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Who moves up the career ladder? A model of gender differences in job promotion*

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Abstract

This paper presents an adverse selection model that contributes to explain why women are less likely to be promoted. There are two types of workers: family-committed and job-committed workers. The cost of job effort during the first period of the working life is higher for the former. Firms offer two types of contract, one involving high effort during the first period with promotion possibilities and the other requiring low effort but with no opportunity for promotion attached. We show that women are less likely to apply for jobs with promotion possibilities, but when they do, women are just as likely to succeed as men.

Keywords: Gender Discrimination, Promotions, Asymmetric Information, Status Concerns.

JEL Classification: D82, J71

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1 Introduction

The fact that women are underrepresented in higher level jobs in relation to men has received a great deal of attention in the literature. The Catalyst Census reports that in 2008 only 15.2% of the corporate officers on Fortune 500 were women. Women find it particularly difficult to move up the ladder in law firms and academic institutions. For example, Rhode (2001) finds that "women in the legal profession remain underrepresented in positions of greater status, influence and economic reward. They account for only 15% of federal judges and law firm partners, 10% of law school deans and 5% of managing partners of large firms"[1]. Recently, Goldin and Snowdon (2007) show the difficulty that women still find to be promoted in academia. These disparities reflect differences in job promotion patterns between men and women and help to explain the well documented gender wage gap (for OECD member countries, the average wage gap was 17% in 2007)[2].

While disparities at the upper levels of many professions are easy to document, the reasons behind them remain unclear. There are few papers that provide theoretical models which account for gender differences in promotion patterns. The seminal paper by Lazear and Rosen (1990) pointed out that fewer women than men are promoted because the ability standard for promotion is higher for women. As women leave the labour market more often than men, because they have better non-market opportunities at home, firms find it more difficult to recover the investment in firm training. In order to compensate this, firms demand higher ability levels from women to promote. Nonetheless, promoted women gain higher average wages than men because the average promoted women have higher ability. Milgron and Oster (1987) argue that employers discriminate against talented Invisibles in promotion. There is a relative lack of recognition for disadvantaged workers (Invisibles) due to misperceptions or cultural taboos. Invisibles include women. Booth et al. (2003) presents a model where promotion is based on the acquisition of specific human capital and women are promoted as men are, but after promotion women may receive smaller wage increases. Women earn lower wages because (i) external discrimination: they have worse outside opportunities than men if they leave the firm; or (ii) internal discrimination: firms may respond differently to outside offer threats from women and men due to discrimination.

The model that we present have some different implications for gender differences in promotion rates and wages after promotion to those mentioned above. More specifically, we propose a model where: (i) women, on average, are promoted less than men; (ii) more women than men occupy jobs without promotion possibilities; (iii) when women are placed in jobs with promotion possibilities, their promotion rate is the same as men's; and (iv) the wages after promotion is the same for men and women. The model formalizes the "dead-end" explanation for gender differences in promotion: women are promoted less frequently to higher hierarchical levels, because women are in dead-end jobs that offer fewer

[1] See this study for references on evidence from the legal profession.
[2] OECD Employment Outlook, 2008.

opportunities for promotion (Groot et al. 1996). The reason why women occupy jobs with less promotion possibilities in our model results from women's choice between the types of contracts that a firm optimally offers.

The traits of the model and the main results that we present are loosely as follows. There are two types of preferences among workers, job-committed and family-committed preferences. The difference between them is that the marginal cost of effort is higher for family-committed workers during the first period of their working life. As a way to capture social norms, it is assumed that among men there are more job-committed workers than among women. Following Becker (1985), greater commitment on behalf of women to child care and housework can affect the effort they make on the job. Preferences are private information, so the employer cannot identify what type the applicant is. Firms face an adverse selection problem.[3] Nonetheless, the difference in the cost of effort only exists during the first period of a worker's lifetime, that is, this difference disappears when child rearing is over and family care requires less effort We divide the working life into two periods. In this context, a firm designs a contract menu that allows these two types of workers to be screened for, by offering two types of jobs: one with a chance of promotion that entails a high level of effort during the first period and another without this opportunity, but requiring a low level of effort. If the optimal contract under perfect information where offered, the types with a lower disutility of effort will have an incentive to mimic those who suffer a greater disutility, in order to obtain a larger utility. As in any standard screening model, distortions in effort are introduced in order to reduce agents' informational rents. We introduce the possibility that firms use promotion incentives to reduce the monetary value of informational rent.

Promotion in our model will imply both monetary and non-monetary rewards. Promoted workers will have higher wages than non-promoted workers) and, as a prize, promotion confers status. As in Besley and Ghatak (2008), we assume that the value of status is negatively correlated to the proportion of promoted workers. Status has no value if everybody is promoted. The introduction of status concerns related to promotion is a relevant aspect of our model (as most papers on promotion do not take into account non-monetary rewards), which incorporates some ideas of recent papers by Fershtman et al. (2006) and Besley and Ghatak (2008) who analyze the influence of status concerns on the effort made on the job. We will show that the introduction of promotion incentives yields higher profits for the firm.

The paper proceeds as follows. Section 2 presents the related literature with our analysis. Section 3 describes the basic model of adverse selection and the equilibrium that provides the intuition for the model presented in Section 4. Section 4 includes the adverse selection problem with promotion incentives and presents the main results. In section 5, the models with and without promotion incentives are compared. In section 6, we convert the model's main results into implications for gender differences in promotion patterns. Finally, the conclu-

[3] Landers et al. (1996) present an adverse selection problem in law firms. They show how criteria for promotion set excessively long hours of work which leads women to record lower promotion rates.

sions of this research are presented in the last section.

2 Related literature

This section outlines several strands of the economic literature related to our analysis.

2.1 Literature on implications of status concerns on effort

While traditional economics has focused on monetary rewards, sociologists stress social rewards, including status, as important motivation for human behavior (Fershtman et al., 2006)[4]. In our model, firms use promotion incentives to screen workers, because firms know that some types of workers are status-concerned. This trait of the model is connected to some recent papers by Fershtman et al. (2006) and Besley and Ghatak (2008), who introduce status incentives in two different hazard problems in which firms use status as a kind of reward to elicit effort on the job[5].

As in these two papers, our model considers that the source of social status is the workplace[6]. We will consider that a promotion on the job will confer status to the promoted workers for two reasons. First, they will get higher wages and workers are concerned about wages in absolute terms, but also in relation to the other wages within the firm[7]. Second, promotion is like a medal, prize or award, which will be worth little if it is obtained by many people. Particularly, the value of status after promotion is determined by the proportion of promoted workers (as in Besley and Ghatak, 2008), whenever the wage of promoted workers is higher than the wage of non-promoted workers (as in Fershtman et al., 2006, relative wages are important).

[4] See Weiss and Fershtman (1998) for an excellent survey about the role of social status in the economic analysis of saving, consumption, wages and economic growth.

[5] See the introduction of Besley and Ghatak (2008) for references on how organisations foster effort using means other than monetary rewards. Fershtman et al. (2006) provide a clear description of the importance of social concerns and how they affect the amount of effort exerted on the job.

[6] Social status has been related to different elements such as conspicuous consumption, relative wealth, or an individual's occupation. For instance, Bagwell and Berheim (1992) assume that relative wealth confers status; in Fersthman and Weiss (1993) status is conferred by a worker's occupation and it depends on the average wage and on the proportion of qualified workers in this occupation. Corneo and Jeanne (1998) and Ireland (1998) consider that status depends on conspicuous consumption. Berheim (1994) assumes that status depends on public perception about an individual predisposition rather than on individual actions.

[7] Frank (1985) analyzes the relationship between wages and status within firms. In Cole et al. (1995) individuals are not only concerned about their level of wealth but also about their relative wealth.

2.2 Literature on gender differences in preferences and gender pay gap

It is important to recall that our results stem from a rational choice made by men and women according to their preferences[8]. We assume that more women than men have family-committed preferences, whereas there are more men with job-committed preferences. Findings in the fields of psychology, biology and anthropology suggest that temperamental sex differences with evolutionary and neurochemical roots exist and that they may explain the differences in the utility function of men and women. Stereotypes considering men to be more competitive, more status-minded and more inclined to take risks than women, and stereotypes deeming women to be more attached to their children and more risk-averse than men are true as generalizations[9]. Browne (1998) outlines the difference in family-commitment between men and women based on evolution:

"Likewise, we should not be surprised when we find mammalian mothers who are loath to be separated from their helpless young, or at least unwilling to be separated from them as much as a single-minded commitment to career might require. It is simply a fact of life, easily understandable in evolutionary terms, that mothers are more tightly bound to their young children than are fathers (Rossi, 1977)." (Cited in Browne 1998, p.436).

We can also find explanation for the differences in preferences by gender from neurobiology[10]. Of course, not all is determined by evolution or biology. There is a place for culture, social environment, education and the expectations that an adult has regarding the behavior of boys and girl. For example, Alesina and Giuliano (2007) confirmed the power of the family measured by family ties in influencing labor market preferences. Escriche et al (2004) and Escriche (2007) use a model of cultural transmission of preferences proposed by Bisin and Verdier (2001) in which children acquire labor market preferences from their parents and from other adults.

The assumption of our model concerning the difference in distribution of preferences among men and women is quite common in the literature. Most theoretical and empirical papers assume that there is a difference between men

[8] A challenge for labour economists is to identify the extent to which observed gender differences in labour market outcomes are due to discrimination, or to other unobservable factors, or to fundamental differences between men and women. See the survey of Booth (2006) where the relevant hypotheses are clearly exposed.

[9] Croson and Gneezy (2008) survey the experimental economics literature that investigates preferences differences between women and men. They focus on risk aversion, social preferences and competitiveness.

[10] The contact with the baby and chemical changes due to large increases in oxytocin (the "connection" hormone), generate a motivated, protective and always attentive brain that requires mothers to change their reactions and priorities in life. In modern society, where women are not only responsible for child birth, but also economic support for the family, these changes in the brain creates a deep conflict in a mother's life and make the rearing period, a time when we can observe diversity in women's priorities depending on whether they assign more importance to career or family life. In maturity, as children grow and menopause comes, women do not receive the calming oxytocin and they are less inclined to be as attentive to others needs. See Brizendine (2007) and the reported references for an explanation of all these neurobiological effects.

and women in terms of attitude concerning child care and other family responsibilities. As a result, research assumes quitting rates (Lazear and Rosen, 1990) or the effort made on the job (Becker, 1985) are different.

2.3 Empirical literature on job promotion

How well do the results of our model fit the empirical results? The empirical literature has provided mixed results. Blau and Devaro (2007) perform a concise survey in the introduction to their research. Paraphrasing these authors: some studies that analyze only promotion probabilities have found that promotion rates are lower for women than for men with similar observed characteristics[11], other studies obtain the reverse[12], while other research has found no significant gender difference in promotion rates[13]. Several studies have considered both the promotion probabilities and wage increases attached to promotions, which we consider should be the main reference for the model we will present. The results of our model state that, overall, women promote less than men but those women that share characteristics with men (in our model women that hold jobs with high effort) have equal promotion opportunities. Women that promote receive the same wage as men. Empirical evidence should show us that men have a higher probability of being promoted than women. However, we should also observe a reduction in the gender disparity in promotion rates if the regressions control for some factors like characteristics that may condition the choice of a dead-end job, unobservable heterogeneity or for women's desire to apply for jobs that offer promotions. Some previous studies coincide with these predictions. For example, Olson and Becker (1983) found lower promotion rates for women than for men, but comparable wage increases attached to promotions for the two groups. McCue (1996), using the 1976-88 survey years of the Michigan Panel Study of Income Dynamics, found that women are less likely to get promoted but no difference between wage growth for white men and women upon promotion is found. Jones and Makepeace (1996), using personnel data from a large UK financial company find that women promote less than men, but much of the observed difference is due to their differences in attributes. Their results also suggest that men and women receive equal payment once senior grades have been reached. Blau and Devaro (2007) find, with a large sample of establishments from the US Multi-City Study of Urban Inequality employer survey, that women have lower probabilities of promotion and expected promotion than men do. However, it is also observed that, as they include job-specific worker performance ratings in the analysis, allowing us to control for performance and ability more precisely than through commonly used skill indicators such as educational attainment or tenure, standard information on occupation, industry

[11] Acosta (2005), Cabral et al. (1981), Cannings (1988), Cobb-Clark (2001), McCue (1996), Olson and Becker (1983), Ransom and Oaxaca (2005) and Spurr (1990).

[12] Barnett et al. (2000), Gerhart and Milkovich (1989), Hersch and Viscusi (1996), Spilerman and Petersen (1999) and Stewart and Gudykunst (1982).

[13] Hartmann (1987), Lewis (1986), Paulin and Mellor (1996), Powell and Butterfield (1994), Giulano et al. (2005), Eberts and Stone (1985) and Mcdowell et al. (2001).

and firm characteristics, the gender effect in promotion and in expected promotion (favoring men) is lower. In addition, there is essentially no gender difference in wage growth with or without promotions. Other authors explicitly test the dead-end-job hypothesis. For example, Groot et al. (1996) found that women actually have jobs that offer promotion less frequently than men. Bihagen and Ohls (2007) in the same line, found that women and men have rather similar levels of average wage mobility within the same jobs and that women are over-represented in dead-end jobs. A very direct study that confirms the dead-end hypothesis is Doyle et al (2004). In this research, the 2003 promotion round at Massey University (New Zealand) is examined[14]. The results show that less women than men promote to high positions. Women were somewhat less likely than men to apply for any kind of promotion (whether within the same rank, to a higher rank, or to obtain a new position). However, once they applied, success rates were similar for women and men. These results are coherent with the model we present.

3 The Benchmark Model

In this section, the main traits and results of a basic model are presented as a benchmark to compare to a model with promotion incentives.

A firm employs a continuum of workers of size one. Workers make an effort, e which gives the firm a reward given by $\pi(e)$, where $\pi'(e) > 0$, $\pi''(e) < 0$ and $\pi(0) = 0$. The marginal value of effort is positive and strictly increasing with the amount of the worker's effort.

The working life of workers is divided into two periods, $t = 1$ and $t = 2$. Period $t = 1$ overlaps with the child-rearing period when family responsibilities require more effort and time. This is important because the cost of effort on the job during this period is not the same for all workers. There are workers that find the effort devoted to the job particularly costly in this period. More specifically, we assume that there are two types of workers, job committed and family committed ($j-$workers and $f-$workers, from now on). The difference between them is that the marginal cost of work effort (or disutility) is higher for $f-$workers than for $j-$workers during the first period of their working life, and is equal for both types during the second period. Formally, during the first period the cost of effort is $ke_1^f > e_1^j$ (where e_1^i is the first period effort cost of type i, $i = j, f$), with $k > 1$. During the second period $e_2^f = e_2^j$. The function cost of the worker is unobservable to the firm.

The workers are paid a wage and make an effort in each period and derive a utility given by:

$$\begin{aligned} u^j &= w_1^j - e_1^j + w_2^j - e_2^j \\ u^f &= w_1^f - ke_1^f + w_2^f - e_2^f \end{aligned}$$

[14] The patterns showed in this study were consistent with the University of Auckland study in 2001.

where w_t^i is the type i's wage in period t.

We assume that there is a firm (or a coalition of firms) that has monopoly power in the labor market and does not compete for workers. We also assume that a firm offers a two-period contract, and that the workers can leave the firm at the beginning of the second period. Effort and wages are both observable and verifiable by a third part as a court or law. We assume that the workers and the firm can commit to the terms of the contract.

The firm does not observe the workers' type when facing an applicant. This is private information. In this context,the firm designs the contracts taking into account the probability that an individual can be job or family committed. We assume that there are q job committed workers and $(1-q)$ family committed, with $0 < q < 1$. Formally, the model is an adverse selection problem. We consider that the firm need to contract both types of workers to produce; we neglect the possibility that the firm offers the contract that only would be accepted by the efficient type, $j-$worker, leaving vacant the job if the applicant is a $f-$type. We neither consider the option that a firm can offer different contracts to men and women because this do not respect antidiscrimianatory laws.

The firm's problem is to maximize expected profits under the constraints that, after observing the contracts, the workers decide to accept the contract and that each worker-type chooses the type of contract addressed to him. Hence, the firm designs a contract menu $\{(\bar{w}_1^j, \bar{e}_{1,}^j \bar{w}_2^j, \bar{e}_{2,}^j), (\bar{w}_1^f, \bar{e}_{1,}^f \bar{w}_2^f, \bar{e}_2^f)\}$, where $(\bar{w}_1^j, \bar{e}_{1,}^j \bar{w}_2^j, \bar{e}_{2,}^j)$ is addressed to the $j-$type and $(\bar{w}_1^f, \bar{e}_{1,}^f \bar{w}_2^f, \bar{e}_2^f)$ to the $f-$type. Formally, the problem is:[15]

$$\max_{\substack{(e_1^j, w_1^j, e_2^j, w_2^j) \\ (e_1^f, w_1^f, e_2^f, w_2^f)}} q\left[\pi(e_1^j) - w_1^j + \pi(e_2^j) - w_2^j\right] + \tag{1}$$

$$+(1-q)\left[\pi(e_1^f) - w_1^f + \pi(e_2^f) - w_2^f\right]$$

$$\begin{aligned}
s.t.\ \ w_1^j - e_1^j &\geq 0 \quad (IR_1^j) && (2)\\
w_1^f - ke_1^f &\geq 0 \quad (IR_1^f) && (3)\\
w_2^j - e_2^j &\geq 0 \quad (IR_2^j) && (4)\\
w_2^f - e_2^f &\geq 0 \quad (IR_2^f) && (5)\\
w_1^j - e_1^j + w_2^j - e_2^j &\geq w_1^f - e_1^f + w_2^f - e_2^f \quad (IC^j) && (6)\\
w_1^f - ke_1^f + w_2^f - e_2^f &\geq w_1^j - ke_1^j + w_2^j - e_2^j \quad (IC^f) && (7)
\end{aligned}$$

Expressions (4) and (5), are the second period individual rationality constraints for both types (IR_2^i, $i = j, f$). These constraints guarantee that the worker obtains at least his reservation utility, if not, the worker will quit at the beginning of the second period. The constraints (2) and (3) are the first period individual

[15] See Macho-Stadler and Pérez-Castrillo (2001) or Laffont and Martimort (2002) for a description of adverse selection problems.

rationality constraints for both types (IR_1^i, $i = j, f$). These constraints mean that if an individual does not cover his utility in the first period, he will not accept the contract. We are considering that workers have an infinite risk aversion for a negative utility (punishment) in each period in the firm. Risk neutrality exists for positive payoffs but not for negative payoffs. In another context, these are the limited liability constraints. Alternatively, it could have been assumed that the constraints were

$$\begin{aligned} s.t.\ w_1^j - e_1^j + w_2^j - e_2^j &\geq 0 \\ w_2^j - e_2^j &\geq 0 \end{aligned}$$

but this makes it feasible for a worker to be paid a wage for example, close to zero ($w_1^j \to 0$) during the first period and that the firm committed to pay a wage $w_2^j \geq e_2^j + e_1^j$ which can not be credible in some context (bad firm's reputation) and/or would require a particular discount factor and/or some non-wage income for the workers during the first period, among other justifications. (For simplicity, we have omitted the discount factors.)Finally, the last two expressions, (6) and (7) are the incentive compatibility constraints for each type ($IC^i, i = j, f$). These last two constraints (6) and (7) set that job committed workers (alternatively, family committed workers) prefer the j-contract (alternatively, f-contract) to the other one.

The problem can be simplified. On one hand, due to the sequential interaction between the worker and the firm, the solution must be calculated beginning in the second period. In the second period, the firm should guaranty the reservation utility to the workers because if not, the worker will quit. Therefore, $w_2^i - e_2^i = 0$ since the firm's profits decrease with wages. The individual rationality constraints (4) and (5) for the second period holds with equality:

$$w_2^i - e_2^i = 0, i = j, f.$$

In addition, as usual in problems of adverse selection, the individual rational constraint for the efficient type, IR_1^j, and the incentive compatibility constraint for the less efficient type, IC^f, are redundant. See Appendix B. The firm's problem can be rewritten as the reduced problem:

$$\max_{\substack{(e_1^j, w_1^j, e_2^j, w_2^j) \\ (e_1^f, w_1^f, e_2^f, w_2^f)}} q\left[\pi(e_1^j) - w_1^j + \pi(e_2^j) - w_2^j\right] + (1-q)\left[\pi(e_1^f) - w_1^f + \pi(e_2^f) - w_2^f\right] \tag{8}$$

$$\begin{aligned} s.t. \quad w_1^f - k e_1^f &\geq 0 \qquad (IR_1^f) && (9) \\ w_1^j - e_1^j &\geq w_1^f - k e_1^f + (k-1) e_1^f \qquad (IC^j)' && (10) \\ w_2^i - e_2^i &= 0, i = j, f && (11) \\ e_1^j &\geq e_1^f. && (12) \end{aligned}$$

The IC for the job-committed type has been rewritten to specify the informational rent, $(k-1)e_1^f$. This informational rent is given to the job committed

worker to avoid him imitating the family committed type. If the first best contract were offered, the $j-$type would choose the f-contract and he will obtain an utility given by $(k-1)e_1^f$.

It is easy to show that constraints IR_1^f and $(IC^j)'$ hold with equality. See Appendix C. Hence, the optimal contracts are such that the family type covers just the reservation utility (individual rationality holds with equality) and the job type is indifferent between choosing the contract addressed to him or the other (incentive compatibility constraint for job type holds with equality).

Substituting constraints (9) and (10) with equality into the profit function, it yields a program with efforts as the only choice variables:

$$\max_{\substack{(e_1^j,e_2^j)\\(e_1^f,e_2^f)}} q\left[\pi(e_1^j)-e_1^j+\pi(e_2^j)-e_2^j\right]+$$
$$+(1-q)\left[\pi(e_1^f)-ke_1^f+\pi(e_2^f)-e_2^f\right]-q(k-1)e_1^f. \tag{13}$$

The objective function includes the social value of effort,

$$q\left[\pi(e_1^j)-e_1^j+\pi(e_2^j)-e_2^j\right]+(1-q)\left[\pi(e_1^f)-ke_1^f+\pi(e_2^f)-e_2^f\right], \tag{14}$$

less the informational rent of the job committed worker, $(k-1)e_1^f$. Recall that under perfect information, the firm's profit would be the above expression but without the last term, $(k-1)e_1^f$. See Appendix A where the model under perfect information is solved. Hence, under asymmetric information, the firm faces a trade-off between efficiency and a decrease in rents paid to j-type.

The next proposition describes the optimal contract with asymmetric information. We index the solution with a bar.

Proposition 1 *The contract menu* $\left\{(\bar{w}_1^j,\bar{e}_{1,}^j\bar{w}_2^j,\bar{e}_{2,}^j),(\bar{w}_1^f,\bar{e}_{1,}^f\bar{w}_2^f,\bar{e}_2^f)\right\}$, *that maximized the expected profit of the firm, is characterized by*
(i) the efforts that solve:

$$\pi'(\bar{e}_1^j)=1,\quad \pi'(\bar{e}_1^f)=k+\tfrac{q(k-1)}{(1-q)},$$

for the first period, where $\bar{e}_1^j>\bar{e}_1^f$ *and*

$$\pi'(\bar{e}_2^j)=1,\quad \pi'(\bar{e}_2^f)=1;$$

for the second, with $\bar{e}_2^j=\bar{e}_2^f$; *and*
(ii) the wages:

$$\bar{w}_1^j=\bar{e}_1^j+(k-1)\bar{e}_1^f,\quad \bar{w}_1^f=k\ \bar{e}_1^f,$$

for the first period, and

$$\bar{w}_2^i=\bar{e}_2^i, i=j,f,$$

for the second period.
The family committed workers cover their reservation utility, $\bar{u}^f=0$ *whereas*

job committed workers obtain a positive utility, the informational rent given by $(k-1)\bar{e}_1^f$.
The firm's profit is given by

$$\bar{\pi} = q\left[\pi(\bar{e}_1^j) - \bar{e}_1^j + \pi(\bar{e}_2^j) - \bar{e}_2^j\right] + (1-q)\left[\pi(\bar{e}_2^f) - \bar{e}_1^f + \pi(\bar{e}_2^f) - \bar{e}_2^f\right] - q(k-1)\bar{e}_1^f. \tag{15}$$

Family and job committed workers have the same wage (and effort) during the second period, as they are identical, but during the first period the job type gets a wage that includes the informational rent to compensate him from not mimicking the f-type.

The features of this problem are the characteristics of an adverse selection problem. First, the low type's individual constraint ($f-$type in this model) binds. Thus, the family committed worker receives zero surplus.

Second, the high type's incentive compatibility ($j-$type) binds. As a result the job committed workers obtain a positive utility, the informational rent. Firm leaves rent to the $j-$type to dissuade him from mimicking the $f-$type.

Third, the high type (job committed worker) exerts the efficient effort. This is the effort that maximizes the social value of effort.

Fourth, the low type (family committed worker) exerts less than the efficient effort. This effort solves $\pi'(\bar{e}_1^f) = k + \frac{q(k-1)}{(1-q)}$ whereas under perfect information it solves $\pi'(e_1^{*f}) = k$.

Fifth, if there is a very low proportion of job committed workers, $q \to 0$, there will be a small effort distortion ($\bar{e}_1^f$ tends to e_1^{f*}) However, if there is a high proportion of job committed workers, $q \to 1$, there will be a high effort distortion and a low information rent, $(k-1)\bar{e}_1^f$.

Finally, recall that under asymmetric information the two-period contract gives the same results as if the firm had offered a one-period contract at the beginning of each period. Contracting period by period, we will observe that hiring workers during the first period of their working life, when there is private information, the contract menu will be $\{(\bar{w}_1^j, \bar{e}_1^j), (\bar{w}_1^f, \bar{e}_{1,}^f)$, with $j-$workers receiving the informational rent. During the second period, the contract will be the same as with perfect information. We choose a two-period contract for expositional reasons.

4 Introducing Promotion Incentives

In this section we will consider that a firm can promote workers. We will show that the reason to introduce promotion incentives is that it raises profits for the firm.

In this model, a promotion gives to the worker monetary and non monetary rewards. A promotion will mean that a worker, after producing high effort for the principal during the first period, receive a wage premium and the award of a positional good (free from the firm's point of view). This could be a job title

change (promotion from associate to full professor), granting some agents interior offices rather than open-plan desks, performing challenging tasks, holding responsibilities, having greater work autonomy or flextime, having the power decide about who promotes and who does not, having the task of reporting on the co-workers' or subordinates' job performance. Nevertheless, this positional good is valuable because it is not given to anyone (due to being scarce) and also because it is linked to a wage premium. The positional good does not confer status if the attached wage is lower or equal to those of non promoted workers.

More specifically, we draw the proposal of status from Besley and Ghatak (2008). These authors introduce status incentives in a moral hazard problem. Suppose that this good generates utility $h(p)$ that depends on the fraction p of workers in the organization who are awarded this positional good or, in other words, that are promoted. If everybody is promoted, the value of the positional good drops to zero. Moreover, positional good confers status if there is a wage premium for promoted workers. Let us denote the wage premium by $(w_2^p - w_2^{np})$

The firm commits to awarding the positional good to the agent that makes high effort during the first period. We assume that the value of status is given by

$$h(p) = \begin{cases} s - \lambda p \text{ if } p \leq \bar{p} = \frac{s}{\lambda} \text{ and } (w_2^p - w_2^{np}) > 0 \\ 0 \text{ otherwise} \end{cases} \tag{16}$$

Thus, $\bar{p} = \frac{s}{\lambda}$ is the fraction of workers producing high effort that can be promoted, above which the value of status goes to zero. Parameters s and λ are assumed to have the appropriate values to guaranty that $\bar{p} < 1$.[16]

We consider that only the workers that exert high effort during the first period have some chance of being promoted. The opposite seems unreasonable and quite far from reality.[17] The problem is solved considering that, during the first period, job committed workers make higher effort than family committed workers.

In this context, the maximization problem of the firm is:

$$\begin{aligned} &\max_{\substack{(e_1^j, w_1^j, e_2^j, p, w_2^{np}, w_2^p) \\ (e_1^f, w_1^f, e_2^f, w_2^f)}} q\left[\pi(e_1^j) - w_1^j + \pi(e_2^j) - pw_2^p - (1-p)\, w_2^{np}\right] + \\ &+(1-q)\left[\pi(e_1^f) - w_1^f + \pi(e_2^f) - w_2^f\right] \end{aligned} \tag{17}$$

[16] The model can be easily modified to consider that status depends on the difference between the wage of promoted workers and non-promoted workers (as in Fershtman et al. 2006). The results changes slightly and the implications for promotion patterns are the same.

[17] The terms of the contract are enforceable by law or are observable and verifiable by a third part.

$$
\begin{aligned}
s.t.\ \ w_1^j - e_1^j &\geq 0 && IR_1^j && (18)\\
w_1^f - ke_1^f &\geq 0 && IR_1^f && (19)\\
w_2^f - e_2^f &\geq 0 && IR_2^f && (20)\\
w_2^{np} - e_2^j &\geq 0 && IR_2^j && (21)\\
w_2^{np} - e_2^j + p(s-\lambda p) + p\left(w_2^p - w_2^{np}\right) &\geq 0 && IR^j && (22)\\
\left(w_2^p - w_2^{np}\right) &> 0 && && (23)
\end{aligned}
$$

$$
w_1^j - e_1^j + w_2^{np} - e_2^j + p(s-\lambda p) + p\left(w_2^p - w_2^{np}\right) \geq w_1^f - ke_1^f + (k-1)e_1^f + w_2^f - e_2^f;\ IC^j \quad (24)
$$

$$
w_1^f - ke_1^f + w_2^f - e_2^f \geq w_1^j - ke_1^j + w_2^{np} - e_2^j + p\left(w_2^p - w_2^{np}\right) + p(s-\lambda p);\ IC^f \quad (25)
$$

The expressions (18) and (19) are the first period individual rationality constraints for both types ($IR_1^i,\ i = j, f$). The following three, (IR_2^f, IR_2^j, IR^j) are the second period individual rationality constraints. Note that the individual rationality constraint IR^j guaranties that the expected utility of $j-$workers cover their reservations utility during the second period. But we need the constraint IR_2^j ($w_2^{np} - e_2^j \geq 0$) to avoid that $w_2^{np} \to 0$ which would imply that a non promoted worker does not cover the effort cost during the second period. The following constraint, $(w_2^p - w_2^{np}) > 0$, is necessary as promotion must be linked to a wage increase if not promotion does not confer status. Finally, the last two expressions are the incentive compatibility constraints for each type ($IC^i, i = j, f$). These two constraints set that job committed workers (alternatively, family committed workers) choose the contract addressed to them.

There are several differences with respect to the basic model in the previous section. Firstly, the firm's expected profits includes the monetary incentives of promotion $p(w_2^p - w_2^{np})$. Conversely, status incentives does not appear in the profit function as they are free from the firm's point of view. Secondly, the individual rationality constraints of the worker that exerts high effort includes promotion incentives (monetary and social rewards), see (22). Thirdly, the incentive compatibility constraints also are different. It is interesting to note that promotion incentives, in terms of wage and status rewards $p\left(w_2^p - w_2^{np}\right) + p(s-\lambda p)$, relax the $j-$worker's incentive compatibility constraint, IC^j.

The firm's problem can be simplified. See Appendix D. Inserting some constraints that hold with equality into the principal's objective function, it yields a program that depends on the efforts, the promotion probability and the wage premium of promoted workers:

$$
\begin{aligned}
&\max_{\substack{(e_1^j, e_2^j, p, w_2^p, w_2^{np})\\ (e_1^f, e_2^f)}} q\left[\pi(e_1^j) - e_1^j + \pi(e_2^j) - p(w_2^p - w_2^{np}) - w_2^{np}\right] + \qquad (26)\\
&+(1-q)\left[\pi(e_1^f) - ke_1^f + \pi(e_2^f) - e_2^f\right]
\end{aligned}
$$

$$
\begin{aligned}
s.t. \qquad w_2^{np} &= e_2^j \\
(w_2^p - w_2^{np}) &> 0 \qquad (27) \\
w_1^j - e_1^j &\geq 0 \qquad (IR_1^j)'' \ (28) \\
w_1^j - e_1^j + p\,(w_2^p - w_2^{np}) - \left[(k-1)e_1^f - p(s-\lambda p)\right] &\geq 0 \qquad (IC^j)'' \ (29)
\end{aligned}
$$

The objective function is decreasing with $p\,(w_2^p - w_2^{np})$. From the constraint $(IC^j)''$, we have that $p\,(w_2^p - w_2^{np}) \geq (k-1)e_1^f - p\,[s-\lambda p] - \left(w_1^j - e_1^j\right)$. Therefore, the constraint must hold with equality. Suppose instead that $p\,(w_2^p - w_2^{np}) > (k-1)e_1^f - p(s-\lambda p) - \left(w_1^j - e_1^j\right)$. Then we could reduce $p\,(w_2^p - w_2^{np})$ by some amount and increase profits. Thus (28) holds with equality. Recall that the IC of the job-committed type is different from the benchmark. In this new context, the firm should give to the j-type an informational rent which is lower when promotion incentives are introduced. In expression (28), it can be seen that the expected wages less the effort during the two periods are equal to the informational rent of the previous section less the value of status, that is, it must be equal to $(k-1)e_1^f - p(s-\lambda p)$.

Substituting expression (28) into the objective function and after some simplifications, the maximization problem is:

$$
\begin{aligned}
\max_{\substack{(e_1^j, e_2^j, p, w_2^p) \\ (e_1^f, e_2^f,)}} \quad & q\left[\pi(e_1^j) - e_1^j + \pi(e_2^j) - e_2^j - (k-1)e_1^f + p\,[s-\lambda p]\right] + \\
& +(1-q)\left[\pi(e_1^f) - ke_1^f + \pi(e_2^f) - e_2^f\right]
\end{aligned}
$$

$$
\begin{aligned}
s.t. \qquad w_2^p - e_2^j &> 0 \\
w_1^j - e_1^j &\geq 0 \qquad IR_1^j \\
w_1^j - e_1^j + p\left(w_2^p - e_2^f\right) &= (k-1)e_1^f - p(s-\lambda p)
\end{aligned}
$$

The solution is described in the next proposition.

Proposition 2 *The contract menu* $\left\{(\hat{w}_1^j, \hat{e}_{1,}^j \hat{w}_2^p, \hat{w}_2^{np}, \hat{e}_{,2}^{\,j}, \hat{p}), (\hat{w}_1^f, \hat{e}_{1,}^f \hat{w}_2^f, \hat{e}_2^f)\right\}$ *with promotion incentives is characterized by*
(i) the efforts that solve :

$$\pi'(\hat{e}_1^j) = 1, \quad \pi'(\hat{e}_1^f) = k + \tfrac{q(k-1)}{(1-q)},$$

for the first period, with $\hat{e}_1^j > \hat{e}_1^f$*; and*

$$\pi'(\hat{e}_2^j) = \pi'(\hat{e}_2^f) = 1;$$

for the second period, with $\hat{e}_2^j = \hat{e}_2^f$;
(ii) the wages:

$$\begin{array}{rcl} \hat{w}_1^f & = & k\ \hat{e}_1^f \\ \left.\begin{array}{c}\hat{w}_2^f \\ \hat{w}_2^{j,np}\end{array}\right\} & = & \hat{e}_2^i, \quad i = j, f \end{array}$$

for family committed workers and job committed that not promote, and the wages for promoted workers $(\hat{w}_1^j\ , \hat{w}_2^p)$ *such that verifies:*

$$\hat{p}\left(\hat{w}_2^p - \hat{e}_2^j\right) + \left(\hat{w}_1^j - \hat{e}_1^j\right) = (k-1)\hat{e}_1^f - \hat{p}(s - \lambda\hat{p}) \tag{30}$$

$$\hat{w}_2^p - \hat{e}_2^j > 0 \tag{31}$$

$$\hat{w}_1^j - \hat{e}_1^j \geq 0 \tag{32}$$

(iii) the probability of promotion given by

$$\hat{p} = \frac{s}{2\lambda},$$

where $\hat{p} = \frac{s}{2\lambda} < \frac{s}{\lambda} = \bar{p}$.
The family committed workers cover their reservation utility and the expected utility of the job committed type is positive, it equals the informational rent:

$$\begin{array}{rcl} \hat{u}^f & = & 0 \\ \hat{u}^j & = & (k-1)\hat{e}_1^f. \end{array}$$

The firm's profit is given by

$$\begin{array}{rcl} \hat{\pi} & = & q\left[\pi(\hat{e}_1^j) - \hat{e}_1^j + \pi(\hat{e}_2^j) - \hat{e}_2^j\right] + (1-q)\left[\pi(\hat{e}_2^f) - \hat{e}_1^f + \pi(\hat{e}_2^f) - \hat{e}_2^f\right] - \\ & & -q\left[(k-1)\hat{e}_1^f - \hat{p}\left[s - \lambda\ \hat{p}\right]\right] \end{array} \tag{33}$$

The optimal contract with promotion incentives shows that the effort are the same as the benchmark, therefore, the introduction of promotion incentives does not lead to any distortion of efforts. The wages are different. Particularly, the firm has a combination of wages $(\hat{w}_1^j\ , \hat{w}_2^p)$ that solve the problem. There is an inverse relation among them, $\frac{\partial w_2^p}{\partial \hat{w}_1^j} < 1$: the firm faces a trade-off between paying more to the efficient worker during the first period or during the second. In any case, in equilibrium (i) both wages cover at least the effort, which is the same in the two periods; (ii) the wage after promotion is higher than the wage of non-promoted workers, and (iii) the expected pecuniary and non-pecuniary rewards equal the informational rent of the job-committed workers.

Recall that if we assume that during the first period the wage equal the cost of effort (i.e., expression (31) holds with equality), then we obtain that

$$w_2^p = \hat{e}_2^j + \frac{1}{p}\left[(k-1)e_1^f - p(s - \lambda p)\right].$$

Under this assumption, the informational rent will be paid as a higher wage premium. This situation produces the largest gap between promoted and non-promoted worker wages.

The fact that there is combination of equilibrium wages can be viewed as a undesirable result of the model. However, we think that this result can also be considered a good approximation to reality. It simply implies that firms can give the informational rent (to the job-committed worker that exerts a high level of effort) during the first or the second period. And empirically we find that there is not always a huge increase in wages for promoted workers. There exists a diversity of wage increases after promotion, all of which are optimal from the firm's point of view.

The wages for promoted people decreases with the possibilities of promotion, ceteris paribus. The higher the probability of promotion, the lower the status payoff and the higher the monetary payoff must be.

Notice that ex-post, unlike the model without promotion, there is a difference between $j-$workers. Those that are promoted obtain higher utility than informational rent, while non-promoted workers just cover reservation utility.

The effects of introducing promotion incentives

The introduction of promotion incentives do not change the optimal efforts of the basic problem of adverse selection, the changes comes from wages paid to job committed workers.

Lemma 3 *The effort levels do not change if the firm introduces promotion incentives*

Lemma 4 *The wages for family committed workers are equal in both types of contracts:*

$$\left.\begin{array}{c}\bar{w}_1^f \\ \hat{w}_1^f\end{array}\right\} = k\ \hat{e}_1^f = k\ \bar{e}_1^f$$

$$\left.\begin{array}{c}\bar{w}_2^f \\ \hat{w}_2^f\end{array}\right\} = \bar{e}_1^i = \hat{e}_2^i,$$

Lemma 5 *The wages for job committed workers are different with promotion incentives. More specifically, in the model with promotion incentives they earn less during the first period:*

$$\left.\begin{array}{c}\bar{w}_1^j = \bar{e}_1^j + (k-1)\bar{e}_1^f \\ \hat{w}_1^j \geq \hat{e}_1^j \text{ with}\end{array}\right\} \text{ with } \bar{w}_1^j > \hat{w}_1^j, \text{ since } \hat{w}_1^j - \hat{e}_1^j < (k-1)\hat{e}_1^f \text{ as (29) is verified.}$$

whereas, during the second period, they have the chance of getting higher wages if are already promoted

$$\left.\begin{array}{c}\bar{w}_2^j \\ \hat{w}_2^{j,np}\end{array}\right\} = \bar{e}_1^i = \hat{e}_2^i$$

$$\hat{w}_2^p = \hat{e}_2^j + \frac{1}{p}\left[(k-1)e_1^f - p(s-\lambda p)\right] - \left(w_1^j - e_1^j\right)$$

The wages of job committed workers change if the firm introduces promotion incentives. The firm knows that to avoid job committed workers mimicking the family committed workers, the former should be led by a positive utility, an informational rent $(k-1)\bar{e}_1^f$. In this context, firms find that they can give this informational rent as monetary or non-monetary rewards. Job committed workers are status concerned and status is free from the firm's point of view. Hence, firms elicit high effort -from job committed types- during the first period with the wage of this period and also with the commitment of a potential promotion. During the second period any worker will obtain at least the wage that covers the cost of effort in this period. Specifically, the firm reduces the wage in the first period and increases the expected wage for the second. Altogether, it makes the expected utility for the worker is the same with both contracts. But those that are actually promoted will obtain a higher second period wage than in the model without promotion and those that are not promoted cover just the utility in this second period. Ex ante, both types of workers obtain the same utility under the two types of contracts.

More important is the comparison of profits. Firms take advantage of the introduction of promotion possibilities. The firm can elicit a given level of effort at lower wages if he the status concern is internalized.

Proposition 6 *The introduction of promotion possibilities increases the profits for the firm.*

Proof. The profit without promotion is

$$\bar{\pi} = q\left[\pi(\bar{e}_1^j) - \bar{e}_1^j + \pi(\bar{e}_2^j) - \bar{e}_2^j\right] + (1-q)\left[\pi(\bar{e}_2^f) - \bar{e}_1^f + \pi(\bar{e}_2^f) - \bar{e}_2^f\right] - q(k-1)\bar{e}_1^f$$

and with promotion possibilities is

$$\begin{aligned}\hat{\pi} \quad = \quad & q\left[\pi(\hat{e}_1^j) - \hat{e}_1^j + \pi(\hat{e}_2^j) - \hat{e}_2^j\right] + (1-q)\left[\pi(\hat{e}_2^f) - \hat{e}_1^f + \pi(\hat{e}_2^f) - \hat{e}_2^f\right] - \\ & -q\left[(k-1)\hat{e}_1^f - \hat{p}\left[s - \lambda\,\hat{p}\right]\right]\end{aligned}$$

In route to contradiction, let us consider that $\bar{\pi} > \hat{\pi}$ and eliminating all the values that are equal, it yields that $\hat{p}\left[s - \lambda\,\hat{p}\right] < 0$ which contradicts the assumption of the model, the value of status is non-negative. Then $\hat{\pi} > \bar{\pi}$, the profits with promotion incentives are higher. ■

Firms take advantage of the possibility of reducing the monetary incentives to elicit a given level of effort, compensating the job committed workers with a combination of monetary and status rewards after promotion.

5 Implications for gender differences in promotion rates

This framework will allow us to consider why promotion rates differ across gender. Let us assume that there are more family committed workers among

women than among men. The introduction exposed some reasons to consider this as a reasonable reflection of biological evolution or social features.

The firm offers a contract menu to screen among the workers. Workers self-select according to a rational choice based on their preferences. Workers can choose two types of contracts. One is addressed to job committed workers and offers promotion possibilities. The other one is addressed to family-committed workers and does not offer such possibilities. Consider, by a moment, that all men are job committed. Then, due to the lower cost of men's effort during the first period (child rearing period) compared to women, they choose the contract $(\hat{w}_1^j, \hat{e}_1^j, \hat{w}_2^j, \hat{e}_2^j, \hat{p})$ that sets a high level of effort during the first period but offer promotion possibilities. However, among women there are also family committed workers. This type of women prefers the contract $(\hat{w}_1^f, \hat{e}_1^f, \hat{w}_2^f, \hat{e}_2^f)$ that does not offer promotion possibilities and sets a lower level of effort during the child rearing period (first period). After this period, all workers have the same effort cost, but promotion has already been decided. Hence, if we compare, on average, the promotion rate of women will be lower than the rate for men. Therefore, two interesting results comes from the model.

Corollary 7 *If there are more family-committed workers among women than among men, women on average are promoted less frequently because more women than men are in jobs that do not offer opportunities for promotion.*

Recall that those women that have job committed preferences will choose the contract addressed to $j-$type, that is, the contract with promotion possibilities. Hence, they have a probability $\hat{p}$ of being promoted which is the same as the probability for job committed men. What is more, the wage after promotion will be the same as both types choose the same contract.

Corollary 8 *If women and men are both in jobs that offer promotion opportunities, then women have the same chance of actually being promoted as men.*

Corollary 9 *The wage premium after promotion is the same for men and women.*

6 Conclusions

Despite of the voluminous literature on gender differences in the labour market, there are few theoretical models on gender differences in promotion patterns. The model that we have presented argues that different gender promotion patterns might arise from a rational choice of men and women according to their preferences.

As usual in the literature on gender differences, this paper relies on different attitudes towards household and family care. The distribution of preferences among the women population is different from that of men. More women than men have a traditional role, and family-committed preferences are more extended among the women population. (On the contrary, the job-committed preferences are more extended among the male population.)

Preferences are private information, so firms need to screen among the workers as they do not know the degree of commitment of a particular applicant. Thus, firms face an adverse selection problem. In this context, we show that firms make higher profits if they introduce the possibility of promotion in the contracts. "The possibility of promotion is a major component of non-pecuniary rewards of a job contributing to motivation and work incentive", (Winter-Ebmer and Zweimuller, 1997, p.44). In particular, the firms offer two types of contracts, one with promotion possibilities and other without such possibilities. The results show that more women than men choose the later. The reason is that the contract without promotion incentives set a lower effort on the job during the first period in the firm, when child care requires more effort and time. Afterwards, during the second period, although the cost of effort on the job is the same for everybody, the decision on promotion has been made. Accordingly, as women are less frequently in jobs that offer promotion possibilities than men, the promotion rates of women, on average, are lower. However, and this is an interesting feature of the model, we show that when women occupy the same jobs as men, that is, a job with promotion possibilities, they have also the same promotion chance and the same wage premium after promotion.

In the extent that preferences for market work evolve among women population toward job-committed preferences, we could observe a reduction in the promotion gap. Additionally, the change in firms policy could reinforce the change in women preferences. This could contribute to explain the profound transformation in the role that women play in the family and in the workplace.

Most theoretical models rely on discriminatory practices: differences in promotions arise because firms discriminate against women because prejudice (Lazear and Rosen, 1990; Booth et al., 2003) or taste for discrimination (Milgron and Oster, 1987). Our paper contributes to the permanent debate about if gender differences in labour market outcomes are due to discrimination or to other unobservable factors which included differences in preferences. We do not reject the presence of any type of gender discrimination in the labour market, in fact it might be a complementary explanation to justify the difference in promotion patterns by gender.

The predictions of our model can be evaluated in the light of the existing empirical literature. As we have exposed in the introduction, we find empirical confirmation of these proposition. First, women, on average, will be less present in higher job levels relative to men and will have lower wages. The empirical literature in support of this prediction is substantial. Our theory also predicts that women are just as likely as men to be promoted in the same type of jobs .Empirical confirmation of this proposition is more difficult to find since, usually, data on possibilities of promotion on-the-jobs is not available. When this information exists, evidence supports our prediction. Our third testable prediction is that promoted women gain the same wages as men. Again, empirical literature is substantial.

Appendix A: The firms' problem under perfect information

If there were not an adverse selection problem and the principal faced to a job-committed worker, he would solve the problem

$$\max_{(e_1^j, w_1^j, e_2^j, w_2^j)} \pi(e_1^j) - w_1^j + \pi(e_2^j) - w_2^j \tag{34a}$$

$$s.t.\ w_1^j - e_1^j \geq 0 \qquad IR_1^j \tag{34b}$$

$$w_2^j - e_2^j \geq 0 \qquad IR_2^j \tag{34c}$$

where (33b) and (33c) are the individual rationality constraints of job committed workers for each period, IR_1^j and IR_2^j.

Due to the sequential interaction between the worker and the firm, the solution must be calculated at beginning of the second period. In the second period, the firm will pay just to cover the reservation utility of the worker. Suppose instead that the firms pays more $w_2^i - e_2^i > 0$. Then we can reduce w_2^f and w_2^j by some amount and increase firm profit. Therefore, the wage in the second period will be equal to the cost effort, i.e., $w_2^j - e_2^j = 0$. This reasoning can also be applied to the first period, so that the first period wage covers the cost of effort, $w_1^j - e_1^j = 0$. Taking into account these values for wages and substituting them into the maximization problem, the firm's problem is

$$\max_{(e_1^j, e_2^j)} \pi(e_1^j) - e_1^j + \pi(e_2^j) - e_2^j.$$

and the optimal effort values are given by

$$\begin{aligned} \pi'(e_1^{j*}) &= 1 \\ \pi'(e_2^{j*}) &= 1 \end{aligned}$$

We index the optimal value contracts under perfect information with an asterisk.

Considering the individual rational constraints, the optimal wages are determined by $w_2^{j*} = e_2^{j*}$ and $w_1^{j*} = e_1^{j*}$.

Similarly, if a firm faces a family committed worker, the optimal contract will be characterized by

$$\pi'(e_1^{f*}) = k \tag{7}$$

$$\pi'(e_2^{f*}) = 1 \tag{8}$$

and wages are determined by $w_2^{f*} = e_2^{f*}$ and $w_1^{f*} = ke_1^{f*}$.

Taking into account that $\pi''(e) < 0$, it is easy to see that, in the first period, the firm finds it optimal to set a higher level of effort for the agents with lower effort cost

$$e_1^{j*} > e_1^{f*}$$

and their wage can be higher or lower depending on the value of the parameters. Therefore, each type covers his reservation utility $u_1^{i*} + u_2^{i*} = 0$, $i = j, f$.

The characteristics of the first best contract menu are the following.

Remark 10 *The optimal contract menu* $\left\{(w_1^j, e_{1,}^j w_2^j, e_{2,}^j), (w_1^f, e_{1,}^f w_2^f, e_2^f)\right\}$ *under perfect information, is characterized by*
(i)the effort levels that solve:

$$\pi'(e_1^{j*}) = 1, \quad \pi'(e_1^{f*}) = k,$$

for the first period, where $e_1^{j*} > e_1^{f*}$, *and*

$$\pi'(e_2^{j*}) = \pi'(e_2^{f*}) = 1.$$

for the second period, with $e_2^{j*} = e_2^{f*}$;
(ii) the wages solve:

$$w_1^j = e_1^{j*}, \quad w_1^f = k\ e_1^{f*},$$

for the first period, and

$$w_2^i = e_2^{i*}, \quad i = j, f.$$

for the second period.
Each type covers his reservation utility $u_1^{i*} + u_2^{i*} = 0$, $i = j, f$.

Appendix B

- The individual rational constraint for the efficient type IR_1^j is redundant. Note that if the incentive compatibility of the job type (IC^j) and the individual rationality constraint of the family type (IR^f) hold, that is:

$$w_1^j - e_1^j \geq w_1^f - e_1^f \quad (IC^j) \tag{35}$$

$$w_1^f - ke_1^f \geq 0 \quad (IR^f); \tag{36}$$

  and we take into account that $w_1^f - e_1^f \geq w_1^f - ke_1^f$, it follows that

$$w_1^j - e_1^j \geq w_1^f - e_1^f \geq w_1^f - ke_1^f \geq 0$$

  that is, $w_1^j - e_1^j \geq 0$, so that the IR_1^j is fulfilled.

- The incentive compatibility constraint of the family type IC^f is redundant. From the (IC^j), $w_1^j - e_1^j \geq w_1^f - e_1^f$, we have that $w_1^j - w_1^f \geq e_1^j - e_1^f$. From the (IC^f), $w_1^f - ke_1^f \geq w_1^j - ke_1^j$, we have that $ke_1^j - ke_1^f \geq w_1^j - w_1^f$. All together leads to

$$e_1^j - e_1^f \leq w_1^j - w_1^f \leq k(e_1^j - e_1^f) \tag{37}$$

  that only can be fulfilled if $e_1^j > e_1^f$ since $k > 1$. From the above inequality we have that if the IC^j (r.h.s) holds, the IC^f also holds (l.h.s.) since $k > 1$. We can neglect the IC^f.

Appendix C

- The individual rationality constraint of the family type IR^f holds with equality. Suppose instead that $w_1^f - ke_1^f > 0$. Then taking into account the incentive compatibility $(IC^j)'$

$$w_1^j - e_1^j \geq w_1^f - e_1^f \geq w_1^f - ke_1^f > 0.$$

  We could reduce w_1^j and w_1^f by some amount without violating the incentive compatibility constraint $(IC^j)'$ and increase profit.

- The incentive compatibility constraint of the job type $(IC^j)'$ holds with equality. Suppose instead that $w_1^j - e_1^j > w_1^f - e_1^f$. Then

$$w_1^j - e_1^j > w_1^f - e_1^f \geq w_1^f - ke_1^f = 0.$$

  We could decrease w_1^j without violating any constraint and increase firm profit.

Appendix D

- The individual rationality constraints IR_2^f and IR_2^j for the second period holds with equality. In the second period, the firm guaranties the reservation utility to the workers because if not, the worker will quit. If wages are higher than the second period cost of effort, the firm profits can raise reducing wages.

- The individual rational constraint for the efficient type IR^j is redundant. Note that if the incentive compatibility of the job type (IC^j) and the individual rationality constraint of the family type (IR^f) hold, that is:

$$\begin{aligned} w_1^j - e_1^j + p(s - \lambda p) + p\left(w_2^p - w_2^{np}\right) &\geq w_1^f - e_1^f \quad (IC^j) \quad (38) \\ w_1^f - ke_1^f &\geq 0 \quad (IR_1^f), \quad (39) \end{aligned}$$

  and we take into account that $w_1^f - e_1^f \geq w_1^f - ke_1^f$, it follows that

$$w_1^j - e_1^j + p(s - \lambda p) + p\left(w_2^p - w_2^{np}\right) \geq w_1^f - e_1^f \geq w_1^f - ke_1^f \geq 0$$

  that is, $w_1^j - e_1^j + p(s - \lambda p) + p\left(w_2^p - w_2^{np}\right) \geq 0$, so that the IR^j is fulfilled.

- The IC^f of the less efficient, $f-$type, is redundant. Considering that the IC^j of the promoted $j-$type can be rewritten as:

$$w_1^j - w_1^f + p\left(w_2^p - w_2^{np}\right) + p(s - \lambda p) \geq \left(e_1^j - e_1^f\right),$$

  and the IC^f for the $f-$type as

$$k\left(e_1^j - e_1^f\right) \geq w_1^j - w_1^f + p\left(w_2^p - w_2^{np}\right) + p(s - \lambda p).$$

These two conditions require:

$$\left(e_1^j - e_1^f\right) \leq w_1^j - w_1^f + p\left(w_2^p - w_2^{np}\right) + p(s - \lambda p) \leq k\left(e_1^j - e_1^f\right).$$

And if the second inequality holds with equality, the first will be fulfilled given that $k > 1$, whenever $e_1^j \geq e_1^f$. Thus, the second one, the IC^j, is operative. Therefore, the constraint IC^f can be eliminated from the maximization problem.

- The individual rationality constraint of the family type (IR^f) holds with equality. Suppose instead that $w_1^f - ke_1^f > 0$. Then taking into account the incentive compatibility (IC^j)

$$w_1^j - e_1^j + p(s - \lambda p) + p\left(w_2^p - w_2^{np}\right) \geq w_1^f - e_1^f \geq w_1^f - ke_1^f > 0.$$

We could reduce w_1^j and w_1^f by some amount without violating the incentive compatibility constraint (IC^j) and increase profit.

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