Discrimination in Organizations

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Abstract

A number of the largest U.S. firms have been found guilty of labor discrimination despite having policies in place that have been designed in order to avoid the outcome. This paper diagnoses the phenomenon and proposes a contractual solution to ameliorate the situation using a mechanism design approach. Existing research (e.g., Becker (1957), Coate and Loury (1993)) studies a situation in which an individual person practices discrimination. In contrast, the paper considers a hierarchical organization in which a manager (the agent) has a discriminatory taste toward his subordinates, whereas an owner (the principal) is unbiased and only cares about profit. The manager perfectly observes productivity of his black and white subordinates and decides whom to promote. Both the black and white subordinates are ex-ante identical in terms of their productivity distribution. The owner only sees results of his manager’s decision, the promoted worker’s identity, and that worker’s performance. That is, the manager knows, but the owner does not know what would have been the productivity of the worker who was not promoted. In this environment, I study a direct mechanism in which the manager reports all information to the owner and the owner makes decisions on promotion and compensation. In the optimal direct mechanism (Bonus-mechanism), which maximizes the firm’s expected profit subject to incentive compatibility conditions, the black worker is promoted if the productivity gap between the black and white workers exceeds the manager’s disutility associated with the discriminatory preference. In this case where the black worker is promoted, the owner provides a fixed amount of bonus to the manager. Additionally, I compare the allocation implemented by this Bonus-mechanism to the first-best (full information) allocation and finally discuss effectiveness of current regulations (e.g. affirmative action, auditing, taxation on the minority promotion ratio): whether or not a regulator (such as the EEOC in the case of employment discrimination) can improve compliance with non-discriminatory conduct, despite the fact that the person on whom the regulation is directly incident—that is, the principal—is not intrinsically biased.

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JEL Classification : D02, D04, D21, D63, D82, D86
1 Introduction

A number of the largest U.S. firms have been found guilty of illegal labor discrimination. In 2000, Coca-Cola paid $192 million to its African-American employees in a racial discrimination settlement, and as recently as 2013, Bank of America paid $39 million in a gender discrimination settlement. FedEx and Wachovia were also involved in these types of discrimination lawsuits and agreed to very costly settlements.

There are two notable points regarding these lawsuits. First, discriminatory treatment was executed by managers at the lowest level, who directly oversee bottom line workers, giving unfair treatment in promotions and wages. Second, the defendant firms are listed among the Top 100 companies in Fortune magazine when the lawsuits were filed. Such accomplishments show that these firms are under sophisticated and successful management. That is, the senior level management of these firms makes highly profit-oriented business decisions. They seem to clearly understand that discrimination toward their workers is not in their firms’ best interests as is shown by the fact that they promulgate explicit non-discrimination policies. In sum, in these huge lawsuits, discrimination was practiced by members of the middle management toward their subordinates, though the firms themselves did not want to practice discrimination. Evidently, the senior management teams did not have the necessary mechanisms in place in order to ensure that such bigoted people were not appointed to the middle management; or, if that was impossible, they did not provide enough incentives for appointed managers to set aside their personal preferences when making business decisions.

In other words, these acts of discrimination resulted from an agency problem between the top management and the middle management. An information gap was created by delegating labor-supervision and related business decisions to the middle managers. Also, they had a preference difference. Under these circumstances, two economic questions can be studied. One is how to block individuals with such discriminatory preferences from entering middle management (a screening problem), and another is, if such person is appointed as a middle manager, how can he be controlled by contractual arrangement?

This paper answers to the second question. The discriminatory manager perfectly

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observes productivity levels of his black and white subordinates. This information is not observable by the firm’s owner who decides the manager’s compensation. The manager needs to promote one of the subordinates, and then the owner will compensate the manager based on what she observes, the promotion decision by the manager and the output of the promoted worker. By the Revelation Principle (Myerson (1981)), I consider a direct mechanism that abstracts the details of any particular contractual setting between the owner and the manager. In the direct mechanism, the manager (the agent) reports all available information to the owner (the principal), and the owner determines the promotion choice based on the report. Also, the manager’s compensation is arranged as a function of the report and the output of the promoted worker to maximize the firm’s profit. Consequently, an optimal incentive for the biased manager in the hierarchy can be obtained by solving a direct mechanism problem where the agent has two-dimensional private information (productivity of both subordinate workers) that is going to be partially revealed (by the output of the promoted worker) after promotion. An optimal direct mechanism (Bonus-mechanism) induces the owner to promote the black worker if the productivity gap between the black and white workers exceeds the managers disutility associated with the discriminatory preference. Whenever the black worker is promoted, the owner provides a fixed amount of bonus to the manager.

There are several branches of existing research in economics of discrimination. In the seminal paper in theories of discrimination, Becker (1957) defines a taste for discrimination such that “if someone has a taste for discrimination, he must act as if he were willing to forfeit income in order to avoid certain transactions.” The subsequent theoretical and empirical research on the taste-based discrimination (Stiglitz (1973); Black and Strahan (2001)) explains that more competitive markets have less discriminatory outputs.

Second, literature formulates theories of statistical discrimination, according to which a decision maker’s belief about worker’s outcome-relevant characteristics is a key affecting their discriminatory decisions. Statistical discrimination assumes that workers’ skills or productivity levels are unobservable by an employer. Instead, workers’ physical attributes are used as a signal to their outcome-relevant features. Phelps (1972) introduces a model of discrimination where statistical distributions of production-skill variables are different in groups. Arrow (1973) and Coate and Loury (1993) develop such statistical differences endogenously. In their environments, ex-ante identical groups can derive different skill investment choices in an asymmetric equilibrium.

Finally, there are recent research showing discriminatory decisions as an optimal outcome in various economic environments even when decision makers are unbiased and workers are identical. Winter (2004) suggests an equilibrium in a team project envi-
ronment, in which a principal wants to provide different rewards to team members for requiring same effort levels. Peski and Szentes (2013) provides a repeated matching environment, where employers do not want to be matched with the other racial workers in an equilibrium.

This paper deals with a hierarchical environment, where discrimination against subordinate workers impairs institution’s profit, and explains what the owner can do best to reduce the discriminatory decisions without compromising the firms profit. As the manager has a discriminatory preference, taste-based discrimination is assumed here. In contrast to prior research, this paper considers a contractual problem between a principal and a decision-maker agent as the agent has authority over the subordinate workers’ promotion.

The remainder of this paper is as follows. In the next section, specific assumptions on the environment and the model are introduced. In section 3, an optimal mechanism (Bonus mechanism) is proposed, and allocations of the other mechanisms and the Bonus mechanism are compared. Section 4 discusses extensions of the study, and section 5 concludes the paper.

2 Model

2.1 Environment

Timeline

1. A firm (an owner and a manager) hires 2 workers - one white and one black.
2. The manager (but not the owner) observes the productivity of both workers.
3. The manager reports this information to owner, who promotes one worker.
4. The owner observes the output (perfectly correlated with the productivity) of the promoted worker, but remains ignorant about the worker who was not promoted.
5. The owner compensates the manager. Note that the compensation depends on the manager’s report and on the identity and output of the promoted worker.

Note that the manager originally has two-dimensional private information, but one of them is revealed later. That is, in this direct mechanism setting, partial verification of the agent’s private information is enabled by the owner after she decides the promotion and observes the outcome of the promoted worker. Therefore, the second decision, the compensation of the manager is a function of the verified partial information and the manager’s initial report.
Absence of outside options The manager is assumed to have no outside option. He provides the productivity report in any case and receives the compensation from the owner.

Discrimination coefficient If the identity of the promoted labor is black, the manager earns disutility equivalent to \( d \). This fact is known commonly.

Note that \( d \) is a personal cost of the manager affecting only the manager’s utility. It does not have an impact either on the firm’s profit or on the firm’s budget for the manager’s compensation.

Productivity Let \( I = \{ B, W \} \) be a set of subordinates. \( x_B \) and \( x_W \) denote the black and white subordinates’ productivity, respectively. Each \( x_i \) is i.i.d drawn from a set \( X = [0, \bar{x}] \in \mathbb{R}_+ \), where \( \bar{x} > d \), with a continuous distribution \( F_i(\cdot) \) and a density function \( f_i(\cdot) \). We assume \( f_B(\cdot) = f_W(\cdot) \) and \( \forall x_i \in X, f_i(x_i) > 0 \). Let \( x = (x_B, x_W) \in X^2 \), and for \( \forall x, f(x) = f_B(x_B) \times f_W(x_W) > 0 \).

2.2 Direct Mechanism \(< Q, P >\)

Let \( z = (z_B, z_W) \in X^2 \) be a productivity report on the black and white subordinates by the manager. A direct mechanism \(< Q, P >\) consists of an allocation rule \( Q : X^2 \to I \) that appoints one subordinate to be promoted and a payment (compensation) rule \( P : X^3 \to \mathbb{R}_+ \) that is a transfer from the owner to the manager. \( Q \) is a function of the manager’s report \( z \) and \( P \) is a function of \( z \) and the promoted subordinate’s true productivity \( x_{Q(z)} \).

**Definition 1** (owner’s informational state). Let \( z = (z_B, z_W) \) denote the productivity values reported by the manager, and \( x = (x_B, x_W) \) denote the true productivity information of the subordinates. Under an allocation rule \( Q(z) \), we define a owner’s informational state \( \xi_Q : X^2 \to X^3 \) as \( \xi_Q(z, x) = (z_B, z_W, x_{Q(z)}) \).

Accordingly, the payment rule is a function of \( \xi_Q(z, x) \). Given \(< Q, P >\), the owner’s profit is \( \pi(z, x) = x_{Q(z)} - P(\xi_Q(z, x)) \). Since a budget for the compensation of the manager is limited to the firm’s output \( x_{Q(z)} \), \( P(\xi_Q(z, x)) \in [0, x_{Q(z)}] \). Given \(< Q, P >\), if the manager reports \( z \), the manager’s utility is \( u(z, x) = P(\xi_Q(z, x)) - d \cdot 1_{Q(z)=B} \).

A mechanism \(< Q, P >\) is incentive compatible (IC) if truthful reporting is a dominant strategy for the manager, i.e.

\[
P(\xi_Q(x, x)) - d \cdot 1_{Q(x)=B} \geq P(\xi_Q(z, x)) - d \cdot 1_{Q(z)=B} \quad \forall x, z \in X^2
\]

With \(< Q, P >\) and the manager’s truthful reporting, profit of the owner is \( \pi(x) = \)
\( x_Q(x) - P(\xi_Q(x,x)) \). Then, the owner’s problem is choosing the optimal \( Q \) and \( P \) to maximize the expected profit, subject to the incentive compatibility constraint. That is,

\[
\max_{Q,P} \int_{x \in X} f(x) \cdot \pi(x) \, dx \\
\text{s.t.} \quad u(x,x) \geq u(z,x) \quad \forall x,z \in X^2.
\] (1)

### 2.3 Full Information benchmark

Suppose that no information gap exists between the manager and the owner. Then, the owner doesn’t need to pay any information rent to the manager, and she can promote whomever has a higher productivity. Therefore, the first-best allocation can be achieved with the allocation rule \( Q(\cdot) \) as a function of the true productivity value \( x \). \( \langle Q^F, P^F \rangle \) that achieves the first-best allocation is defined as follows.

\[
Q^F(x) = B, \quad \text{if } x_B > x_W \\
Q^F(x) = W, \quad \text{if } x_B < x_W \\
Q^F(x) = B \text{ or } W, \quad \text{if } x_B = x_W.
\]

\[
P^F(\xi_Q(z,x)) = 0, \quad \text{for all } \xi_Q(z,x) \in X^3.
\]

- First-best Mechanism \( \langle Q^F, P^F \rangle \)

Define \( x_{(1)} = \max\{x_B, x_W\} \). Following \( \langle Q^F, P^F \rangle \), expected profit of the firm in the first-best case is \( E(\pi_F) = E(x_{(1)}) \). Expected surplus of the firm defined by a sum of the owner’s expected profit and the manager’s expected utility is \( E(S_F) = E(\pi_F) + E(u_F) = E(x_{(1)}) - d \cdot \text{pr}(x_B > x_W) \). Note that at the first-best allocation, the expected profit of the firm exceeds the expected surplus as the owner takes all the firm’s output. Simultaneously, whenever the black worker is promoted, it creates negative externality to the manager.

### 2.4 Incomplete Information Model

Let \( M^* \) be a set of optimal mechanisms, which are solutions to problem (II), i.e. profit maximizing mechanisms subject to the incentive compatibility constraint. In this sec-

\footnote{The manager’s participation constraint is not included as the manager doesn’t have an outside option.}
tion, we characterize conditions for the optimal mechanism. First, one specific mechanism, a constant mechanism is defined as a candidate of the optimal mechanism.

**Definition 2** (Constant mechanism). A mechanism \(< Q^i, P^i >\) is a constant mechanism, if it promotes a specific worker \(i \in \{B, W\}\) and pays zero to the manager regardless of the reports and the owner’s information state. That is,

\[
\forall z \text{ and } \forall \xi_Q(z, x), \quad Q^i(z) = i \text{ and } P^i(\xi_Q(z, x)) = 0.
\]

Note that this mechanism can represent a situation, where the manager practices discrimination against the black worker. If the owner does not provide any incentive, the manager always promotes the white worker, and the situation is equivalent to the constant allocation with \(Q(z) = W\). Under the constant mechanism, expected profit of the owner is

\[
E[\pi_i] = E[x_i] = E[x_B] = E(x_W),
\]

since the productivity levels of the black and white workers are ex-ante identical. The manager’s utility depends on \(i\), as \(u_B = d\) and \(u_W = 0\) under the \(< Q^i, P^i >\).

**Lemma 1** (Constant mechanism). Any constant mechanism is incentive compatible.

**Proof.** For arbitrary \(i\), \(< Q^i, P^i >\) provides a fixed allocation in promotion and payment independent of the manager’s report. Therefore, the agent does not have a deviation incentive, and \(\forall i\), \(< Q^i, P^i >\) is incentive compatible. □

Recall that the agent’s private information is partially verifiable. Next, I propose a type of untruthful reports by the manager, which the owner can detect. Subsequently, I provide a lemma about a punishment level for such off-equilibrium strategy of the manager.

**Definition 3** (Detectable lie). An owner’s informational state \(\xi_Q(z, x) = (z_B, z_W, x_Q(z))\) is a detectable lie, if \(x_{Q(z)} \neq z_{Q(z)}\). Let \(\Xi^d_Q \subset X^3\) be a set of all detectable lie reports under \(Q\).

**Lemma 2** (Maximum punishment on the detectable lie). Suppose \(< Q, P >\in M^*\) and for some detectable lie \(\xi_Q(z', x), P(\xi_Q(z', x)) > 0\). Then, \(\exists < Q, P^0 >\in M^*\) s.t.

1. \(P^0(\xi_Q(z', x)) = 0\), and
2. \(E[\pi(Q, P^0)] = E[\pi(Q, P)]\).

**Proof.** For every \(\xi_Q(z, x) \neq \xi_Q(z', x)\), let \(P^0(\xi_Q(z, x)) = P(\xi_Q(z, x))\). For \(\xi_Q(z', x)\), let \(P^0(\xi_Q(z', x)) = 0\). Then, the new payment rule \(P^0\) affects the IC condition of the report.
Suppose that \( \xi_Q(z', x) \). I show that the IC condition still holds as follows:

\[
P(\xi_Q(x, x)) - d \cdot 1_{Q(x) = B} \geq P(\xi_Q(z', x)) - d \cdot 1_{Q(z') = B}, \quad < Q, P > \in M^* \\
\geq 0 - d \cdot 1_{Q(z') = B} \\
= P(\xi_Q(z', x)) - d \cdot 1_{Q(z') = B}.
\]

Therefore, \(< Q, P^0 >\) is incentive compatible. For every truthful report \( \xi_Q(x, x) \), 
\( P(\xi_Q(x, x)) = P(\xi_Q(z, x)) \), so 
\[ E[\pi(Q, P^0)] = E[\pi(Q, P)] \]. Thus, if \(< Q, P >\in M^* \), then \(< Q, P^0 >\in M^* \). 

By a benefit of Lemma 2, in order to characterize the optimal mechanism, we can concentrate on the compensation schemes that punish detectible lies by giving a minimum level of compensation to the manager.

**Lemma 3** (IC). Suppose that \(< Q, P >\) is IC. For \( x \) and \( z \) s.t. \( x \neq z \in X^2 \), if 
\( Q(x) = Q(z) \) and \( x_{Q(x)} = z_{Q(z)} \), then \( P(\xi_Q(x, x)) = P(\xi_Q(z, x)) \).

**Proof.** The following inequalities prove the lemma.

\[
P(\xi_Q(x, x)) \geq P(\xi_Q(z, x)), \text{ IC} \\
= P(z, x_{Q(x)}) \text{, } Q(x) = Q(z) \\
= P(z, z_{Q(z)}) \text{, } x_{Q(x)} = z_{Q(z)} \\
\geq P(x, z_{Q(x)}), \text{ IC} \\
= P(\xi_Q(x, x)), \text{ IC} \\
\]

Lemma 3 shows that if two reports (one true and one false) produce the same outcome, then a payment scheme should treat them equally in a set of incentive compatible mechanisms.

**Definition 4** (Non-constant allocation rule). An allocation rule \( Q(z) \) is a non-constant allocation rule, if for some \( z, z' \in X^2 \), \( Q(z) = B \) and \( Q(z') = W \). Let \( Q^N \) be a set of all non-constant allocation rules.

**Lemma 4** (IC). Suppose that \(< Q, P >\) is IC, and \( Q \in Q^N \). Also, assume that for \( \forall \xi_Q(z, x) \in \Xi_{Q}^d \), 
\( P(\xi_Q(z, x)) = 0 \). If \( Q(z) = B \) and \( \xi_Q(z, x) \notin \Xi_{Q}^d \), then \( P(\xi_Q(z, x)) \geq d \).

**Proof.** By way of contradiction, assume that \( P(\xi_Q(z, x)) < d \) when \( Q(z) = B \). Due to the discrimination coefficient of the agent, if \( z = x \), \( u(z, x) < 0 \). Therefore, in this case, the agent wants to deviate to \( z' \), where \( u(z', x) \geq 0 \) as \( P(\xi_Q(z', x)) \geq 0 \) and \( Q(z') = W \),
which does not cause the discrimination disutility $d$. ■

Lemma 4 shows that in order to select a black worker where an allocation rule allows deviations leading to a white worker to be promoted, the owner must compensate the manager at least as much as the discrimination coefficient.

**Lemma 5** (Profit max). Given an arbitrary allocation rule $Q \in \mathbb{Q}^N$, the following payment rule $P$ formulates $<Q,P>$ to be maximizes expected profit subject to the incentive compatibility constraint.

For $\forall z, x \in X^2$,

1. (P1) If $\xi_Q(z, x) \in \Xi_Q$, then $P(\xi_Q(z, x)) = 0$;
2. (P2) If $\xi_Q(z, x) \notin \Xi_Q$ and $Q(z) = W$, then $P(\xi_Q(z, x)) = 0$;
3. (P3) If $\xi_Q(z, x) \notin \Xi_Q$ and $Q(z) = B$, then $P(\xi_Q(z, x)) = d$.

**Proof.** First, I show that given $Q \in \mathbb{Q}^N$, $P$ maximizes expected profit by presenting that $P$ provides a minimum payoff to the agent among possible payoffs satisfying necessary conditions of IC that described in previous lemmas. After that, I show that such $<Q,P>$ is incentive compatible.

By lemma 1, (P1) is feasible for $\forall \xi_Q(z, x) \in \Xi_Q$. Suppose $\xi_Q(z, x) \notin \Xi_Q$. $P(\xi_Q(z, x)) = 0$ when $Q(z) = W$ ensures a minimum transfer from the owner to the manager, since the payment rule is bounded below by 0. When $Q(z) = B$, by Lemma 4, $P(\xi_Q(z, x)) = d$ is the possible minimum transfer. Therefore, given $Q \in \mathbb{Q}^N$, the payment rule $P$ presented in this lemma maximizes expected profit.

To check the IC condition, let’s choose an arbitrary allocation rule $Q \in \mathbb{Q}^N$. First, I consider a true productivity type vector $x$, where $Q(x) = W$. By the payment rule $P$ in this Lemma, $u(x, x) = 0$. Suppose that the agent reports $z \neq x$. The untruthful report $z$ is different from the truthful productivity $x$ either or both of in $x_B$ or in $x_W$, and the arbitrary $Q$ can allocate such $z$ to $B$ or $W$. By (P1), any deviations to a detectible lie yield weakly smaller utility to the agent than the truthful report. Excluding such detectible lie deviations, only two kinds of deviation possibilities might be profitable to the agent; $z = (x_B, x_W' \neq x_W)$, where $Q(z) = B$ and $z = (x_B' \neq x_B, x_W)$, where $Q(z) = W$. However, under (P2) and (P3), both deviations do not produce higher utility for the agent resulting $u(z, x) = 0$. Therefore, under $P$, $\forall x$ s.t. $Q(x) = W$, the agent report truthfully. Another case, where $Q(x) = B$ is proved in a similar manner.

■
The optimal payment scheme for non-constant allocation rules described in Lemma 5 shows that the output of the promoted worker is useful only for distinguishing detectable lies. The optimal payment scheme with given $Q \in \mathbb{Q}^N$ compensates the agent only when his report is not a detectable lie and induces the black worker’s promotion. The amount of such compensation does not vary in the output. It is fixed with $d$, which is exactly equivalent to the agent’s discriminatory coefficient.

3 Result

Theorem 1 (Optimal Mechanism). The following arrangement uniquely achieves profit maximization subject to the owner’s limited information and to the manager’s incentive compatibility constraint: if the productivity gap between the black and white workers exceeds the level of the manager’s disutility associated with the discriminatory preference, then the owner will promote the black worker and compensate the manager as much as the disutility generated by this promotion decision. Otherwise, the white worker will be promoted, and no payment will be made to the manager. That is, the following Bonus-mechanism $< Q^*, P^* >$ is the unique optimal mechanism that maximizes expected profit subject to the incentive compatibility constraint.

$$
Q^*(z) = B, \quad \text{if } z_B - d > z_W
$$

$$
Q^*(z) = W, \quad \text{if } z_B - d < z_W
$$

$$
Q^*(z) = B \text{ or } W, \quad \text{if } z_B - d = z_W.
$$

$$
P^*(\xi_Q(z,x)) = 0, \quad \text{if } \xi_Q(z,x) \in \Xi_Q^D
$$

$$
P^*(\xi_Q(z,x)) = d, \quad \text{if } \xi_Q(z,x) \notin \Xi_Q^D \text{ and } Q^*(z) = B
$$

$$
P^*(\xi_Q(z,x)) = 0, \quad \text{if } \xi_Q(z,x) \notin \Xi_Q^D \text{ and } Q^*(z) = W.
$$

- Optimal Mechanism $< Q^*, P^* >$ -

Proof. First, we show that the optimal allocation rule $Q^*$ achieves the maximum profit among incentive compatible non-constant mechanisms. By Lemma 5, given an arbitrary non-constant allocation rule $Q \in \mathbb{Q}^N$, the payment rule $P^*$ maximizes expected profit subject to the incentive compatibility constraint. Following such $P^*$, for some $x$, if $Q(x) = B$, $\pi(x) = x_B - d$, and if $Q(x) = W$, $\pi(x) = x_W$. Given such $P^*$, if $x_B - d > x_W$, it is optimal to promote the black worker. Otherwise, promoting the white worker is profitable. Therefore, $Q^*$ is an unique allocation rule. Accordingly, the mechanism $< Q^*, P^* >$ is incentive compatible and achieves a maximum profit among non-constant mechanisms. Next, I compare this maximum profit to the constant
mechanism’s maximum profit. Define \( y(1) = \max\{x_W, x_B - d\} \), and let \( F_{y(1)}(\cdot) \) be a cumulative distribution function of \( y(1) \). Expected profit under \( < Q^*, P^* > \) is \( E(y(1)) \). Under constant mechanisms \( < Q^i, P^i > \), the expected profit is \( E(x_i) \). Since \( F_{y(1)} \) first-order stochastically dominates \( F_i \), \( E(y(1)) > E(x_i) \). That is, the expected profit of \( < Q^*, P^* > \) exceeds the expected profit of any constant mechanism. Therefore, \( < Q^*, P^* > \) is an optimal solution to the problem (1).

The optimal bonus mechanism suggests that the owner should provide an incentive to discriminatory middle management encouraging to promote the more qualified black worker. Recall that without any contractual arrangement between the owner and the manager, the allocation is implemented by the constant mechanism \( < Q^W, P^W > \) such that \( \forall z \) and \( \xi_Q(z, x), Q(z) = W \) and \( P(\xi_Q(z, x)) = 0 \). Accordingly, the utility of the manager \( u(z, x) \) is always zero, and expected profit of the firm is \( E(x_W) \) in that case.

After enforcing the optimal mechanism described in Theorem 1, the expected revenue (equivalent to the promoted worker’s output) is

\[
E(R^*) = \text{pr}(x_B - d > x_W) \cdot E(x_B|x_B - d > x_W) + (1 - \text{pr}(x_B - d < x_W)) \cdot E(x_W|x_B - d < x_W).
\]

From the expected revenue, the owner takes the expected profit \( E(\pi^*) = E(y(1)) \), where \( y(1) = \max\{x_W, x_B - d\} \) and pays an information rent to the manager as much as \( d \cdot \text{pr}(x_B - d > x_W) \). Note that the owner’s expected profit increases by \( E(y(1)) - E(x_W) \), and the black worker’s promotion probability increases by \( \text{pr}(x_B - d > x_W) \). However, the manager’s expected utility level does neither decrease nor increase due to the level of the information rent.

As the Bonus-mechanism compensates \( d \) when the black worker is promoted, the mechanism makes the discriminatory manager indifferent between promoting the black worker and the white worker. As a result, truthful reporting is rationalized in a direct mechanism setting. Note that in an equilibrium path, as Lemma 5 suggests, output of the promoted worker does not matter to the manager’s compensation. It is only used to recognize the detectable lies. The compensation of the manager is determined by only the identity of the promoted worker. \(^2\)

\(^2\)If \( d \) is too large and \( F_B \neq F_W \), then a constant mechanism that selects a subordinate with higher productivity-average can be optimal. However, such environment is not in our main interest. The constant mechanism case doesn’t support a delegation situation in a hierarchical organization, since the manager plays no role in that environment. Therefore, in this paper, we focus on the ex-ante identical case.

\(^3\)For those of whom consider the optimal bonus mechanism in Theorem 1 politically improper (though it actually ameliorates discrimination situation), it is worth to devise another indirect contract that exactly implements the optimal direct mechanism. Such contract will not improve any economic agents’ utilities relating to the problem, but it might be helpful alleviating opposition to executing the optimal
A linear compensation scheme that provides positive profit to the owner, in which the owner pays a bonus proportionally to the outcome of the promoted worker, produces lower promotion probability of the black worker. Suppose that the manager receives $\alpha x_i$, where $i$ is the identity of the promoted worker and $\alpha < 1$. In this case, the manager only chooses the black worker if $x_B - x_W > d/\alpha$. Since $d/\alpha > d$, the promotion probability of the black worker is smaller than the Bonus-mechanism case. That is, more qualified black worker is not promoted, and it causes such contract to be sub-optimal compared to the optimal bonus mechanism.

**Theorem 2.** Differences between the full-information efficient allocation and the Bonus-mechanism allocation are described as follows.

1. Promotion probability of a black worker: Compared to the first-best mechanism, there is a decrease in promotion ratio of black subordinate by $\text{pr}(x_B > x_W) - \text{pr}(x_B - d > x_W)$.

2. Profit: Compared to the first-best mechanism, the expected profit of the firm decreases by $E(x(1)) - E(y(1))$.

*Proof.* Section 2.3 and the proof of Theorem 1 provides the proof.

4 Discussion

In this section, topics relating to assumptions and extensions of this paper are discussed. This paper’s goal was to present a simple model in which discrimination occurs at the middle management level in a hierarchical organization. The optimal mechanism suggests that providing an incentive to the discriminatory manager for promoting a black worker yields benefits in terms of reducing discrimination and increasing profit of the firm. As this paper offers basics for modeling discrimination in hierarchical organizations, important research extensions exist.

First, as Theorem 2 suggests, there is a gap between the first-best and the second-best allocations. Therefore, even though the owner is not a personally bigot, regulatory incentives are likely to improve the second-best allocation in terms of fairness. That is, it is feasible that regulations on the firm increase a probability that more qualified worker to be promoted regardless of his or her demographic category. Such regulation-mechanisms do not maximize firm’s expected profit, so the following allocations would not obtain the first-best expected profit though the allocation rule is close to the firm’s first-best. Current research on regulations for discrimination problems is based on the bonus mechanism.
principal’s discriminatory taste. Applying those regulations (affirmative action, auditing, and taxation on the minority promotion ratio) to the setting in which the agent has discriminatory preference, we can ask how the effects of such regulations change.

Second, the proposed model here can be modified by adding the subordinate workers’ choice problem (e.g. effort level). Such a model can incorporate statistical discrimination setting. The workers’ decisions on the effort will affect their principal’s belief on their productivity levels. Specifically, an asymmetric equilibrium in the workers’ choice problem can create different statistical distribution on each worker’s productivity, and it can lead to the statistical discrimination. With such extension, we can study more about the subordinate people’s behavior who are exposed to discriminatory treatment. That is, we can see how the minority and non-minority workers strategically behave for a trade-off between their labor cost and the promotion opportunity when they acknowledge the fact that the firm’s owner tries to restrict the manager’s discretion. Additionally, since this extension creates another principal-agent relationship between the manager and the subordinate workers including the workers’ strategies, we can formulate other competition environments than the promotion. For example, we can consider a contest in which the manager wants to design the contest favorably to whom he prefers, and the owner tries to provide incentives to him for designing fairer contests.

Third, an extension with incomplete information of $d$ (whether or not the manager is prejudiced) is compelling. In this paper, we assume that the discrimination coefficient is common knowledge. Relaxing such assumption, a direct mechanism including a report about $d$ can be studied. In this case, there are new incentive compatibility conditions for the agent that deters mimicking a different type in discriminatory coefficient to obtain higher information rent. Then, the optimal bonus mechanism’s allocation in Theorem 1 will be the benchmark of this new constrained optimization problem.

5 Conclusion

This paper provides a baseline model differentiating between a discriminatory owner and a discriminatory manager in a multiple hierarchical institution. The paper deals with such hierarchical environment where discrimination against workers impairs the institution’s profit. The manager whose position is at the middle of the institution is an agent of the owner in their contractual relationship. Simultaneously, he is also a decision maker of his subordinate workers for their promotion. Without any incentive arrangement, the discriminatory manager always promotes a white worker regardless of
the black and white workers’ productivity difference. This paper proposes an optimal contract for what the owner can do best to reduce such discriminatory decisions without compromising the firm’s profit. Employing such contract, the firm’s expected profit actually increases, and the manager’s discretion can be partially mitigated.

References


