most able workers are likely to work. Thus, one should observe workers at all levels of personal bonuses in all the tasks. Furthermore, bonus payments should not depend on the firm's external demand conditions but employers should use the whole scale of bonuses every year. Personal bonuses are not intended to be a way of profit-sharing that is done only in good years. To enforce these requirements, the collective agreement actually dictates that personal bonuses should be distributed symmetrically around the mean of 9.5% within tasks of similar complexity in the firm.[9] Thus, the performance evaluation in the Finnish metal industry is conditioned on the task. Second, our sample of workers who enter the metal industry during 1990-1995 makes it straightforward to compare workers within categories of actual seniority.

Our idea is to study whether men and women face different promotion thresholds by looking at the distributions of personal bonuses for a given group of new employees, both at the initial assignment and after an eventual promotion. More specifically, we selected the workers who enter the metal industry between years 1990-1995. Using the job ladder described above, we can then partition that set of workers into two subsets: those who have got a promotion up to some specific year (the "promoted" group) and those who have stayed at the initial assignment until that year (the "stagnant" group).

In table 6 we report the mean bonuses for workers in each of these groups. In the first row we display the mean bonuses of the new entrants during the first year. We see that men and women get approximately equal assessments during that initial year. The next row depicts the mean bonus of men and women as measured in the next career year, separately for those who were promoted after the initial year and those who were not. The following row depicts the mean bonuses two years after the initial assignment, similarly differentiated between those who had been promoted up to their third year of activity and those who were not; and analogously for the fourth row. The salient result in table 6 seems to be that the female bonuses dominate in both groups, precisely as we would expect if the female threshold is higher. The differences also tend to be statistically significant among the promoted workers.

In order to have a broader view on the distributions, we plot kernel estimators of the distributions of personal bonuses for men and women in figure 3, both at the initial task assignment and after 1 year of seniority, separately for stagnant and promoted workers.[10] The male and female distributions of personal bonuses are almost indistinguishable at the initial task assignment. However, after the first year the female distribution of personal bonuses is clearly shifted to the right with respect to the male distribution in the group of promoted workers.

Thus, personal bonus comparisons deliver a very clear message. If one is willing to accept bonuses as a measure of individual productivity, the results in table 6 and in figure 3 give support to the "strong version" of the asymmetric promotion threshold hypothesis: there are no significant productivity differences between men and women at the initial task assignment but women are more productive in absolute terms among promoted and

[8] Medoff and Abraham (1980) and Flabbi and Ichino (2001) defend the use of performance evaluation data by showing that in their cases high evaulations predict promotions. According to table 3 this seems to be the case here as well.

[9] To some extent, this is observed in the data. The distribution of bonuses does not change a lot from year to year and in large firms the bonuses are distributed more or less symmetricaly in tasks of similar complexity.

[10] The estimation was done using Epanechnikov kernel with a bandwidth of .025. Different bandwidths were tried without relevant changes in the qualitative results. The figures for 2, 3, and 4 years after the initial task assignment were very similar.

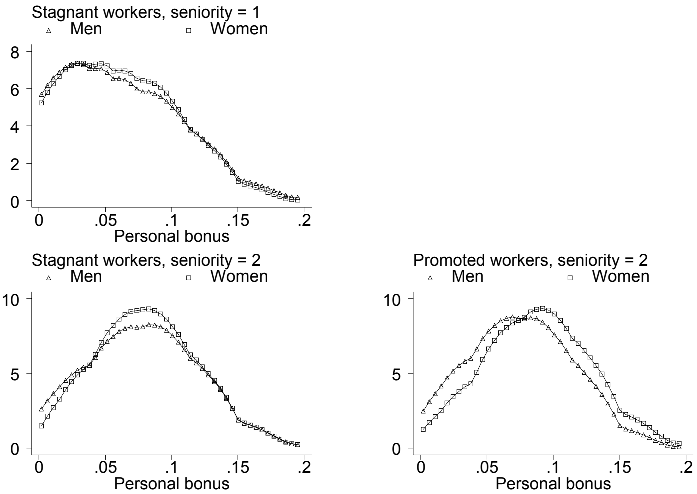

Figure 3: Kernel density estimates of the distribution of personal bonuses

non-promoted workers.

6.2 Hourly wage gap and promotions

As was explained in section 3, there is considerable variation in the final-hourly wages on top of the occupational-related wages and personal bonuses. Most of the workers earn hourly wages that are higher than the sum of the occupation-related wages and personal bonuses. It is obvious that this surplus in final wages is also affected by worker's individual productivity. This information can be used to provide additional evidence on the relationship of the gender productivity gap and the promotion process.

In order to use this variation in final hourly wages as a measure of individual productivity, we have to condition it on the tasks of the worker and on firm-specific factors, such as production technology and wage schemes. Thus, we calculate the difference between the final wage and the sum of the occupation-related wages and personal bonuses. The conditioning on the task is done by taking the ratio of this difference and the occupation-related wage. To account for firm-specific factors, we measure this ratio as a deviation from the firm-specific mean. We call this measure of productivity the *individual hourly wage surplus*.

Table 7 reports an analogous comparison to that of table 6, this time carried out for the individual fixed-rate hourly wage surpluses. We chose to use the fixed-rate wages as a performance measure, since the fixed-rate scheme is the most common wage scheme and most workers have positive fixed-rate hours.[11] In order to have a reliable estimate of the fixed-rate hourly wages for each worker, we left out of this comparison the workers who had very low number of hours (less than 50 per quarter) of fixed-rate work. Consequently, the selection of workers differs slightly from that of table 7.

The results in table 7 follow the same pattern as in table 6 with some interesting differences. At the initial task assignment women seem to perform worse with respect to the firm-mean than men. The promotion process decreases this gender gap in the stagnant group of workers and reverses the sign among promoted workers. The standard

[11] Unfortunately, there were not enough workers with positive piece-rate hours in this sample to conduct any meaningful comparison with piece-rate wages.

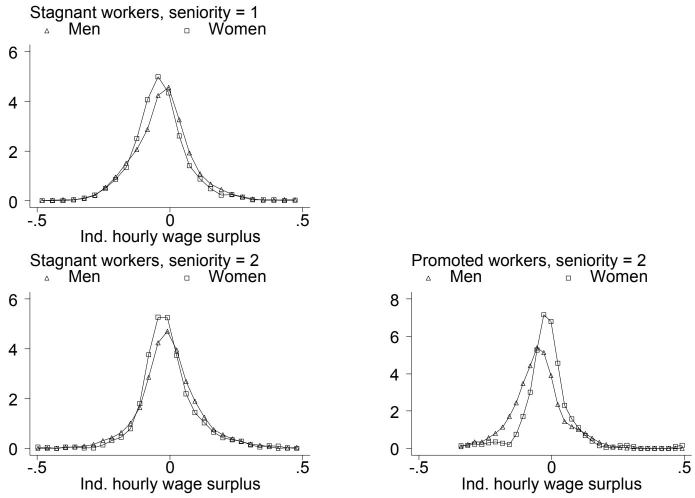

Figure 4: Kernel density estimates of the distribution of hourly wage surpluses

errors of the estimates of the differences are fairly large, so that we find significant gender differences only at some levels of seniority. However, it is important to note that the significant difference in favour of men at the initial task assignment is reduced to insignificant differences among the stagnant workers and reversed to significant or close to significant differences in favour of women in the group of promoted workers.

In figure 4, we plot the kernel estimates of the distributions of the hourly wage surpluses in the same way as in figure 3. These pictures tell a clearer story than the simple mean comparisons. The initial female distribution of hourly wage surpluses is to the left of the male one. However, after the promotion decision has been taken the female distribution seems to dominate that of men among the group of promoted workers, just as observed in the case of personal bonuses above.

We interpret these results as support for the "weak version" of the asymmetric promotion threshold hypothesis: women seem to perform worse at the initial task assignment but as a result of promotion process they catch up some of this difference in the stagnant group and overcome men in the promoted group.

6.3 Gender productivity gap and separations

Both of our individual productivity measures seem to indicate that women improve their relative position in the groups of promoted and not-promoted workers as a result of the promotion process. These results can be interpreted as evidence on asymmetric promotion threshold. Because women need to overcome a higher productivity threshold, they will be on average more productive both among the workers that are selected for promotion and the workers who remain in their previous tasks.

However, the type of gender differences in productivity seen above can also be generated by separations. If exceptionally productive male workers or unproductive female workers leave the firm after the first years of seniority, we would see similar gender differences in productivity as above. There are reasons to make such a case. Topel and Ward (1992), for example, show that the early careers of young men involve a number of separations that account for a significant part of the wage growth during these years. Productive male workers may receive better outside offers than women and leave the firm.

On the other hand, it is well known that female workers are less attached to the labour market. This problem may be particularly severe with a male-dominant industry such as ours. Thus, lower than average female workers may leave the industry altogether after the first years of seniority.

In our data we observe two kinds of movement away from the firms that can be used to check the robustness of the productivity gap results in tables 6 and 7: there are workers who leave the industry and workers who move from one firm to another within the industry.[12] Movement of the first type is much more common in our data with an incidence rate of 0.17 (0.16 for men and 0.19 for women). Firm-to-firm movement is relatively rare. The incidence rate is only 0.03. Curiously, the incidence of firm-to-firm movement is slightly lower for men, 0.029, than for women, 0.04.

In table 8, we present results from Cox proportional hazards models of leaving the industry and firm-to-firm movement. The co-variates are the same ones as in table 5 with fixed rate hourly wage surplus as an additional explanatory variable. Women seem to be slightly more likely to leave the industry, but there are no significant gender differences in movement between firms. Interestingly, our productivity measures - personal bonuses and the hourly wage surplus - do not have a significant on the overall likelihood of leaving, apart from the negative effect of hourly wage surpluses on the firm-to-firm movement.

However, the results in table 8 do not tell anything about the productivity of those male and female workers who decide to leave the metal industry or change firms within the metal industry. Ideally, we would like to know whether the productivity difference between staying and leaving workers is less negative or more positive among women than among men. We are thus interested in the gender difference in the productivity difference between staying and leaving workers. In tables 9 and 10 we examine these differences with respect to workers leaving the metal industry and workers who change the firm within the metal industry, using both personal bonuses and fixed hourly wage surpluses as measures of individual productivity.

In the panel A of table 9, we report the mean personal bonuses of workers who stay in the firm and who leave the metal industry before the next year and the difference between these workers among men and women. The last column reports the difference between the male and female differences. If productivity differences were driven by leaving workers, we would expect this number to be mostly negative and significant. Panel B reports a similar decomposition using the fixed rate hourly wage surpluses as a measure of productivity. The last rows of both panels report the total differences in the pooled data. The numbers in table 9 do not point to any systematic differences.

Table 10 reports the results from a similar decomposition, this time conducted with respect to workers who change firms within the metal industry. In this case, there is somewhat clearer pattern to the numbers. The productivity difference seems to be smaller between staying and changing men than among women. However, these differences are not statistically significant, apart from few cases.

We find it difficult to see the results in tables 9 and 10 as indicating that the selection of leaving workers could account for the consistent pattern in productivity differences among promoted and non-promoted workers reported in tables 6 and 7. There are some interesting differences in the productivity differentials of staying and leaving men and women but there is no consistent pattern that would imply that particularly productive men and unproductive women leave their jobs after the first few years of seniority. Finally, we repeated the comparisons in tables 6 and 7 with a group of workers who stayed with the same employer for at least four years. The results (not reported here) were qualitatively unchanged.

[12] Movement outside the industry involves workers who leave the labour force alltogether as well as workers who change the industry. Unfortunately, we cannot distinguish these two types of movements.

7 Conclusions

One of the most common explanations for gender differences in job assignments and promotion patterns is the comparative advantage that women have in non-market activities with respect to men. Because of this comparative advantage, female reservation wages are higher than the male ones and women have to meet higher productivity requirements than men to be promoted. This is the reasoning in the model of Lazear and Rosen (1990) discussed in the second section. If men and women in the same tasks have more or less same productivity initially, the differential promotion threshold implies that women will be less likely to be and that promoted and not-promoted women will be on average more productive than their male counterparts in the corresponding groups.

The Finnish metal industry data are exceptionally suitable for the analysis of promotions. They provide a task metric that is valid for both within and between firm comparisons and that is linked to the actual task contents. Furthermore, the data provide variables that can be used to study the productivity implications of the asymmetric promotion process.

We find that women are allocated in less complex tasks than men. This difference is clearly visible already at the initial task assignment. Furthermore, women are promoted less often than men. This result holds both when we measure the promotion as a continuous variable and as a binary variable. Thus, women move up the complexity ladder less than men who start on similar kind of tasks. Furthermore, the results from proportional-hazards models imply that women have to wait longer in order to move up at all.

Promoted women are on average more productive than promoted men. This results holds if we use either performance evaluations or final hourly wages as a measure of individual productivity although the significance of the differences vary. Furthermore, there is some evidence that women tend to be on average more productive in the group of not-promoted workers as well. We interpret these results as supporting the hypothesis that women face a higher promotion threshold than men.

All in all, these results seem to indicate that women have to pass higher productivity thresholds to be promoted. What the results also highlight is the importance of the initial task assignments. On average, the gender differences are not at all clear in these data. It is only when the initial task assignments are controlled for that gender differences arise. Typically job outcomes are results of both initial assignments and subsequent promotions. We believe that the ability to distinguish between these two phenomena is important when studying gender differences in promotion patterns.

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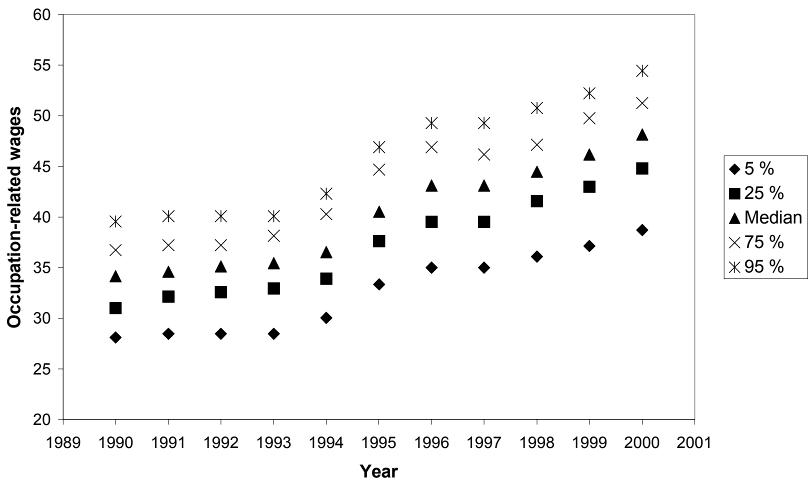

Figure 5: Yearly distributions of occupation-related wages 1990-2000

8 Appendix

The problem with using occupation-related wages as a measure of the complexity of the tasks is that they are increased in some years by general growth factor that is not related to real changes in tasks. Figure A1 plots the yearly distributions of occupation-related wages and reveals that in some years the whole distribution of the occupation-related wages shifts. It is clear that complexity of the tasks cannot undergo such changes. Thus, in order to use the occupation-related wages as measure of the complexity of the tasks we need to clean away these changes.

We corrected the occupation-related wages from this kind of changes by constructing two year samples of workers who (i) were present in both years t and $t+1$, (ii) who did not change their occupational code, (iii) and who did not change the firm between the two years. Thus, we ended up with 10 separate samples of workers with two observations per worker in each. The idea of this was to have samples of workers who remained in the same tasks in years t and $t+1$ and to observe the changes in their occupation-related wages.

We grouped the workers in each two-year sample according to their occupation-related wages in year t and analyzed the distributions of year-to-year changes in occupation-related wages of each group. This analysis revealed that for the most of the workers within a group the year-to-year changes in occupation-related wages were identical. Thus, we interpreted the group mode of the change of occupation-related wage as the increase in occupation-related wage that is not related to changes in the tasks. All the rest of the changes were interpreted as a change in tasks.

The occupation-related wages were then corrected in order to make them correspond to complexity by substracting from each occupation-related wage the mode of the change of the occupation-related wage of the workers with the same value of occupation-related wage. Figure A2 plots the yearly distributions of the corrected occupation-related wages.

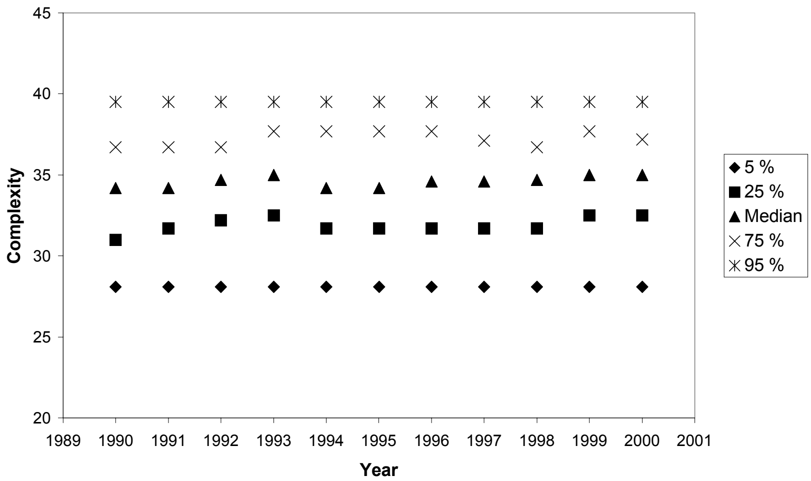

Figure 6: Yearly distributions of complexity 1990-2000

Table 1 Descriptive statistics

Variable	Men in our sample		Women in our sample		Men in 1990 cross-section		Women in 1990 cross-section	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Age	30.72	10.96	33.06	9.90	37.45	10.22	40.19	10.28
Complexity	33.05	3.24	29.69	2.72	35.17	3.08	30.50	2.58
Bonus	0.06	0.05	0.06	0.05	0.09	0.04	0.09	0.04
Fixed-rate wage	40.34	7.31	33.89	4.90	45.15	12.38	36.63	5.38
Piece-rate wage	50.57	12.32	37.93	6.04	53.45	11.98	41.68	6.09
Share of piece rate	0.36	0.43	0.34	0.42	0.48	0.45	0.47	0.44
Share of overtime	0.04	0.07	0.02	0.04	0.04	0.06	0.02	0.04
Individuals	1 706		603 (26%)		3 969		1 198 (23%)	
Ind/year observations	8 679							

Our sample consists of all the observations during 1990-2000 on approximately every 15th who enters the metal industry during 1990-1995. The descriptive statistics are 1990 means and standard deviations. 1990 cross-section consists of every 15th worker workers in the metal industry population in 1990. Complexity refers to the occupation-related wage in FIM 1990. Bonus is reported as a proportion of occupation-related wage. Fixed-rate and piece-rate wages are hourly wages in the corresponding schemes in FIM 1990. Share of piece rate is the proportion of total hours worked in the piece rate scheme and the share of overtime similarly for overtime hours.

Table 2 Transition matrix between jobs for newcomers in the metal industry, 1990-1991

	Exit	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	Total	N
Entry		4,7	3,7	9,0	7,3	4,6	16,2	10,7	3,8	9,3	13,8	5,2	5,2	2,0	1,8	2,4	100	782
26	34,8	52,2	0,7	9,4	0,7	.	0,7	1,4	.	.	.	.	.	.	.	.	100	138
27	37,5	1,6	46,9	6,3	.	.	4,7	.	.	.	3,1	.	.	.	.	.	100	64
28	30,7	1,2	0,4	59,5	3,1	1,2	1,9	0,8	.	0,4	0,4	0,4	.	.	.	.	100	257
29	27,7	0,4	.	1,5	63,8	0,4	3,3	2,6	.	0,4	.	.	.	.	.	.	100	271
30	28,9	.	.	0,7	.	59,3	7,4	.	2,2	.	1,5	.	.	.	.	.	100	135
31	26,9	.	0,2	0,4	1,3	0,2	62,1	4,9	1,6	1,6	0,4	0,2	0,4	.	.	.	100	554
32	23,2	.	.	.	0,4	0,2	1,9	62,3	0,8	8,5	1,9	.	0,8	.	.	.	100	483
33	17,3	.	.	.	.	0,8	0,8	.	74,0	0,8	2,8	3,1	.	0,4	.	.	100	254
34	18,5	.	.	.	.	.	0,6	2,2	.	66,6	9,5	0,4	1,6	.	0,6	.	100	497
35	16,7	.	.	0,1	0,1	0,1	0,1	0,5	1,0	2,6	68,4	2,8	6,0	0,5	0,9	0,1	100	797
36	16,9	.	.	.	.	.	0,4	.	0,4	.	4,6	72,2	.	4,6	0,4	0,7	100	284
37	12,9	.	.	.	.	.	0,7	0,2	.	2,0	7,4	.	72,3	0,2	4,2	.	100	404
38	10,8	.	.	.	.	.	.	.	.	.	1,0	2,1	.	82,5	.	3,6	100	194
39	10,2	.	.	.	.	.	.	.	.	.	1,1	.	6,8	.	81,8	.	100	264
40	7,6	.	.	.	.	.	.	.	0,5	.	2,2	1,6	.	2,7	1,6	83,7	100	184
Total	20,0	1,6	0,7	3,7	4,0	1,9	8,2	7,4	4,5	8,7	14,0	5,1	7,8	3,8	5,2	3,4	100	4780

Shows all transitions between complexity levels, including entry, exit, and stays from 1990 to 1991, as percentage of movements from a complexity level to another. Aggregating occupation-related wages into integers creates complexity levels. Shaded cells indicate the level that was the most frequent destination of the complexity level moves. Numbers in boxed cells indicate stays within a complexity level. Zeros denote nonempty cells that round up to zero and "."s denote empty cells.

Table 3 Change in complexity – regression results

Variable	(1)	(2)	(3)
Female	.0009	.0021*	-.0061**
	(.0012)	(.0012)	(.0015)
Age/10	-	-.0135**	-.0071*
		(.0041)	(.0041)
$(Age/10)^2$	-	.0013**	.0006
		(.0005)	(.0005)
Seniority/10	-	-.0379**	-.0423**
		(.0125)	(.0125)
$(Seniority/10)^2$	-	.0276**	.0306**
		(.0122)	(.0122)
Newcomer	-	.0203**	.0197**
		(.0033)	(.0032)
Newcomer x bonus	-	-.2076**	-.1917**
		(.0364)	(.0353)
Bonus	-	.0368**	.0485**
		(.0164)	(.0163)
Piece rate share	-	-.0005	-.0015
		(.0011)	(.0011)
Overtime share	-	.0057	.0106
		(.0072)	(.0073)
Firm-size	-	.0000	.0000
		(.0000)	(.0000)
Initial task complexity	-	-	-.3769
			(.3109)
$(Initial task complexity)^2$	-	-	.0446
			(.0443)
Constant	.0101	.0425**	.8023
		(.0077)	(.5450)
R^2	.0001	.0550	.0785
N	5 541	5 541	5 541

Dependent variable is the difference between log of the occupation-related wage in the next period and the log of the occupation-related wage at the current period. Seniority measured as number of years that individual has been present in the metal industry. Newcomer is a dummy that takes value one at the first observation on individual. Personal bonus is measured as a proportion of occupation-related wage. Piece-rate share is measure as a ratio of hours worked on piece rate. Overtime share is the ratio of hours worked on overtime. Initial task complexity is the log of the occupation-related wage at the initial task assignment. Numbers in parenthesis are robust standard errors.

Table 4 Change in complexity – Regression results from within initial task complexity-groups regressions

Initial task complexity-group	Coefficient on gender dummy	Observations	Percentage of women
26	-.0189** (.0064)	304	62%
27	.0064 (.0164)	111	71%
28	-.0106** (.0038)	608	62%
29	-.0080** (.0046)	295	46%
30	-.0098** (.0038)	240	46%
31	-.0026 (.0030)	904	25%
32	-.0068** (.0029)	704	15%
33	.0002 (.0038)	462	15%
34	-.0126** (.0033)	410	7%
35	-.0033 (.0024)	720	6%
36	.0033 (.0048)	249	6%
37	.0104** (.0035)	239	2%
38	-	88	0%
39	-	147	0%
40	.0084 (.0085)	54	3%

The numbers in the second column are the estimated coefficients of the female dummy from within group regressions of the within firm change of the logarithm of the occupation-related wages on gender dummy and the same set of co-variates as in the second column of table 3. The groups were constructed by aggregating the occupation-related wages of the workers' initial task assignments to integers. The third column reports the sample size of each regression, and the fourth column reports the percentage of female workers in each group.

Table 5 Duration to promotion – Cox proportional hazards estimates. The newcomer sample.

Coefficients

Variable	(1)	(2)	(3) Low-complexity	(4) Medium-complexity	(5) High-complexity
Female	-0.0951	-0.3444**	-0.3114**	-0.5319**	0.2838
	(0.0820)	(0.0922)	(0.1278)	(0.1564)	(1.6338)
Age/10	0.0980	0.3311	0.7076	0.1974	-1.1017
	(0.2768)	(0.2811)	(.4781)	(0.3795)	(1.1604)
$(\text{Age}/10)^2$	-0.0478	-0.0697**	-0.1162	-0.0576	0.1045
	(0.0401)	(0.0407)	(.0708)	(0.0552)	(0.1525)
Newcomer	0.8290**	0.8648**	1.1070**	0.8019**	1.7439
	(0.1569)	(0.159)	(0.2846)	(0.2023)	(1.1701)
Newcomer x bonus	-6.3888**	-5.2341**	-5.1281	-5.8855**	-4.7979
	(1.8300)	(1.8368)	(3.2456)	(2.3636)	(8.2482)
Bonus	1.1588	1.3772	2.2989	1.0822	0.2083
	(1.3160)	(1.3178)	(2.4568)	(1.6696)	(4.9398)
Piece rate share	-0.0018	-0.0497	0.2324	-0.2165	0.4085
	(0.0739)	(0.0743)	(0.1411)	(0.0951)	(0.3188)
Overtime share	0.4055	0.5458	-0.3185	0.2962	3.4089**
	(0.5201)	(0.5094)	(1.1637)	(0.6256)	(1.4357)
Firm-size	0.0060**	0.0081**	0.0084	0.0050	0.0071
	(0.0027)	(0.0027)	(0.0059)	(0.0033)	(0.0109)
Initial task complexity	-	111.4668**	-	-	-
		(23.6588)			
$(\text{Initial task complexity})^2$		-16.5119**	-	-	-
		(3.4223)			
N	5 624	5 624	1 589	3 232	803

Estimates from a proportional-hazards model of a positive change in log occupation-related wage. Newcomer is a dummy that takes value one at the first observation on individual. Personal bonus is measured as a proportion of occupation-related wage. Piece-rate share is measured as a ratio of hours worked on piece rate. Overtime share is the ratio of hours worked on overtime. Initial task complexity is the log of the occupation-related wage at the initial task assignment. Numbers in parenthesis are standard errors. Low complexity group consists of workers whose initial task complexity was not higher than 30. Medium complexity group consists of workers whose initial task complexity was between 30 and 35. High complexity group consists of workers whose initial task complexity was higher than 35.

Table 6 Personal bonus means in the groups of promoted and not-promoted workers

	Stagnant men	Stagnant women	Difference	Promoted men	Promoted women	Difference
First assignment	.053	.053	.000	-	-	-
	(n=1 706)	(n=603)	(.002)			
After 1 year	.074	.079	-.005*	.073	.086	-.013**
	(n=851)	(n=308)	(.003)	(n=292)	(n=101)	(.004)
After 2 years	.081	.088	-.007**	.081	.088	-.008**
	(n=546)	(n=199)	(.003)	(n=308)	(n=100)	(.004)
After 3 years	.087	.091	-.004	.084	.096	-.012**
	(n=402)	(n=148)	(.008)	(n=265)	(n=97)	(.004)
After 4 years	.091	.093	-.002	.089	.102	-.013**
	(n=300)	(n=103)	(.004)	(n=253)	(n=100)	(.004)

Stagnant refers to the group of workers that are not promoted. The second row reports the average bonuses of men and women at the initial task assignment. In the rows 3-6 these workers are split into two groups according to whether they were promoted or not and the means of bonuses are reported for each group. N refers to the sample size of the cell.

Table 7 Final fixed-rate wage surplus as deviations from firm-specific means in the groups of promoted and not-promoted workers

	Stagnant men	Stagnant women	Difference	Promoted men	Promoted women	Difference
First assignment	-.027	-.048	.021**	-	-	-
	(n=1 168)	(n=379)	(.006)			
After 1 year	-.003	-.017	.015	-.053	-.029	-.024
	(n=553)	(n=168)	(.009)	(n=180)	(n=51)	(.016)
After 2 years	-.006	-.019	.013	-.044	-.022	-.022
	(n=344)	(n=107)	(.011)	(n=181)	(n=48)	(.015)
After 3 years	.002	-.019	.022*	-.025	.002	-.027*
	(n=248)	(n=86)	(.012)	(n=163)	(n=54)	(.015)
After 4 years	.021	.009	.012	-.033	.007	-.040**
	(n=177)	(n=63)	(.013)	(n=150)	(n=64)	(.011)

Stagnant refers to the group of workers that are not promoted. The second row reports the average ratio of final fixed-rate hourly wage and the sum of occupation-related wage and bonus as a deviation from firm mean for men and women at the initial task assignment. In the rows 3-6 these workers are split into two groups according to whether they were promoted or not and the means of final fixed-rate wage surpluses as deviations from firm means are reported for each group.

Table 8 Duration to industry and firm-to-firm exit – Cox proportional hazards estimates. The newcomer sample.

Coefficients

Variable	Industry exit	Firm-to-firm movement
Female	0.1623*	0.0575
	(0.0869)	(0.2233)
Age/10	-0.5831**	0.7219
	(0.2537)	(0.6532)
$(Age/10)^2$	0.0770**	-0.0818
	(0.0352)	(0.0895)
Newcomer	0.1157	-0.1145
	(0.4018)	(0.5326)
Newcomer x bonus	1.9749	3.8152
	(1.7260)	(4.3610)
Bonus	-0.6575	-1.7997
	(1.2715)	(3.2502)
Hourly wage surplus	0.2206	-1.4126*
	(0.2851)	(0.7643)
Piece rate share	-0.0855	0.2008
	(0.0858)	(0.2095)
Overtime share	0.3520	0.6002
	(0.4896)	(1.2116)
Firm-size	-0.0098**	-0.0338**
	(0.0035)	(0.0114)
Initial task complexity	-0.1513	-0.4475
	(0.3793)	(0.9740)
N	4 941	4 408

Estimates from a proportional-hazards model of a worker leaving the metal industry and worker moving from one firm to another within the metal industry. Newcomer is a dummy that takes value one at the first observation on individual. Personal bonus is measured as a proportion of occupation-related wage. Piece-rate share is measured as a ratio of hours worked on piece rate. Overtime share is the ratio of hours worked on overtime. Initial task complexity is the log of the occupation-related wage at the initial task assignment. Numbers in parenthesis are standard errors.

Table 9 Productivity comparisons of workers who stay in the firm and workers who leave the metal industry

Panel A. Differences in Personal Bonuses

	Staying men	Exiting men	Difference among men	Staying women	Exiting women	Difference among women	Male-female Dif-in-Dif
First assignment	.056	.047	.009** (.002)	.058	.047	.011** (.003)	-.002 (.004)
After 1 year	.076	.069	.008** (.003)	.081	.080	.001 (.004)	.007 (.005)
After 2 years	.083	.076	.007** (.003)	.091	.085	.006 (.004)	.001 (.006)
After 3 years	.086	.085	.001 (.004)	.098	.081	.017** (.005)	-.016** (.006)
After 4 years	.090	.086	.005 (.004)	.097	.095	.002 (.007)	.002 (.007)
Total	.081	.063	.018** (.001)	.086	.068	.018** (.002)	.000 (.002)

Panel B. Differences in Hourly Wage Surpluses

	Staying men	Exiting men	Difference among men	Staying women	Exiting women	Difference among women	Male-female Dif-in-Dif
First assignment	-.027	-.023	-.004 (.007)	-.045	-.046	.001 (.009)	-.005 (.013)
After 1 year	-.017	-.014	-.002 (.009)	-.022	-.020	-.001 (.012)	-.001 (.017)
After 2 years	-.022	-.019	-.002 (.010)	-.020	-.019	-.002 (.016)	-.001 (.021)
After 3 years	-.010	-.038	.028** (.013)	-.010	-.022	.012 (.015)	.017 (.022)
After 4 years	-.012	.010	-.022* (.013)	.005	.011	-.006 (.016)	-.016 (.023)
Total	-.017	-.019	.003 (.004)	-.017	-.028	.012** (.005)	-.009 (.007)

Staying refers to workers who stay in the firm in the following year. Exiting refers to workers who leave the industry between the current and the following year. Male-female Dif-in-Dif refers to the difference between 4th and 7th columns.

Table 10 Productivity comparisons of workers who stay in the firm and workers who change firms in the metal industry

Panel A. Differences in Personal Bonuses

	Staying men	Changing men	Difference among men	Staying women	Exiting women	Difference among women	Male-female Dif-in-Dif
First assignment	.056	.059	-.003 (.004)	.058	.046	.012 (.008)	-.015* (.009)
After 1 year	.076	.070	.006 (.005)	.081	.080	.001 (.007)	.005 (.009)
After 2 years	.083	.085	-.002 (.007)	.091	.060	.031** (.010)	-.033** (.013)
After 3 years	.086	.088	.002 (.008)	.098	.085	.012 (.010)	-.014 (.013)
After 4 years	.090	.088	.002 (.008)	.097	.095	.002 (.016)	-.001 (.017)
Total	.081	.072	.009** (.003)	.086	.070	.017** (.004)	-.007 (.005)

Panel B. Differences in Hourly Wage Surpluses

	Staying men	Changing men	Difference among men	Staying women	Changing women	Difference among women	Male-female Dif-in-Dif
First assignment	-.027	-.060	.034** (.013)	-.045	-.089	.044** (.020)	-.011 (.027)
After 1 year	-.017	.013	-.030 (.020)	-.022	-.002	-.019 (.024)	-.010 (.034)
After 2 years	-.022	-.059	.037 (.024)	-.020	-.022	.002 (.037)	.036 (.049)
After 3 years	-.010	-.051	.042 (.031)	-.010	.027	-.037 (.055)	.077 (.074)
After 4 years	-.012	-.016	.004 (.027)	.005	-.002	.008 (.050)	-.003 (.064)
Total	-.017	-.040	.024** (.008)	-.017	-.044	.027** (.012)	-.003 (.016)

Staying refers to workers who stay in the firm in the following year. Changing refers to workers who change the firm within the industry between the current and the following year. Male-female Dif-in-Dif refers to the difference between 4th and 7th columns.

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