

Labour market discrimination as an agency cost

P-G. Méon et A. Szafarz

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Abstract: This paper studies labour market discriminations as an agency problem. It sets up a principal-agent model of a firm, where the manager is a taste discriminator and has to make unobservable hiring decisions that determine the shareholder's profits because workers differ in skills. The paper shows that performance-based contracts may moderate the manager's propensity to discriminate, but that it is unlikely to fully eliminate discrimination.

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1. Introduction

Differences on the labour market are despairingly ubiquitous and persistent. By and large, women have been, and still are, discriminated against men, and ethnic minorities against ethnic majorities virtually everywhere, as surveys by Altonji and Blank (1999) or Blau and Kahn (2000) emphasize.

When it comes to explaining this stylised fact, economic theory usually rejects the idea that discrimination finds its roots in employers' prejudices. The influential argument, put forward by Becker (1957), is that in a competitive environment, firms that discriminate would get smaller profits. This argument does not rule out prejudices, but stresses that hiring workers in a prejudiced manner is costly. Employers should therefore face a strong incentive not to discriminate. This argument is particularly appealing for large firms, where shareholders never even meet workers and should therefore not seek anything but profit maximisation.

The persistence of discrimination has subsequently been blamed on statistical discrimination. According to Phelps (1971), employers hold biased beliefs on the skills of discriminated workers, who in turn rationally validate those beliefs by not acquiring these skills, because their return would be too low on a discriminatory labour market. The only prejudice that may affect firms' behaviour is therefore those of consumers, as documented by Holzer and Ihlanfeld (1998), and those of employees, as in Bertrand and Hallock (2001). That view of discrimination does however not apply to large modern corporations where shareholders maximise profit, and should therefore ban any form of costly discrimination. However, in this industrial context, the firm's owners do not hire workers.

On the other hand, managers do work with employees, and hire them. If they are biased against a given minority, they may therefore be tempted to behave in a discriminatory way. Their temptation is moreover not mitigated by lower profits, since managers, unlike shareholders, earn wages, not dividends. As shareholders can moreover not precisely monitor hiring processes, hiring decisions therefore have all the features that result in a classical principal-agent problem that stems from the separation of ownership and control emphasized in the classic works of Berle and Means (1932) or Jensen and Meckling (1976).

Surprisingly, while the corporate governance literature has extensively stressed that managers' incentives interfere with profit maximisation, and found evidence of such a behaviour, as Shleifer and Vishny (1997) emphasize, it has not extended to discrimination.

Conversely, the literature on discrimination has not taken managerial incentives into account. Namely, all theories that, to our knowledge, analyze discrimination assume that decision makers either maximise profits or weigh profit maximisation against the psychological benefits of discrimination. In other words, those theories implicitly consider that ownership and control are not separated.

Yet, it is important to take true incentives into account when designing public policies to curb discrimination. The discrimination literature has already underlined that the incentives of discriminated groups mattered, as in Phelps (1971) or more recently Coate and Loury (1993a, b). Nevertheless, the literature has so far overlooked the incentives faced by managers and shareholders or implicitly assumed an ownership structure that is at odds with the organisation of most firms. Managers' specific incentives should also be taken into account, because they control the hiring process. The present paper therefore focuses on the incentives of managers when they hire workers for a firm that they do not own. It thus offers a model acknowledging the agency problem pointed out by Arrow (1998, p. 95): *"It is hardly in the stockholders' interests to discriminate under the postulated condition, and competition in the capital market should be effective in eliminating discrimination. (...) An alternative hypothesis is that labor market discrimination is due to discriminatory tastes of other employees. In the case of large corporations, for example, it would be those of the executives (...)"*.

With that end in view, this paper sets up a principal-agent model of a firm, where the manager is a taste discriminator and has to make unobservable hiring decisions that determine the shareholder's profits. This is to our knowledge the first theoretical attempt to set up a model of discrimination that takes into account the principal-agent relationship at work in hiring decisions. The paper shows that performance-based contracts may moderate the manager's propensity to discriminate, but that it is unlikely to fully eliminate discrimination.

The paper is organised as follows. Section 2 presents the model, where a manager, chooses workers according to two characteristics, skill and group membership, where only the former matters to the firm's shareholder. Section 3 investigates its equilibrium outcome and the impact of the model parameters on this outcome. Section 4 proposes an extension to the case where the manager's taste for discrimination is unknown to the shareholder. Section 5 concludes.

2. The model

The model describes a firm that faces a hiring decision. Workers who apply for the job can be either skilled ($\kappa = S$) or unskilled ($\kappa = U$), and belong to an identifiable group i ($i = M, W$). Following Coate and Loury (1993), we assume that both skills and group membership are observable, and that a worker's pay-off is F , irrespective of his/her characteristics. A rejected worker's pay-off is simply zero.

Productivity R is related to skills, but not to group membership. We assume that a skilled employee yields to the firm revenue $R_s > 0$, while an unskilled employee's yield is normalized such that $R_u = 0$.

To model the hiring decision, we assume that two candidates apply for the open position, and that they are drawn randomly from a large pool of workers. Within the pool of potential workers, applicants can be either skilled or unskilled, and belong to group M or W . The full population of the pool of workers has the following proportions of each of the four categories: γ_{MS} , γ_{MU} , γ_{WS} , γ_{WU} . The outcome of the hiring process is described by the chosen worker's vector of characteristics (i, κ) .

The worker who finally gets the job is chosen by the manager from the two applicants, on the basis of their characteristics. The manager is paid a wage w and has an outside option that would provide him with a utility normalised to zero. Most of all, the manager is a taste discriminator. Namely, he/she is biased against one of the two identifiable groups of workers, and is therefore reluctant to work with members of that group.

That behaviour may be due to the manager's affinity with his/her own group. Several recent empirical evidences support the affinity theory. For instance, experiments from Garcia and Ibarra (2007) show that, all other things being equal, Californians tend to hire Californian candidates. Bertrand and Mullainathan (2005) uncovered racial discrimination on the US job market by sending fictitious résumés to US firms, and observing that white-sounding names received 50% more call-backs than African American ones.

However, the manager may even discriminate against his/her own group, when that group is a discriminated. For instance, Steinpreis et al. (1999) report experimental evidence that not only male but also female judges prefer male over female applicants when their records were identical. More generally, the observed propensity of individually successful women to be reluctant to support other women in male-dominated environments has attracted

attention under the name “queen bee syndrome” since Staines et al. (1974) coined the expression.

The manager’s group membership notwithstanding, what matters here is that he/she would rather not hire a member of the discriminated group. As a result, it is clear that whenever the skills of the two applicants are identical, a biased manager will never choose a worker of the group against which he/she is prejudiced. Thus, in this setting costless discrimination is always at work.

The manager’s decision may however become ambiguous if the more skilled applicant belongs to the discriminated group. It is important for our argument that the manager’s distaste for that group be so large that he/she would rather hire an unskilled member of the other group than a competent member of the group against which he/she is biased. In other words, the manager’s prejudice is detrimental to the firm’s efficiency. We therefore explicitly model discrimination to be costly to shareholders.

However, for reasons that will appear below, the manager does not always choose the applicant on the basis of his/her prejudice. More precisely, when the applicant of the discriminated group is the more skilled, the manager hires the other applicant with probability $(1 - \lambda)$, $\lambda \in [0, 1]$. Under the same circumstances, his/her decision is therefore only based on skills, regardless of group membership, with probability λ , $\lambda \in [0, 1]$. This parameter may therefore be interpreted as a measure of the manager’s propensity not to let his/her prejudices interfere with the hiring decision.

A key feature of the model is that the manager’s prejudice needs not systematically be relevant in the hiring decision. Namely, that prejudice does not affect that decision when the two candidates belong to the same group, discriminated or not. In that case, which occurs with a positive probability, the manager can only base the hiring decision on skills. The result is that an outside observer who would not know the skills of applicants would be unable to determine whether the outcome of the hiring process is due to discrimination against one group, or simply luck.

Table 1: outcomes of the hiring process (i, κ)

Worker 1 \ Worker 2	(W, S) γ_{WS}	(W, U) γ_{WU}	(M, S) γ_{MS}	(M, U) γ_{MU}
(W, S) γ_{WS}	(W, S)	(W, S)	(M, S)	(W, S) with prob. λ (M, U) with prob. $(1-\lambda)$
(W, U) γ_{WU}	(W, S)	(W, U)	(M, S)	(M, U)
(M, S) γ_{MS}	(M, S)	(M, S)	(M, S)	(M, S)
(M, U) γ_{MU}	(W, S) with prob. λ (M, U) with prob. $(1-\lambda)$	(M, U)	(M, S)	(M, U)

The distribution of outcomes of the hiring decision is summarized in table 1, given that the discriminated population is group W . The characteristics of one applicant are displayed in the first column of table 1, while the other applicant's characteristics are displayed in the table's first row. Each cell of that table displays the characteristics of the hired worker, and, whenever relevant, their probabilities.

Now, depending on the hiring decisions made, the firm's revenue will differ. Table 2 displays the revenue for the firm in each possible configuration.

Table 2: Revenues associated to the outcomes of the hiring

	(W, S) γ_{WS}	(W, U) γ_{WU}	(M, S) γ_{MS}	(M, U) γ_{MU}
(W, S) γ_{WS}	R_s	R_s	R_s	R_s with prob. λ 0 with prob. $(1-\lambda)$
(W, U) γ_{WU}	R_s	0	R_s	0
(M, S) γ_{MS}	R_s	R_s	R_s	R_s
(M, U) γ_{MU}	R_s with prob. λ 0 with prob. $(1-\lambda)$	0	R_s	0

The revenue of the firm is thus the random variable defined by:

$$R = \begin{cases} 0 & \text{with probability : } \Omega(\lambda) = (\gamma_{WU})^2 + (\gamma_{MU})^2 + 2\gamma_{MU}\gamma_{WU} + 2(1-\lambda)\gamma_{MU}\gamma_{WS} \\ R_s & \text{with probability : } 1 - \Omega(\lambda) \end{cases} \quad (1)$$

Note that $\Omega(\lambda)$ is a linear function of λ :

$$\begin{aligned}\Omega(\lambda) &= (\gamma_{WU}^2 + \gamma_{MU}^2 + 2\gamma_{MU}\gamma_{WU} + 2\gamma_{MU}\gamma_{WS}) - 2\lambda\gamma_{MU}\gamma_{WS} \\ &= a - b\lambda\end{aligned}\tag{2}$$

where :

$$\begin{cases} a = \gamma_{WU}^2 + \gamma_{MU}^2 + 2\gamma_{MU}\gamma_{WU} + 2\gamma_{MU}\gamma_{WS} \\ b = 2\gamma_{MU}\gamma_{WS} \end{cases}$$

Parameter a is the probability that a fully discriminating manager hires an unskilled worker. This occurs whenever both applicants are unskilled, and when an unskilled M worker is chosen instead of a skilled W worker because of the manager's bias. Parameter b is the probability of having to choose from a pair of applicants consisting of an unskilled M worker and a skilled W worker. Namely, b is the probability of the only situation where discrimination between the two applicants affects the firm's revenue. This situation occurs each time the more skilled worker belongs to the discriminated group. As both a and b are probabilities, they are positive and smaller than one. Moreover, the definition of b makes it clear that $b \leq a$.

Given his/her preferences, the key decision that the manager has to make is the value of probability λ , namely the probability that he/she will not act according to his/her prejudices when the better candidate belongs to the discriminated group. We must therefore specify his/her objective and constraint. The manager gets consumption utility from his/her wage w . At the same time, increasing λ entails a psychological cost due to his/her bias against the discriminated group. The manager's utility therefore decreases with λ . We assume the following risk-neutral utility function:

$$U = E[w] - \frac{1}{2}d\lambda^2 \quad (d \geq 0)\tag{3}$$

As d increases, the manager's disutility of hiring a skilled W worker in lieu of an unskilled M worker increases. Parameter d gauges the aversion for the discriminated group relative to the utility of consumption. It thus measures the intensity of the manager's gender or ethnic bias. An unbiased manager is characterised by $d = 0$.

Finally, the manager has an outside option that will provide him/her utility U_0 , normalized here to zero.

The wage that is paid to the manager is determined by the shareholder. The latter is assumed risk-neutral, and seeks to maximize expected profits. The key characteristic of the shareholder's position is that he/she owns the firm but does not run it. Consequently, he/she

can only observe the firm's performance, and not the decisions that have been made by the manager. The shareholder does in particular not observe the hiring process, and cannot therefore observe discriminatory behaviours. The best he/she can do is therefore to pay a wage that is contingent on the firm's performance. We assume a standard linear contract of the following form:

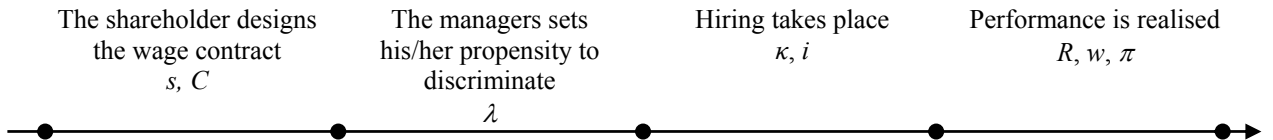
$$w = C + s.R, \quad s \in [0,1] \quad (4)$$

where C and s are parameters that are determined before the hiring decision. They are therefore chosen by the shareholder who is assumed to maximise expected profits. The value of C is chosen to ensure fulfilling of the manager's participation constraint.² Accordingly, the shareholder's utility reads:

$$V = E(R - w - F) \quad (5)$$

To close the model, we must now specify the timing of the game. We therefore assume that the shareholder first chooses the parameters of the wage schedule, under the participation constraint, which states that the manager's expected utility must exceed that provided by his/her outside option. The manager then determines the value of λ . The hiring process subsequently takes place. Once workers have been hired, the firm's performance is observed and the manager's wage paid. Finally, profits are distributed. This timing is summarized by the timeline below:

Figure 1: the timing of the game



This timing allows us to describe one of the key features of hiring decisions by managers who do not own the firm. Namely, their principals do not participate in hiring decisions, which is moreover surrounded by a lot of uncertainty, pertaining in particular to the skills of applicants. Managers can therefore always deny having made biased decisions by arguing that they were made only on the basis of skills, but that the quality of applicants was such that it resulted in hiring fewer members of the discriminated group. We now investigate the equilibrium of that game in our model.

² Note that if we impose $s = 1$ and $C = 0$, then the manager's incentives mimic those of a biased shareholder. Our model can thus be used to describe the behaviour of a firm run by its owner.

3. Equilibrium discrimination

We solve the model by backward induction. As the manager is the last player to make a decision, we therefore start by describing his/her behaviour.

3.1. The manager's reaction function

His/her problem is thus to choose the value of λ that maximizes his utility, which reads:

$$\text{Max } U = E[w] - \frac{1}{2}d\lambda^2 \quad (d \geq 0) \quad (6)$$

Replacing w , Ω by their value, the manager's maximisation problem becomes:

$$\text{Max}_{\lambda} \left\{ C + s.R_s(1 - a + b\lambda) - \frac{1}{2}d\lambda^2 \right\} \quad (7)$$

The first order condition accordingly reads:

$$s.R_s.b - d\lambda = 0 \quad (8)$$

which yields:

$$\lambda = \frac{s.R_s.b}{d} . \quad (9)$$

As it is a product of positive terms, the above expression is positive and increasing in s . However, as λ is a probability, one must also make sure that it is smaller than or equal to one, which the above expression does not guarantee. Depending on the values of the parameters, the manager's optimum may therefore lead to corner solutions.

Two configurations may arise. The first configuration arises when λ does not exceed one, i.e. when $d > R_s.b$ that is when the manager's taste for discrimination is large. Then eq. (9) provides the interior solution of the manager's problem. In that case, the manager's optimal reaction, $\lambda^*(s)$, is positive and strictly smaller than one. It is moreover a linear and increasing function of s , the parameter that determines the performance-dependent part of the wage schedule. The second configuration arises when λ can exceed one, i.e. if $d \leq R_s.b$. In that case, the manager's bias is small enough to lead to a corner solution for some values of s .

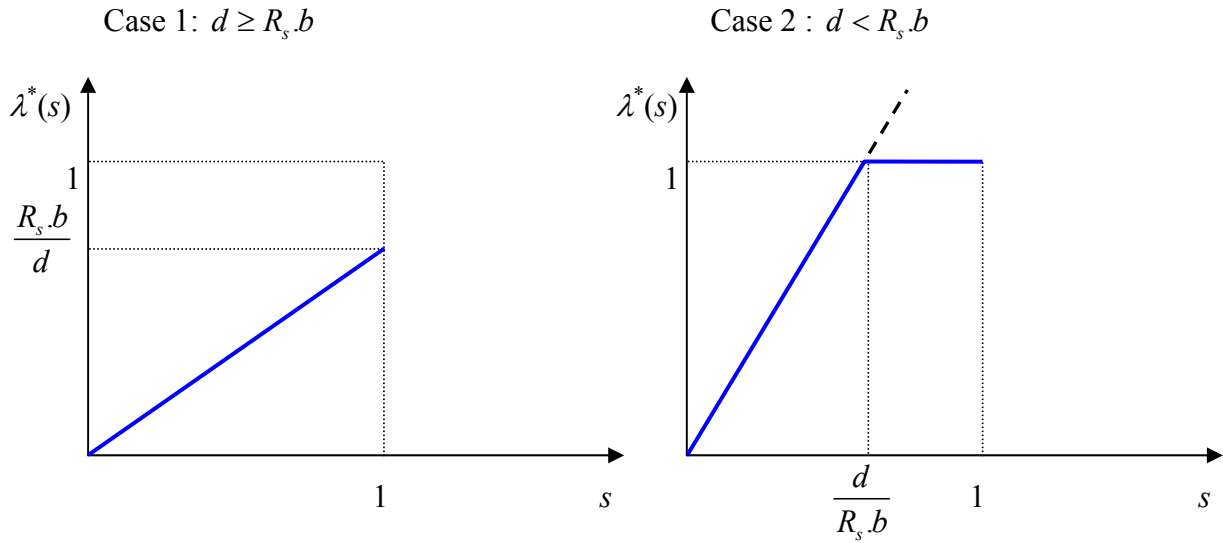
The manager's optimal λ will then be given by (9) for small values of s ($s \leq \frac{d}{R_s \cdot b}$), and be equal to one for larger values of s .

The manager's reaction function is accordingly a function of s from $[0, 1]$ to $[0, 1]$ that reads:

$$\lambda^*(s) = \begin{cases} \frac{s \cdot R_s \cdot b}{d} & \text{if } s < \frac{d}{R_s \cdot b} \\ 1 & \text{if } s \geq \frac{d}{R_s \cdot b} \end{cases} \quad (10)$$

Figure 2 below displays that function in the two cases. The left-hand side quadrant shows the manager's reaction function when only interior solutions occur, while the right-hand-side quadrant displays it in the case where there may be a corner solution.

Figure 2: The manager's reaction function



The quantity $\frac{s \cdot R_s \cdot b}{d}$ is the product of the probability b of a skilled W candidate and an unskilled M candidate applying at the same time, on the one hand, and, on the other hand, the ratio $\frac{s \cdot R_s}{d}$, which compares the manager's benefit in terms of increased wage to his/her psychological cost of hiring a skilled W worker instead of an unskilled M worker. For a given probability $b > 0$, if that ratio is small enough, that is if the premium is small enough or the

taste for discrimination large enough, then the manager chooses a value of λ that is smaller than one. In that case, increasing the monetary benefit of hiring discriminated workers gives the manager an incentive to discriminate less.

On the other hand, once the incentive to hire skilled workers from the discriminated group becomes large enough for the manager to always base his/her decision on skills only, that is once $\lambda = 1$, he/she cannot react to further increases of the premium. The manager's behaviour then becomes independent from s .

3.2. The shareholder's optimal contract

Being the Stackelberg leader, the shareholder designs the performance contract by anticipating its effects on the manager's behaviour. He/she therefore maximises expected profit taking the manager's reaction as a constraint. Namely:

$$\text{Max}_s E[R - w - F] = \text{Max}_s [(1-s)E[R] - C - F] \quad (11)$$

Replacing $E[R]$ by its value, $E[R] = R_s [1 - \Omega(\lambda)] = R_s (1 - a + b\lambda)$, and taking the value of λ that is optimal for the manager as given by expression (10), one gets the shareholder's programme.

However, depending on the parameters values, there can be an interior as well as a corner solution to the manager's programme. Accordingly, one must treat the two cases that appeared in the previous section separately. In the first case, i.e. whenever $d < R_s b$, the manager's bias is small enough for corner solutions to exist. In the second one, i.e. when $d \geq R_s b$, the manager's programme only leads to interior solutions. For simplicity sake, we start by investigating the second case.

When the manager's bias is large enough, i.e. whenever $d \geq R_s b$, the shareholder's programme reads :

$$\text{Max}_s \left[(1-s)R_s \left(1 - a + \frac{b^2 \cdot s \cdot R_s}{d} \right) - C - F \right] \quad (12)$$

The first order condition therefore is:

$$\frac{b^2 \cdot R_s}{d} - 1 + a - \frac{2b^2 \cdot s \cdot R_s}{d} = 0$$

It leads to the following solution:

$$s_0 = \frac{1}{2} \left(1 - \frac{1-a}{b} \cdot \frac{d}{b.R_s} \right) \quad (13)$$

For this solution to be realistic, the performance premium, s , must be non-negative. We therefore impose $s \geq 0$. Two sub-cases must then be considered depending on whether this additional constraint bites or not.

The constraint that $s \geq 0$ does not bite whenever $\frac{1-a}{b} \cdot \frac{d}{b.R_s} < 1$. This condition is fulfilled if the manager's taste for discrimination is not too large, namely if $d < \frac{b}{1-a} b.R_s$.

In that case, $s_0 \in [0, 1]$. The optimal value of s is consequently given by (13):

$$s^* = s_0 = \frac{1}{2} \left(1 - \frac{1-a}{b} \cdot \frac{d}{b.R_s} \right) \quad (14a)$$

The optimal performance premium is therefore decreasing in the manager's bias and increasing in the productivity of skilled workers.

The manager's optimal reaction is then given by the first line of expression (10). By plugging the value of s^* in that expression, one gets:

$$\lambda^* = \lambda_0 = \frac{1}{2} \left(\frac{R_s \cdot b}{d} - \frac{(1-a)}{b} \right) \quad (14b)$$

In that case, the probability of hiring a skilled W worker competing against an unskilled M worker is increasing in skilled workers' output and decreasing in the manager's bias. That solution however only applies when the manager's bias is not too large.

If the value of the manager's taste is very large, that is $d \geq \frac{b}{1-a} b.R_s$, then the value of s_0 in expression (13) is negative, and the shareholder's programme leads to the corner solution: $s^* = 0$. The manager's optimal response is again found by replacing s^* by its value in the first line of expression (10). The outcome of the game accordingly reads:

$$s^* = 0 \quad (15a)$$

$$\lambda^* = 0 \quad (15b)$$

In that configuration, the risk of the manager having the possibility to make a decision according to his bias is so small that the shareholder is better off not paying a performance premium, which would be wasted most of the time.

Let us now turn to the case where the manager's taste for discrimination is small enough for the reaction function to be kinked ($d < R_s b$). The resulting shareholder's optimal contract can be either an interior point or a corner solution, depending on the position of s_0 defined by eq. (14a) with respect to $\frac{d}{b.R_s}$.

Consequently, the game results in an interior solution, if $s_0 \leq \frac{d}{b.R_s}$. To check if it the case, we replace s as defined by (13) by its value in the manager's reaction function (10). This gives:

$$s_0 = \frac{1}{2} \left(1 - \frac{1-a}{b} \cdot \frac{d}{b.R_s} \right) \leq \frac{d}{b.R_s}$$

Solving the above inequality reveals that the game leads to interior solutions when the manager's taste for discrimination remains larger than a given threshold:

$$d \geq \frac{b}{1-a+2b} b.R_s$$

In that case, the equilibrium values of λ and s are respectively given by expressions (14a) and (14b).

The last sub-case arises when the manager's taste for discrimination becomes very small. Namely, whenever:

$$d < \frac{b}{1-a+2b} b.R_s$$

In this specific case, the manager's programme leads to a corner solution. His/her behaviour is accordingly described by the second part of expression (10). Namely, he/she does not discriminate skilled W workers ($\lambda^* = 0$). The shareholder's best response is therefore to pay the manager the smallest premium that will give the latter the incentive not to discriminate. The equilibrium of the game therefore reads:

$$s^* = \frac{d}{b.R_s} \tag{16a}$$

$$\lambda^* = 1 \tag{16b}$$

The outcomes of the game may be ranked according to the intensity of the manager's taste for discrimination, which takes us to our first three propositions:

Proposition 1: If the manager's taste for discrimination is small ($d < \frac{b}{1-a+2b}b.R_s$), then:

- i. the probability of choosing a skilled worker from the discriminated group against an unskilled worker from the other group is equal to one;
- ii. the manager's wage is an increasing function of the firm's profits, an increasing function of his/her taste for discrimination, and a decreasing function of the probability that discrimination between the two applicants affects the firm's revenue.

Proof: We have shown that whenever $d < \frac{b}{1-a+2b}b.R_s$, the outcome of the game is described by expressions (16a) and (16b). λ is therefore equal to one, which proves (i). As s is positive, the manager's wage is therefore an increasing function of the firm's profits. Moreover, expression (16a) shows that s is increasing in d , and decreasing in b and R_s , which proves (ii).

The rationale of this result is that, as long as the manager is biased against the discriminated group, an incentive is needed to reduce discrimination, and the larger his/her bias, the larger the incentive must be. However, if the manager's bias is sufficiently small, reducing that bias is cheap enough for the shareholder to find it optimal to completely eliminate that bias. The latter therefore pays the manager the exact premium that eliminates the bias.³

The manager's taste for discrimination may however not always be sufficiently low for the previous configuration to arise, which takes us to our second proposition.

Proposition 2: If the manager's taste for discrimination is intermediate,

$$\frac{b}{1-a+2b}b.R_s \leq d < b.R_s, \text{ then:}$$

- i. the probability of choosing a skilled worker from the discriminated group against an unskilled worker from the other group is smaller than one. It decreases with the manager's taste for discrimination, and increases with the skilled workers' impact on profits;

³ One should however keep in mind that the performance contract only eliminates the discrimination of skilled W workers who compete against an unskilled M worker. W workers remain discriminated against M skilled workers and unskilled W workers remain discriminated even against unskilled M workers.

- ii. the manager's wage is an increasing function of the firm's profits, an increasing function of his/her taste for discrimination, and a decreasing function of the probability that discrimination between the two applicants affects the firm's revenue.

Proof: This configuration occurs either when the manager's taste for discrimination is small enough to lead him/her to choose a value of λ that is strictly smaller than one regardless of the value of s , i.e. $d < R_s \cdot b$, but not small enough to result in being equal to zero, $d \geq \frac{b}{1-a+2b} b \cdot R_s$, or when the manager's reaction function is kinked, namely $d \geq R_s \cdot b$, but the shareholder's optimum lies on the increasing part of that curve, which occurs when the manager's taste for discrimination is not too large, $d < \frac{b}{1-a} b \cdot R_s$. In both instances, the outcome of the interaction between the manager and the shareholder is described by expressions (14a), and (14b).

According to expression (14b), λ is strictly smaller than one, increases with R_s and b , and decreases with d , which proves (i). Expression (14a) shows that s is strictly positive, increasing in b and R_s , and decreasing in d which proves (ii).

The intuition of that result is the following: when the manager's taste for discrimination is neither too small nor too large, the outcomes of both the manager's and the shareholder's programmes lead to interior solutions. It means that the manager weighs the psychological benefit of discriminating W workers against increasing his/her expected wage. Therefore, the manager will discriminate more if his/her relative taste for discrimination is larger, and less if the impact of discrimination on the firm's profits is larger. Moreover, knowing that the manager's decision has a larger impact on the firm's profits, the shareholder has an incentive to increase the performance-related part of the manager's wage. As a result, increasing probability b has a twofold impact on discrimination.

Unfortunately, the manager's taste for discrimination may not always be small enough for the performance contract to dissuade him/her from fully discriminating skilled W workers. In that case, the outcome of the game is described by our third proposition.

Proposition 3: If the manager's taste for discrimination is large, namely if

$$d \geq \text{Max} \left(b \cdot R_s, \frac{b}{1-a} b \cdot R_s \right), \text{ then:}$$

- i. there is full discrimination against W workers;
- ii. the manager's wage is independent from the firm's profits.

Proof: If $d \geq \text{Max}\left(b.R_s, \frac{b}{1-a}b.R_s\right)$, then the outcome of the game is described by expressions

(15a) and (15b). According to expression (15a), $s^* = 0$. The manager's wage is therefore constant, which proves (i).

Moreover, $\lambda^* = 0$ according to expression (15b). The probability to hire a skilled W worker facing an M unskilled worker is therefore zero. Accordingly, there is full discrimination in equilibrium.

The rationale for this result is that when the manager's bias is too large, then the marginal expected benefit of increasing the probability of hiring skilled W workers against unskilled M workers is smaller than its marginal expected cost. In that case, the shareholder prefers to pay the manager a fixed wage, even though the former knows that the latter will systematically waste the skills of W applicants.

To complete the description of the outcome of the model, we investigate how it is affected by the composition of the pool of workers. To do so, we simply compute partial derivatives of the optimal premium s^* and discriminating factor λ^* with respect of the probabilities γ_{WS} , γ_{WU} , γ_{MU} . However, as $\sum_{i=M,W} \sum_{k=S,U} \gamma_{ik} = 1$, this implies considering scenarios in which increasing a given class of the population is compensated by an equivalent decrease in the complementary class, namely skilled M workers. Moreover, to save on space, we only consider the configuration of the model where both the manager's and the shareholder's programmes lead to interior solutions.

Under those circumstances, our next proposition describes the evolution of discrimination as a function of the composition of the population.

Proposition 4a: If the manager's taste for discrimination is intermediate,

$$\frac{b}{1-a+2b}b.R_s \leq d < b.R_s, \text{ then the probability of choosing a skilled worker from the}$$

discriminated group against an unskilled worker from the other group:

- iii. increases when the proportion of skilled W workers increases at the expense of the proportion of skilled M workers,
- iv. decreases when the proportion of unskilled W workers increases at the expense of the proportion of skilled M workers,
- v. increases when the proportion of M workers increases at the expense of the proportion of skilled M workers.

Proof: In this configuration, the equilibrium level of l is given by (14b). One then simply shows that:

$$\frac{\partial \lambda^*}{\partial \gamma_{WS}} = R_s \frac{1 - (\gamma_{MU} + \gamma_{MU})^2}{4\gamma_{MU}\gamma_{WS}^2} + R_s^2 \frac{\gamma_{MU}}{d} > 0, \text{ which proves (i),}$$

$$\frac{\partial \lambda^*}{\partial \gamma_{WU}} = -\frac{1}{2} \frac{\gamma_{WU} + \gamma_{MU}}{\gamma_{WS} + \gamma_{MU}} < 0, \text{ which proves (ii),}$$

$$\frac{\partial \lambda^*}{\partial \gamma_{MU}} = \frac{4R_s\gamma_{WS}^2\gamma_{MU}^2 + d(\gamma_{MU}^2 - \gamma_{WU}^2 + 1)}{4d\gamma_{WS}\gamma_{MU}^2} > 0, \text{ which proves (iii).}$$

The next proposition is the previous one's counterpart, and describes the evolution of the equilibrium performance premium.

Proposition 4b: If the manager's taste for discrimination is intermediate,

$\frac{b}{1-a+2b}b.R_s \leq d < b.R_s$, then the percentage of profits s that is paid to the manager:

- i. increases when the proportion of skilled W workers increases at the expense of the proportion of skilled M workers,
- ii. increases when the proportion of unskilled W workers increases at the expense of the proportion of skilled M workers,
- iii. increases when the proportion of M workers increases at the expense of the proportion of skilled M workers.

Proof: In this configuration, the equilibrium level of l is given by (14a). One then simply shows that:

$$\frac{\partial s^*}{\partial \gamma_{WS}} = \frac{d}{4\gamma_{MU}\gamma_{WS}^2R_s} + \frac{1-a}{4\gamma_{MU}^2\gamma_{WS}^3R_s} > 0, \text{ which proves (i),}$$

$$\frac{\partial s^*}{\partial \gamma_{WU}} = \frac{\gamma_{WU} + \gamma_{MU}}{4\gamma_{MU}^2\gamma_{WS}^2R_s} \cdot \frac{d}{R_s} > 0, \text{ which proves (ii),}$$

$$\frac{\partial s^*}{\partial \gamma_{MU}} = \left(\frac{\gamma_{MU} + \gamma_{WU} + \gamma_{WS}}{4\gamma_{MU}^2 \gamma_{WS}^2} + \frac{1-a}{4\gamma_{MU}^3 \gamma_{WS}^2} \right) \frac{d}{R_s} > 0, \text{ which proves (iii).}$$

The intuition of propositions (4ai) and (4bi), and (4aii) and (4bii) is fairly straightforward. When the proportion of skilled W workers or unskilled M workers increases at the expense of the proportion of skilled M workers, the probability b that the manager's bias influences the shareholder's profits increases. The latter therefore has a stronger incentive to write a stimulating wage contract, which explains why s^* increases. The manager then reacts to the stronger incentive by hiring skilled W workers more often.

The rationale for propositions (4aiii) and (4biii) is slightly different, because the proportion of unskilled M workers does not affect profits through the manager's bias. One may indeed see that b is independent from γ_{MU} . However, increasing the proportion of MU workers still affects expected profits, because it increases the probability that an unskilled worker is hired. The marginal cost to the shareholder of rewarding performance therefore decreases, as the first order condition of the shareholder's programme shows. He/she therefore has an incentive to increase s . The manager then simply reacts by hiring more skilled W workers.

3.3. A graphical interpretation

The succession of the three configurations of the model may look tedious at first sight. They may however be understood more easily thanks to a graphical interpretation. To do so, we must complement figures 2a and 2b, which graph the manager's reaction function, by the shareholder's objective. The shareholder's objective is to maximise expected profits, which increase when λ increases and s decreases. Moreover, expected profits will be at their maximum when $\lambda = 1$ and $s = 0$. The shareholder's objective can thus be described by a series of increasing and convex iso-profit curves centred on $(0, 1)$, which is his/her bliss point. The shareholder thus maximises expected profit by choosing the point on the manager's reaction function that lies on the rightmost iso-profit curve.

We can now represent the result of increasing the manager's taste for discrimination. The larger the manager's taste for discrimination, the steeper his/her reaction function. When the manager's bias exceeds the threshold $b.R_s$, a kink appears in the reaction function.

The following four graphs depict the four sub-cases that may appear in our model. They start from a very small bias and gradually increase it. The first graph describes the outcome of the model for a very small value of the manager's taste for discrimination. That parameter is then increased, thus allowing visualizing the four configurations of the model.

Figure 3: Configurations of the model

Fig. 3a: $d < \frac{b}{1-a+2b} b.R_s$

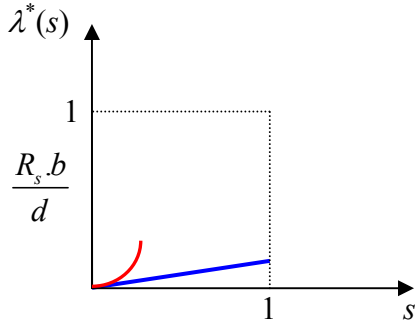


Fig. 3b: $\frac{b}{1-a+2b} b.R_s \leq d < b.R_s$

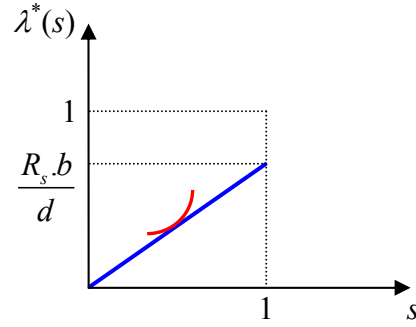


Fig. 3c: $b.R_s \leq d < \frac{b}{1-a} b.R_s$

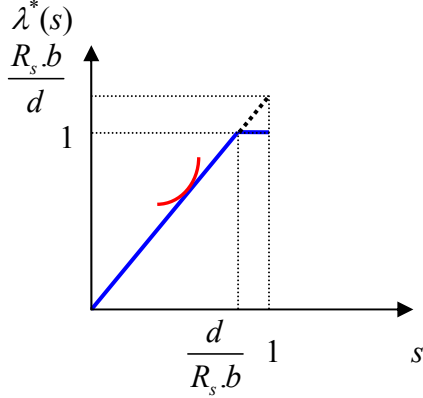
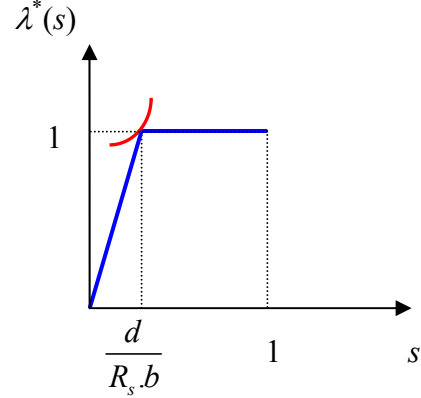


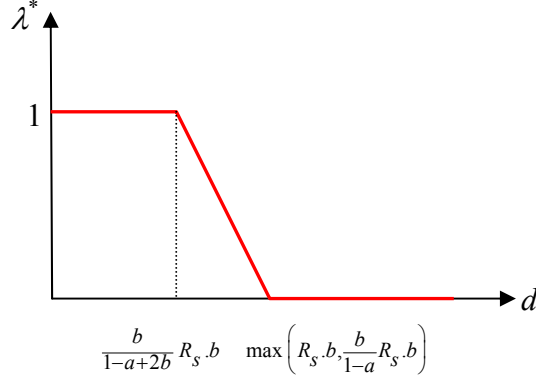
Fig. 3d: $d \geq \frac{b}{1-a} b.R_s$



It thus appears that both s^* and λ^* increase when d increase. When d is very small (fig. 3a), the manager's reaction function is very flat. The shareholder's optimum therefore lies on the origin, and both s^* and λ^* are equal to zero. When d takes on intermediate values (fig. 3b and 3c), the manager's reaction function becomes steeper, and the shareholder's optimum is to be found on the increasing part of the manager reaction function. Both s^* and λ^* are therefore increasing in d . Finally, when d is very large (fig. 3d), the shareholder's optimum lies exactly on the kink of the manager's reaction function. λ^* then becomes equal to one, and s^* is given by the kink's abscissa $\frac{d}{R_s \cdot b}$.

Figure 4 below summarizes the manager's equilibrium behaviour by describing the evolution of λ as a function of d :

Figure 4: Equilibrium probability of hiring skilled discriminated workers



The graph recalls that, for low values of the manager's bias, there will be no discrimination of skilled workers in equilibrium. For larger values of that bias, discrimination will start increasing. For even larger values of that parameter, there will be full discrimination of skilled W workers. As a result, figure 4 shows that the larger the cost of hiring an unskilled worker instead of a skilled one, the larger the range of values of the manager's bias for which the performance-based contract will be able to eliminate discrimination of skilled W workers.

What the model consequently overall underlines is that discrimination of skilled workers is less likely where profits are very dependent on skills. This occurs when the productivity gap between skilled and unskilled workers is large and the probability b that discrimination between applicants affects the firm's revenue is large. As a result we should expect to see less discrimination in sectors and occupations where skills matter. This is consistent with Meulders et al (2003) finding that, although women are still underrepresented among industrial researchers, there is a trend for firms to hire more highly qualified young women.

Second, as b is increasing in the proportion of skilled discriminated workers in the population, we should expect discrimination to be less prevalent in societies where discriminated groups are more skilled.

4. Extension: Unknown taste for discrimination

The previous section rested on the assumption that the manager's bias was known to the shareholder. However, people's prejudices differ, and some managers' bias may be larger than others. As the bias is unobservable, the shareholder must design the performance contract without knowing the actual value of that parameter. This is bound to affect the resulting contract, but also the behaviour of managers.

To address this issue, we now modify our model to allow managers to be of two types. We thus assume that the manager may either be very biased ($d = \bar{d} \geq R_s \cdot b > 0$) with probability ψ , or completely unbiased ($d = \underline{d} = 0$) with probability $(1 - \psi)$. This implies that the manager's reaction function is:

$$\lambda^*(s) = \begin{cases} \frac{s \cdot R_s \cdot b}{\bar{d}} & \text{with probability } \psi \\ 1 & \text{with probability } (1 - \psi) \end{cases}$$

The firm's expected revenue is then the sum of expected profits with a biased and an unbiased manager weighted by their probabilities :

$$\begin{aligned} E[R] &= \psi E[R|d = \bar{d}] + (1 - \psi) E[R|d = \underline{d}] \\ &= \left[1 - a + b \left(\psi \frac{s \cdot R_s \cdot b}{\bar{d}} + 1 - \psi \right) \right] R_s \end{aligned} \quad (17)$$

The shareholder therefore maximizes expected profits that read:

$$\text{Max}_s \left\{ (1 - s) R_s \left[1 - a + b \left(\psi \frac{s \cdot R_s \cdot b}{\bar{d}} + 1 - \psi \right) \right] - C - F \right\} \quad (18)$$

The first order condition then gives:

$$\frac{\psi b^2 \cdot R_s}{\bar{d}} - 1 + a - b + b\psi - \frac{2\psi \cdot b^2 \cdot s \cdot R_s}{\bar{d}} = 0$$

As a result, we can express the equilibrium wage contract and the manager's probability of hiring a skilled W worker competing against an unskilled M worker:

$$s^* = s_0(\psi) = \frac{1}{2} \left(1 - \frac{1 - a + b}{\psi b^2} \cdot \frac{\bar{d}}{R_s} \right) \quad (19a)$$

$$\lambda^*(s) = \begin{cases} \frac{1}{2} \left(\bar{d} - \frac{1 - a + b}{\psi b^2 R_s} \right) \cdot R_s \cdot b & \text{with probability } \psi \\ 1 & \text{with probability } (1 - \psi) \end{cases} \quad (19b)$$

We thus reach our fifth proposition, which complements the previous ones:

Proposition 5: When the manager may be either biased ($d = \bar{d} \geq R_s \cdot b > 0$) or unbiased ($d = \underline{d} = 0$), then:

- i. the probability that a biased manager chooses a skilled worker from the discriminated group against an unskilled worker from the other group is decreasing in the probability that the manager be unbiased;
- ii. the manager's wage is an increasing function of the firm's profits, and an increasing function of the probability that the manager be unbiased;

Proof: Expression (19b) shows that λ^* is a decreasing function of ψ , which proves (i).

Expression (19a) shows that s^* is an increasing function of ψ , which proves (ii).

The intuition of that proposition is straightforward. If most managers are unbiased then there is no incentive to relate their wage to performance. Indeed, unbiased managers spontaneously maximise the firm's profits. However, if the probability of the manager being biased is large, then the shareholder has a large incentive to relate the manager's wage to performance, so as to limit the impact of the latter's bias. As a result, the equilibrium performance premium increases in the probability that the manager is biased.

A corollary is that unbiased managers benefit from the existence of biased managers. They thus get a free lunch in the guise of a performance-related wage, without having to change their behaviour to maximize their wage. The wage schedule is more stimulating the more common are biased managers. This increases unbiased managers' free lunch.

On the flip side, the wage contract is more stimulating when the probability of having a biased manager increases. Consequently, biased managers are more induced to refrain from discriminating in environments where biased managers are common place. Ironically, discrimination may thus be less prevalent on markets where biased managers are more numerous.

5. Conclusion

In this paper, we set up a model where labour discrimination is costly, but where the cost is not borne by the agent who discriminates. Hiring decisions thus result in a principal-agent problem between shareholders and managers. In that model, performance-based

contracts may fail to avoid costly discrimination, namely discrimination where unskilled workers are hired instead of skilled workers of the discriminated group. Moreover, they have no impact on the discrimination that is costless to shareholders, namely the discrimination of unskilled workers. Profit maximisation is therefore not sufficient to preclude labour discrimination.

The present paper's natural extension is therefore to investigate the impact of public policies against discrimination. Our model indeed allows investigating how shareholders' and managers' incentives are affected. This has to our knowledge been overlooked in the literature on discrimination and affirmative action, which has so far stuck to the assumption that firms are profit, or utility maximisers. Our model could in particular be used to compare the relative merits of quotas and other antidiscrimination measures.

The model could also be extended to investigate discrimination in a more general context. First, a wage gap between the discriminated and the non-discriminated group could be incorporated. This would extend the cost for the shareholder of discrimination to unskilled workers. Second, a more realistic hiring process could be investigated, where a human resources department, facing specific incentives, would be in charge of hiring new workers.

Regardless of the extension considered, using a more realistic description of firm behaviour and organisation is likely to provide new insights in the consequences of anti-discrimination policies. Our model provides a framework to investigate those consequences.

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