Reputation, Informational Externalities, and Discrimination.*

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Abstract

We pose two simple questions in the context of a competitive model of the labor market where some firms have a 'taste for discrimination'. Are firms that seem to discriminate against minorities in their hiring or wage policies necessarily prejudiced? And can discriminatory behavior persist in a competitive equilibrium? In our model monitoring workers is costly and firms use effi ciency wages to provide incentives. We show if firms base their hiring decisions partly on a worker's past record with other firms, then the resulting informational externalities between firms will cause the discriminatory tastes of prejudiced firms to affect the incentives of non-prejudiced firms to hire workers belonging to minority groups adversely.

1 Introduction

This paper analyzes how 'a taste for discrimination' on the part of some employers in a competitive model of the labor market may affect the wage and hiring strategies of other firms which are not intrinsically prejudiced. In our model monitoring is costly, and firms may base their hiring decision on a worker's past employment record with other firms. We show that the presence of prejudiced firms may *increase* the cost of hiring workers belonging to minority groups to firms who are not prejudiced due to this strategic interaction and as a result may lead to a market equilibrium involving discrimination.[1]

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[1] We define discrimination as an outcome in the labor market where equally productive workers end up with different levels of welfare depending on whether they possess some characteristic unrelated with productivity.

We develop a simple efficiency wage model of the labor market in the presence of moral hazard based on the work of Shapiro and Stiglitz (1984), and Greif (1993). In these models workers are fired if they are caught shirking and to make the threat of firing credible and effective firms pay workers a wage strictly higher than what they would be willing to work for. As a result, there is unemployment in equilibrium. The existing literature on efficiency wages (e.g., Shapiro and Stiglitz, 1984 and Bulow and Summers, 1986) focus on hiring strategies of firms which do not look at a worker's past record with other employers when choosing her from the pool of unemployed job-seekers.[2] In contrast, Greif (1993) looks at firm strategies which are based on a worker's past employment record with other firms and in particular, involves not hiring a worker who has shirked with any firm in the past even once. He shows that under such a strategy the threat of firing carries a much higher punitive value for any wage rate, and as a result equilibrium wages are lower compared to the strategy considered by Shapiro and Stiglitz. We depart from the existing literature in two different directions. First, given that the ability of firms to adopt the strategy analyzed by Greif (1993) is based on the assumption of perfect flow of information regarding worker-histories across firms, we explicitly introduce a parameter capturing the degree of information transmission across firms regarding a worker's past behavior. This allows us derive conditions under which one of these two strategies would emerge *endogenously*. Second, we allow workers to vary according to some observable characteristic unrelated to productivity (such as race, gender or caste) and allow firms to have heterogenous tastes regarding it following the literature on 'taste-discrimination' pioneered by Becker (1957). His model of the labor market is frictionless except for the presence of some prejudiced firms who are willing to hire minority workers at a lower wage rate to compensate for their disutility of having to associate with them. We study how the wage and hiring decision of firms which differ in their degree of prejudice towards minorities interact in a market setting in the presence of frictions in the form of moral hazard, and whether the presence of enough non-prejudiced firms is sufficient to eliminate discrimination, as suggested by Becker's original analysis. Towards this end we derive the efficiency wages of workers belonging to different groups in terms this characteristic under different hiring strategies of firms (in terms of conditioning on a worker's past history) and compare them in terms of potential for discriminatory outcomes. Theories of "statistical discrimination" (e.g., Phelps, 1972, Lundberg and Startz, 1983 and Coate and Loury, 1993) also show how observed discriminatory practices of a firm may not have anything to with its 'tastes' as suggested by Becker.[3] But the main force driving the results have to

[2] Other contributions to the literature look at similar hiring strategies. See for example Bulow and Summers (1986), and in a slightly different context, Eswaran and Kotwal (1985).

[3] If measures of an individual worker's productivity that is available to a firm when screening her are noisy, then it optimally puts some weight on moments of the distribution of the respective group-populations. Accordingly, equally productive members of different groups may treated differently if the underlying population distributions are different or firms differ in their ability to screen an individual worker across groups. More interestingly, when worker productivity is endogenous these

do with multiple expectational equilibria, which is not necessarily a market phenomenon and could arise even if there was only one firm and one worker. In contrast, we show how discriminatory outcomes can result explicitly from the market interaction of firms with different degrees of prejudice, and how the unique equilibrium of the labor market could involve extreme forms of discrimination even when there are many non-prejudiced firms.

The main idea behind our model is simple. In general, how we treat another person in a given bilateral relationship is guided by, apart from our innate preferences and the relevant technology, how we expect others to treat her. In our labor market story the expected behavior of other firms matters to a given firm in two ways. First, it determines the outside option of the worker and, second, it determines the relative benefits from working and shirking. Formally speaking, these two effects affect the participation constraint and the incentive-compatibility constraint respectively. But in efficiency wage models workers earn more than what they are willing work for, so that the participation constraint is not binding. The incentive-compatibility constraint depends on whether firms condition their hiring decision based on a worker's past record. Suppose they do, and in particular, a worker who has been revealed to have shirked in another firm in the past is never hired by anybody. Then for a worker with a clean record there are two reasons for working : first, to enjoy the high wage (relative to income earned while unemployed) and retain the current job till an exogenous split occurs, and second, to maintain a good record which will help her get a job more easily in the event of an exogenous split. In contrast, a worker with a bad record will work only to enjoy the high wages while employed, because she won't get a job if there is an exogenous split even if she did not shirk in her last job. Now consider two workers both of whom have clean records and are equally productive, but differ in terms of some attribute which is unrelated to productivity. Suppose they are being considered for employment by a firm which does not have any preference over this attribute. If they are offered the same wage rate, and they decide to work, both of them maintain a good record but the worker belonging to a 'minority' group faces a relatively lower probability of re-employment in the event of an exogenous split because of the presence of prejudiced firms. In contrast if they shirk, both of them face the same consequence : they enjoy a one-period gain but they are shunned by all firms in the future. To compensate for the lower return from maintaining a good reputation for minority workers due to the presence of prejudiced firms, a non-prejudiced firm will have to offer them a relatively higher wage. This however reduces their own incentive to hire such workers! Contrast this with a market where firms don't look at a worker's past record with other firms when making hiring or wage decisions. Then the only reward for working is the high wage enjoyed in a job, and the only punishment for shirking is unemployment for one period, and then waiting to be re-employed with some probability. The lower are a worker's chances of re-employment, the greater is the punitive impact of being fired so that such a worker

perceived group-differences by firms can be self confirming in equilibrium.

will be willing to work at a lower wage. This makes her attractive to employers and undoes the effect of presence of firms with a taste for discrimination.

We show that markets where information flows across firms are very strong, firms will find it profitable to look at a worker's past record. Greif's (1993) study of 11-th century Jewish traders operating mainly in the Islamic world in western basin of the Mediterranean (known as *Maghribi* or western traders) is a good example of labor markets where a lot of importance was given to an agent's history and reputation within a network of firms. Greif cites the following examples from contemporary documents and letters: an agent went out of his way to please a trader even when he knew for sure they were not going to transact again just in order to maintain a good reputation; an agent in Jerusalem embezzled a trader found that his reputation was ruined in areas as far away as Sicily. These hiring strategies however create a lot of interdependence between decisions of different firms and may, in the presence of prejudiced firms, result in the complete exclusion of minorities from the labor market. If instead information flows across firms are not very strong then the only equilibrium is one where firms do not look at a worker's past record and as a result there is no discrimination. This is very similar in spirit to Becker's conclusion that as long as there are enough non-prejudiced firms, there will not be any discriminatory outcome in equilibrium. An example of such a hiring strategy is suggested by the following quote by Henry Ford : "It is all one to me if a man comes from Sing Sing or Harvard. We hire a man, not his history."[4] This also conforms with the casual empirical observation that pervasive discrimination is more observed within close-knit societies, often in rural areas, (e.g., the caste-system in Indian villages or in the American South) as compared to more anonymous and individualistic settings, such as in urban areas.[5] There are alternative explanations explaining the pervasiveness of discriminatory norms in close-knit social networks and why they cannot be eliminated by profit-maximizing behavior of individual agents who don't derive any intrinsic pleasure from conforming to such norms. Akerlof's (1976) model of caste-discrimination shows how such norms could be an equilibrium phenomenon if social sanctions against non-conformists are strong enough. In contrast, our model shows that exclusion of minorities need not necessarily be enforced by third-party or group sanctions to deviants but by eminently sensible cost-benefit calculations.

[4] Quote taken from *Five Thousand Gems of Wit and Wisdom* compiled by Lawrence Peter, London (Treasure Press, 1993). I would like to thank Kaniaru Wacieni for suggesting it.

[5] The caste system in India involves an elaborate set of rules regulating occupational choice on a hereditary basis. They draw legitimacy from religious scriptures and are enforced by the threat of social sanctions. From the purely economic point of view they are inefficient because they regulate economic transactions and decisions without any regard to productivity. It is still is prevalent in rural India, whereas in urban areas its effect is much less apparent.

2 The Model

The following are the main features of the firm-worker game :

Production Technology : In a given period a firm needs one worker to operate some machine and if the worker works, she produces a profit of $Y > 0$ for the firm. If she shirks she produces zero. Once hired a worker is paid a wage after which he chooses whether to work hard, which costs e in terms of utility, or shirk, which costs nothing. There is no asymmetric information - the firm finds out with certainty whether a worker shirked or not at the end of the period. Also, conditioned on the effort choice of a worker, output is deterministic. Due to limited punishment possibilities the maximum punishment that can be inflicted on a worker is firing him. Upon being fired by a firm a worker has to stay unemployed for at least one period during which he earns some exogenously given payoff $\overline{w}$.[6]

Workers and Firms: There are m firms and n workers in the economy. Since the number of firms and workers are inelastically given, to have unemployment in equilibrium the number of workers must exceed that of firms. We make the following stronger assumption for simplicity:

Assumption 1

$$2m < n.$$

Workers and firms are risk-neutral and infinitely-lived. Workers have a discount factor δ, where $0 < \delta < 1$. They are of two possible types based on some observable characteristic *unrelated* to productivity, $i \in \{B, W\}$ to be referred to as B workers and W workers. Let λ be the proportion of W workers in the economy. Also, there are two types of firms based on their preferences over worker types. Other things being exactly equal, a fraction ρ of firms, to be called P firms will strictly prefer to hire W to B workers, while the remaining firms, to be called N firms, will be indifferent between hiring W and B-workers. We follow Becker (1957) in modelling 'taste for discrimination' : a P firm has a degree of bias $c > 0$ towards a B worker if the wage at which she is willing to offer employment to that worker is $w - c$ where w is the going market wage rate for W workers.

Information Transmission : If a worker is ever caught shirking then while her employer finds out with certainty, *other* firms get to find out about it with some probability $\sigma \in [0, 1]$. In that case she is forever branded as a shirker. Even if

[6] The contracting aspects of this model are admittedly very rudimentary to focus attention on the main issues of interest, namely information flows, efficiency wages and discrimination. We can easily extend it to a more sophisticated contracting model where output is noisy, workers choose some unobservable action that affects the probability distribution of output, and because of limited liability, even if workers can be offered a contract monotonic in output (as opposed to a flat wage contract), they still earn rents. As a result the threat of firing can still be used as an incentive device. See Dutta, Ray and Sengupta (1989) and Banerjee and Ghatak (1996) for such models.

she gets re-employed in the future the stigma remains whether or not she shirks again. However, with probability $(1-\sigma)$ a worker who is caught shirking with a firm escapes being branded as a shirker to other firms so even if she is fired by her current employer she re-enters the job-market with a clean track-record. For example, we could think of a bureau that maintains records of all workers in the economy which can be accessed by any firm. If a worker shirks with some firm then the firm lodges a complaint against the worker that gets successfully entered into the files of the bureau with some probability σ. If $\sigma = 0$ then we have an 'anonymous' or 'urban' setting where all workers appear faceless to firms and if $\sigma = 1$ then we have a 'close-knit' or 'village' setting where information flows freely. For $\sigma \in (0,1)$ we have an intermediate situation. [7]

Matching and Wage offers : Assume that an employer looking for a worker can choose a worker randomly from the pool of workers looking for a job. The matching process is frictionless. Let $\widehat{x}$ denote the history or record of a worker observed by the firm at the time of hiring. Under the kind of hiring strategies we will consider, either we will have $\widehat{x} \in \{\widehat{h}, \widehat{s}\}$ where a record of $\widehat{s}$ indicates that a worker was found shirking with a firm at least once in the past and a record of $\widehat{h}$ indicates the worker has a clean history, or $\widehat{x} \in \emptyset$, where a worker's past employment history is not observable. Let the probability of being re-employed of a worker of type i who has a record $\widehat{x}$ be denoted by $p(\widehat{x}, i)$. Once hired a worker of type i who has a record $\widehat{x}$ is paid a wage $w(\hat{x}, i)$, can be retained in subsequent periods, replaced by another worker or may have to quit due to exogenous reasons which occurs with probability q where $0 < q < 1$. We are going to refer to $p(\widehat{x}, i)$ and $w(\hat{x}, i)$ as the labor-contract faced by a worker of type i and record $\widehat{x}$ in equilibrium which will be endogenously determined to ensure that workers don't shirk.

3 Equilibrium under Bilateral & Multilateral Punishment Strategies

If the game is played once then the unique subgame-perfect equilibrium is one where the worker chooses to shirk whatever is the firm's wage offer, anticipating that, the firm would offer any $w \leq \overline{w}$ and the worker would choose self-employment. The Folk Theorem tells us that if any game is repeated infinitely outcomes more efficient than a one-shot game can be sustained and here we want to find out whether there exists an equilibrium where the worker works. Following Greif (1993) we will compare

[7] Note that we assume once branded as a shirker a worker is always branded as a shirker irrespective of her later performance. We could relax this assumption without changing the results by allowing a worker with a bad record who is offered employment by a firm and does not shirk with it to have her bad record erased. That is, in the event of an accidental split, her employer recommends removing her previous bad record with some probability τ. See Tirole (1996) for an alternative specification of the mapping from a worker's behavior to the probability of a potential employer finding out about her record.

stationary (or Markov) subgame-perfect equilibria of this game with firms adopting **multilateral punishment strategies** (MPS) and **bilateral punishment strategies** (BPS). Under a MPS firms have the following strategy : offer a wage of at least $w(\hat{x}, i)$ to a worker of type i who has a record $\hat{x}$ to induce her to work; rehire the same agent if she has not cheated so long as the match is not broken by an exogenous separation; fire a worker if she shirks; don't hire a worker who has been revealed to have shirked with another firm in the past, i.e., $p(\widehat{s}, i) = 0$; if there is a vacancy, choose a worker randomly from the pool of unemployed workers who have not been revealed to have shirked with any firm in the past with probability $p(\widehat{h}, i) > 0$. A worker who is of type i and has history $\hat{x}$ has the following strategy : work if paid $w(\hat{x}, i)$ and shirk if paid less than $w(\hat{x}, i)$. A BPS is the same as the MPS in all respects except for an important one : a firm does not base its hiring decision conditional on a worker's past record, i.e. $p(\widehat{h}, i) = p(\widehat{s}, i) > 0$.

We are going to use the one-period deviation principle to check whether the equilibrium strategies are subgame-perfect.[8] Thus to find out if working in every period is an equilibrium strategy for employed workers we will check she can gain by shirking in the present period and then reverting to the equilibrium strategy of working whenever employed (and offered a wage $w(\hat{x}, i)$) from next period on. For the two types of hiring strategies we consider, there are three state variables that characterize a worker : her current employment status (whether she is employed or unemployed, denoted by E and U), her history (whether she is known by all firms to have shirked in the past or not, denoted by $\widehat{s}$ or $\widehat{h}$ under MPS, and nothing under BPS), and her type (whether she is a B worker or a W worker). Upon being hired workers choose the strategy whether to work or shirk (denoted by h and s) in the current period and in *all* future periods (denoted by $\overline{h}$ and $\overline{s}$). Let (1) $V^{h,\overline{h}}(E, \widehat{x}, i)$ be the equilibrium lifetime expected utility of a worker of type i with history $\widehat{x}$, who is currently in the state of being employed, who chooses the strategy of staying honest in the current period and in the future whenever she is employed; (2) $V^{\overline{h}}(U, \widehat{x}, i)$ be the equilibrium lifetime expected utility of a worker of type i with history $\widehat{x}$, who is currently in the state of being unemployed and who chooses the strategy of staying honest in the future whenever she is employed.

The following standard recursive equations give the state-contingent lifetime expected utilities workers with record $\widehat{x}$:

$$V^{h,\overline{h}}(E, \widehat{x}, i) = w(\hat{x}, i) - e + \delta(1-q)V^{h,\overline{h}}(E, \widehat{x}, i) + \delta q V^{\overline{h}}(U, \widehat{x}, i) \tag{1}$$

$$V^{\overline{h}}(U, \widehat{x}, i) = \overline{w} + \delta p(\widehat{x}, i)V^{h,\overline{h}}(E, \widehat{x}, i) + \delta(1 - p(\widehat{x}, i))V^{\overline{h}}(U, \widehat{x}, i) \tag{2}$$

[8] A slightly modified version of the one-period deviation principle for infinite horizon games as stated in Fudenberg and Tirole (1991) is: in an infinite horizon game with observed actions, if per-period payoffs are uniformly bounded and overall payoffs are a discounted sum of per-period payoffs, a strategy profile s is subgame perfect if and only if there is no player i and strategy $\widetilde{s}_i$ that agrees with s_i except at a single period t and history h_t such that $\widetilde{s}_i$ is a better response to s_{-i} than s_i conditional on h_t being reached.

We require wage offers to satisfy the *participation constraint* (PC) for a worker of type i with history $\widehat{x}$:

$$w(\widehat{x}, i) - e \geq \overline{w} \ . \tag{3}$$

Now we are ready to prove an important property of efficiency wage models :

Lemma 1 : $V^{\overline{h}}(U, \widehat{x}, i)$ is non-decreasing in $p(\widehat{x}, i)$ for wage offers that satisfy the participation constraint of a worker. If the participation constraint is not binding then $V^{\overline{h}}(U, \widehat{x}, i)$ is strictly increasing in $p(\widehat{x}, i)$.

Proof : We can solve (1) and (2) simultaneously for $V^{h,\overline{h}}(E, \widehat{x}, i)$ and $V^{\overline{h}}(U, \widehat{x}, i)$. This yields

$$V^{\overline{h}}(U, \widehat{x}, i) = \frac{\delta p(\widehat{x}, i)(w(\hat{x}, i) - e) + \{1 - \delta(1 - q)\}\overline{w}}{(1 - \delta)[1 - \delta\{1 - (p(\widehat{x}, i) + q)]}. \tag{4}$$

Upon differentiation we get:

$$\frac{\partial V^{\overline{h}}(U, \widehat{x}, i)}{\partial p(\widehat{x}, i)} = \frac{\delta\{1 - \delta(1 - q)\}}{(1 - \delta)[1 - \delta\{1 - (p(\widehat{x}, i) + q)]^2}\{(w(\hat{x}, i) - e) - \overline{w}\}.$$

Then the result follows directly from the definition of the PC of a worker, (3).■

This implies that if workers earn rents in equilibrium for incentive reasons, the higher is the probability of being re-hired faced by a currently unemployed worker, the greater is her lifetime expected utility. The size of the rent is derived from the *incentive-compatibility constraints* (ICC) of workers which make sure that the threat of firing gives strong enough incentives to work. So far whatever we have said applies to both the MPS and the BPS with $\widehat{x} \in \{\widehat{h}, \widehat{s}\}$ in the former case and $\widehat{x} \in \emptyset$ in the latter. But in analyzing the ICC we must distinguish between the two types of strategies, because the consequence of shirking is different for a worker depending on her record under the MPS while it does not depend on her record under the BPS. Under the MPS, the ICC for a worker of type i depends on whether she has a good record or a bad record. They are, respectively,

$$V^{h,\overline{h}}(E, \widehat{h}, i) \geq w(\hat{h}, i) + \delta\{\sigma V^{\overline{h}}(U, \widehat{s}, i) + (1 - \sigma)V^{\overline{h}}(U, \widehat{h}, i)\}. \tag{5}$$

$$V^{h,\overline{h}}(E, \widehat{s}, i) \geq w(\hat{s}, i) + \delta V^{\overline{h}}(U, \widehat{s}, i). \tag{6}$$

In contrast, under the BPS the *incentive-compatibility constraint* (ICC) for a worker of type i is simply :

$$V^{h,\overline{h}}(E, i) \geq w(i) + \delta V^{\overline{h}}(U, i). \tag{7}$$

where for notational simplicity we have dropped the argument $\hat{x}$ from the state-contingent value functions and the labor contract under the BPS.

The minimum wages that a firm needs to offer to induce a worker of type i with record $\widehat{h}$ and $\hat{s}$ to work under the MPS are those that satisfy the respective ICC

with equality. Using (1) we can write the difference between the minimum incentive-compatible wages of workers with record $\widehat{h}$ and $\hat{s}$ as :

$$w(\hat{s},i) - w(\hat{h},i) = \frac{1}{1-q}[q-(1-\sigma)\{1-\delta(1-q)\}]\{V^{\overline{h}}(U,\widehat{h},i) - V^{\overline{h}}(U,\widehat{s},i)\} \quad (8)$$

Under the MPS, once branded a shirker no one hires a worker and so $V^{\overline{h}}(U,\widehat{s},i) = \frac{\overline{w}}{1-\delta}$. Let us define :

$$\overline{\sigma} \equiv \frac{(1-q)(1-\delta)}{1-\delta(1-q)}.$$

Notice that $(\sigma - \overline{\sigma})$ and $[q - \{1-\delta(1-q)\}(1-\sigma)]$ have the same sign from the definition of $\bar{\sigma}$. Similarly, the minimum wage that a firm needs to offer to induce a worker of type i to work under the BPS is one that satisfies (7) with equality. Using (1) we get:

$$w(i) = \frac{e}{\delta(1-q)} + (1-\delta)V^{\overline{h}}(U,i) \quad (9)$$

This helps us prove the following useful result:

Lemma 2 : If firms adopt the MPS, then $(p(\widehat{h},i) - p(\widehat{s},i))(w(\hat{h},i) - w(\hat{s},i))$ is negative if $\sigma > \overline{\sigma}$ and positive if $\sigma < \overline{\sigma}$.

Proof : This follows directly from (8) since **Lemma 1** implies $V^{\overline{h}}(U,\widehat{h}) - V^{\overline{h}}(U,\widehat{s})$ and $(p(\widehat{h},i) - p(\widehat{s},i))$ always have the same sign.■

Now we are ready to show under what conditions the alternative hiring strategies constitute an equilibrium :

Proposition 1 : A subgame perfect equilibrium of the infinitely repeated firm-worker game exists when firms adopt the MPS only if $\sigma > \overline{\sigma}$. However, a subgame perfect equilibrium of the infinitely repeated firm-worker game always exists when firms adopt the BPS.

Proof : Under the MPS, $p(\widehat{h},i) > p(\widehat{s},i) = 0$. Hence if $\sigma > \overline{\sigma}$, $w(\hat{h},i) < w(\hat{s},i)$ and all firms prefer workers with good records to those with bad records given their type $(i = B, W)$. Also, under both types of hiring strategies no firm can gain by offering a wage higher than that satisfies the ICC with strict equality because there is no friction in the matching process and since the number of firms exceed that of workers they can always have a worker willing to work at that wage. On the other hand a lower wage does not satisfy the ICC.

However if $\sigma < \overline{\sigma}$, $w(\hat{h},i) > w(\hat{s},i)$ by **Lemma 2** and so an individual firm would strictly prefer to hire workers with *bad* records given their type if firms adopt the MPS. But if all firms prefer to hire workers with bad records, then $p(\widehat{s},i) >$

$p(\widehat{h}, i) = 0$, and hence by **Lemma 2** we get $w(\hat{h}, i) < w(\hat{s}, i)$. But this cannot be an equilibrium too as an individual firm would strictly prefer to hire a worker with a good record. Hence a situation where $p(\widehat{h}, i) \neq p(\widehat{s}, i)$ cannot be self-reinforcing and will be reversed by the behavior of individual firms. Accordingly, the unique equilibrium is one where firms are indifferent between hiring workers with bad and good records, that is, $w(\hat{h}, i) = w(\hat{s}, i) = w(i)$ and $p(\widehat{s}, i) = p(\widehat{h}, i) = p(i)$. In such an equilibrium a worker's history does not matter even when it is observable, i.e., firms adopt the BPS. ■

Let us now discuss the intuition behind this result. If firms adopt the MPS, a worker gets two kinds of benefits from not shirking : first, she enjoys a high wage (compared to her reservation payoff) so long as an exogenous split does not occur, and second, by maintaining a good record she ensures that she will get a job more easily if an exogenous split occurs. Rearranging terms in (1) we get :

$$V^{h,\overline{h}}(E, \widehat{x}, i) = \frac{w(\hat{x}, i) - e}{1 - \delta(1 - q)} + \frac{\delta q}{1 - \delta(1 - q)} V^{\overline{h}}(U, \widehat{x}, i).$$

The two terms on the right-hand side captures these two effects. In contrast, if a worker with a bad record is ever hired, the only reason she will work is due to the higher wages she will enjoy while employed, because she won't get a job if there is an exogenous split even if she did not shirk in her last job. Hence workers who have clean track-records have a higher *absolute* return from working compared to workers with bad track-records because in case an exogenous split occurs, they would get rehired with higher probability under the MPS. Formally speaking,

$$\frac{\delta q}{1 - \delta(1 - q)} V_i^{\overline{h}}(U, \widehat{h}) \geq \frac{\delta q}{1 - \delta(1 - q)} V_i^{\overline{h}}(U, \widehat{s}).$$

if $p(\hat{h}, i) > p(\hat{s}, i)$. This means, for the same wage rate workers with clean records have a higher incentive to work, which implies employers can elicit the same effort as a worker with a bad record at a lower wage. Shirking yields an immediate gain of a high wage without having to work in the current period to all workers irrespective of their record. For workers with good records shirking has the cost that if other firms find out about it (with probability σ) she would never get hired again. For workers with bad records, shirking is more costly because no firm was going to hire such a worker anyway. Hence workers who have clean track-records have a higher *absolute* return from shirking compared to workers with bad track-records too. Formally speaking, comparing the left-hand sides of the respective $ICCs$ we get :

$$\delta\{\sigma V_i^{\overline{h}}(U, \widehat{s}) + (1 - \sigma) V_i^{\overline{h}}(U, \widehat{h})\} \geq \delta V_i^{\overline{h}}(U, \widehat{s}).$$

The assumption $\sigma > \bar{\sigma}$ is needed to make sure that the former effect outweighs the latter so that on balance workers with clean records have a greater *net* reward from working than workers with bad records for the same wage rate. Hence for the same wage workers with bad records have lower net rewards from working under the MPS because they do not get a job if an exogenous split occurs because of their past record even if they did not shirk in their present job. Accordingly, they have to offered a higher efficiency wage compared to workers with clean records. This makes them unattractive to all firms and hence, the MPS is self-enforcing. The insight behind this result is due to Greif (1993). Grief assumed firms within a network can exchange information perfectly, i.e., $\sigma = 1$. However, we show that if the quality of information flow falls below a certain critical level, an equilibrium will not exist when firms adopt the MPS because workers with clean records will have a greater incentive to shirk than workers with bad records, making the latter more attractive to firms. In such a situation the only equilibrium is where firms do not condition their hiring on a worker's past history, i.e., the they adopt the BPS. Under such a strategy, if a worker works she gets fired with probability q where if she shirks she gets fired with probability 1 and hence anything that increases the probability of being re-hired of a worker will reduce the punitive impact of being fired. Such a worker will get a job easily if she is fired for shirking and since firms don't look at workers' past records it will not affect her re-employment chances. This will make her a less attractive hire to employers because she will have to paid a higher wage to make her work.

Under both the MPS and BPS no worker will shirk in equilibrium. So all workers will have a good record which will be observed and used under the MPS and ignored under the BPS. Let p_i be the probability of being re-hired for an unemployed worker of type i. We can explicitly solve for the minimum wages required to provide incentives to a worker of type i *in an equilibrium* (to be referred to as efficiency wages) under the MPS and the BPS from the relevant $ICCs$ using (4) :

$$w^{MPS}(p_i) = \overline{w} + e + \left(\frac{1-\delta+\delta(p_i+q)}{\delta}e\right)\frac{1}{(1-q)+\frac{\delta}{1-\delta}\sigma p_i} \quad (10)$$

$$w^{BPS}(p_i) = \overline{w} + e + \left(\frac{1-\delta+\delta(p_i+q)}{\delta}e\right)\frac{1}{(1-q)} \quad (11)$$

Notice that in both cases the wage rate is greater than $\overline{w} + e$ so the PC of a worker is satisfied and he earns a rent, which is the reason why the threat of firing is an incentive device. The following proposition states an important property of the two kinds of equilibria :

Proposition 2 : In an equilibrium with firms adopting the BPS, $w^{BPS}(p_i)$ is increasing in p_i whereas in an equilibrium with firms adopting the $MPS, w^{MPS}(p_i)$ is decreasing in p_i.

Proof : The first part follows directly from (11) :

$$\frac{\partial w^{BPS}(p_i)}{\partial p_i} = \frac{e}{1-q} > 0.$$

For the second part, we get

$$\frac{\partial w^{MPS}(p_i)}{\partial p_i} = e\frac{(1-q) - \sigma(1+\frac{\delta}{1-\delta}q)}{\{(1-q)+\frac{\delta}{1-\delta}\sigma p_i\}^2}$$

from (10). Now $(1-q) - \sigma(1+\frac{\delta}{1-\delta}q) < 0$ if $\sigma > \bar{\sigma}$, which must be true for an equilibrium with firms adopting the MPS to exist by **Proposition 1**.■

This result shows that an important property of equilibria with MPS is that anything that increases the probability of being re-hired of a worker will tend to make her a more attractive hire to all employers. Under such a strategy a worker is never re-hired if she is caught shirking and hence the only way the benefits of re-employment enter into her calculations is by increasing the benefit from working for the same wage. In contrast, under the BPS anything that improves the worker's probability of re-employment strengthens her incentive to shirk : by shirking a worker is guaranteed to enjoy the benefit of a higher chance of getting a job (because she is fired) while by working she enjoys it only when there is an accidental separation. This result is important for our subsequent analysis of discrimination.

Next we show that efficiency wages will be different under the two hiring strategies for the same probability of being re-hired for an unemployed worker because the punishment for shirking is higher under the MPS.

Proposition 3 : For the same probability of re-employment of a worker with a clean record, p_i, the efficiency wage is higher under the BPS compared to the MPS.

Proof: Follows upon inspection from (10) and (11) so long as $\sigma > 0, p_i > 0$ and $\delta > 0$.■

This result is due to Greif (1993) and is a direct consequence of the fact that under the MPS the cost of shirking is higher because firms exchange worker-records and hence if caught shirking, the worker will be forever shunned by all firms. In contrast, under the BPS the cost of being caught shirking is merely unemployment for one period and then facing the same probability as any other unemployed person to be re-employed.

4 Efficiency Wage Equilibria with Discrimination

First let us consider the 'color-blind' benchmark case where either workers do not vary in terms of the characteristic i or equivalently, firms do not have any preference over i. Since under both the MPS and BPS no worker will shirk in equilibrium, and the number of workers and firms are given, under both strategies the probability of being rehired for an unemployed worker will be the same. It can be solved from the condition that in steady-state equilibrium the inflow into the pool of unemployed workers should equal the outflow from it:

$$p = \frac{qm}{n-m} = \frac{q}{\frac{n}{m}-1}.$$

Assumption 1 implies $\frac{n}{m} - 1 > 1$ and hence $p < 1$ for any $q \in [0, 1]$.

We must check whether firms earn non-negative profits in equilibrium.. By **Proposition 3** wages are higher under an equilibrium with the BPS.[9] Hence the following assumption, which says that a firm's profit when a worker works is large enough, suffices:

Assumption 2

$$Y - w^{BPS}(\frac{q}{\frac{n}{m}-1}) > 0$$

Now let us consider the implication of the presence firms with a taste for discrimination in this model. The following two features of the model together with **Proposition 2** drive our main results regarding discrimination :

First, if a worker is offered an efficiency wage to provide her incentives to work, then there must exist some workers who are observationallly indistinguishable from her from the point of view of *any* employer who are unemployed in equilibrium and would strictly prefer to be employed. Second, P firms prefer hiring W workers to B workers, everything else being the same. In particular, they are willing to B workers only if the equilibrium efficiency wage of W workers is higher by an amount c or more than that of the former. These two features of this model restrict the number of possible candidates for an equilibrium when firms adopt the BPS or the MPS.

Lemma 3 : In any equilibrium of the labor market it is impossible to have both P and N firms hiring both B and W workers.

Proof: For this to be an equilibrium both types of firms must be indifferent between hiring B and W workers. That is true for P firms only if $w(W) = w(B) + c$ while it is true for N firms only if $w(W) = w(B)$ and so both can't be simultaneously true whether or not firms adopt the BPS or the MPS.■

Lemma 3 rules out the following two possibilities as candidates for an equilibrium as well : (a) N firms hire W workers only while P firms randomize between B and

[9] This means it is possible have a situation where an equilibrium with the BPS may not exist but one under MPS exists. This is the sense in which Greif (1993) calls MPS more efficient than BPS. In particular, as $q \to 1$, the required efficiency wage tends to infinity under the BPS while it tends to a finite number under the MPS. In a model where the demand for workers (i.e., m in this model) is endogenous to the wage rate, as in Shapiro and Stiglitz (1984), this would imply that the equilibrium rate of unemployment would have to be higher under the BPS.

W workers and, (b) N firms randomize between B and W workers while P firms hire B workers only). We discuss the remaining possibilities in turn.

Case 1 : All firms hire W workers only.

In this case,

$$p(W) = \frac{q}{\lambda \frac{n}{m} - 1} > p(B) = 0.$$

By **Proposition 3** W workers should be cheaper to hire under MPS for all employers, irrespective of their taste. Let

$$\bar{\lambda} \equiv (1 + q)\frac{m}{n}.$$

Then we must have $\lambda > \bar{\lambda}$ to ensure that $p(W) \in (0, 1)$. This equilibrium is **stable** in the sense that if some firm(s) starts hiring B workers for some reason (say, entry of firms which prefer to hire B workers, or government policy encouraging hiring of minorities) it would not induce other firms to change their behavior so long as $p(W) > p(B)$.

Next consider the BPS. If $p(W) > p(B)$, by **Proposition 3** W workers should be more expensive to hire under the MPS. Then N firms will strictly prefer to hire B workers (and indeed, P firms too if the original wage differential exceeds c) and hence this cannot be an equilibrium.

Case 2 : All firms hire B workers only.

Here

$$p(B) = \frac{q}{(1 - \lambda)\frac{n}{m} - 1} > p(W) = 0.$$

To ensure that $p(B) \in (0, 1)$ we must have $\lambda < 1 - \bar{\lambda}$.By **Proposition 3** B workers should be cheaper to hire under the MPS. Hence so long as the wages of W workers when $p(W) = 0$ exceed that of B workers by more than c, even P firms will strictly prefer to hire B workers. This will happen if :

$$w^{MPS}(0) - w^{MPS}\left(\frac{q}{(1 - \lambda)\frac{n}{m} - 1}\right) > c.$$

This implies that if the 'taste for discrimination' on the part of P firms is large, then this equilibrium cannot exist. Since $w^{MPS}(p)$ is monotonically decreasing in p by **Proposition 3,** a sufficient condition for such an equilibrium *not to* exist is

$$c > w^{MPS}(0) - w^{MPS}(1) = \frac{e}{1 - \delta}\{\sigma(1 - \delta + \delta q) - (1 - q)(1 - \delta)\} \equiv \bar{c}_{MPS}$$

Case 3 : N firms are indifferent between hiring B and W workers, P firms hire W workers only.

Let α be the probability with which a N firm chooses a B worker. For convenience of interpretation, let us imagine that a fraction α of N firms always hire B workers, and the remaining $1-\alpha$ always hire W workers. Then,

$$\begin{aligned} p(\hat{h}, W) &= \frac{q}{\frac{\lambda}{\rho+\alpha(1-\rho)}\frac{n}{m}-1} \\ p(\hat{h}, B) &= \frac{q}{\frac{1-\lambda}{(1-\rho)(1-\alpha)}\frac{n}{m}-1} \end{aligned}$$

This is an equilibrium under the MPS if

$$p(\hat{h}, W) = p(\hat{h}, B)$$

or,

$$\alpha = \frac{\lambda-\rho}{1-\rho}.$$

The following condition needs to be satisfied

$$\lambda \geq \rho.$$

for such an equilibrium to exist. If this condition is satisfied, then *Assumption* 1 is sufficient to ensure that the equilibrium probability of re-employment lies within the open interval $(0,1)$.

However, this non-discriminatory equilibrium is **unstable** under the MPS. Any perturbation that makes $p(W) > p(B)$ or $p(W) < p(B)$ will destroy the equilibrium and propel the economy towards equilibria where all firms end up hiring one type of worker only (if such an equilibrium exists).

In contrast, this is a **stable** equilibrium under the BPS. For example, if any perturbation makes $p(W) > p(B)$, then the wage of W workers will increase causing employers to prefer B workers thereby restoring the original wage equality.

Case 4 : P firms are indifferent between hiring B and W workers, N firms hire B workers only.

Let β be the fraction of P firms that always hire B workers. For P firms to be indifferent between hiring B and W workers, we must have :

$$w(W) = w(B) + c.$$

Then

$$\begin{aligned} p(\hat{h}, W) &= \frac{q}{\frac{\lambda}{\rho(1-\beta)}\frac{n}{m}-1} \\ p(\hat{h}, B) &= \frac{q}{\frac{1-\lambda}{(1-\rho)+\rho\beta}\frac{n}{m}-1} \end{aligned}$$

For this to be an equilibrium under the MPS we must have

$$p(\hat{h}, W) < p(\hat{h}, B)$$

or,

$$\beta > \frac{\rho - \lambda}{\rho}.$$

For this condition to be satisfied we need

$$\lambda > 0.$$

Such an equilibrium will exist if there exists $\beta \in (\frac{\rho-\lambda}{\rho}, 1]$ which satisfies :

$$w^{MPS}(\frac{q}{\frac{\lambda}{\rho(1-\beta)}\frac{n}{m} - 1}) - w^{MPS}\left(\frac{q}{\frac{1-\lambda}{(1-\rho)+\rho\beta}\frac{n}{m} - 1}\right) = c$$

If the 'taste for discrimination' on the part of P firms is large, then such an equilibrium will not exist. A sufficient condition for such an equilibrium *not to* exist is

$$c > \bar{c}_{MPS}.$$

So long as the difference between $p(\hat{h}, W)$ and $p(\hat{h}, B)$ is large, this equilibrium is stable with respect to small perturbations.

For this to be an equilibrium under the BPS we must have

$$p(\hat{h}, W) > p(\hat{h}, B)$$

or,

$$\beta < \frac{\rho - \lambda}{\rho}.$$

The following condition needs to be satisfied for this case :

$$\lambda \leq \rho.$$

Such an equilibrium exists if there exists $\beta \in (\frac{\rho-\lambda}{\rho}, 1]$ which satisfies :

$$w^{BPS}(\frac{q}{\frac{\lambda}{\rho(1-\beta)}\frac{n}{m} - 1}) - w^{BPS}\left(\frac{q}{\frac{1-\lambda}{(1-\rho)+\rho\beta}\frac{n}{m} - 1}\right) = c.$$

If the 'taste for discrimination' on the part of P firms is large, then such an equilibrium will not exist. Since $w^{BPS}(p)$ is monotonically increasing in p by **Proposition 3,** a sufficient condition for such an equilibrium *not to* exist is

$$c > w^{BPS}(1) - w^{BPS}(0) = \frac{e}{1-q} \equiv \bar{c}_{BPS}.$$

We are ready to state our main results concerning properties of equilibria in the presence of taste-discrimination. First consider a situation where the 'taste for discrimination' on the part of P firms is sufficiently large :

Proposition 4 : Suppose $c > \max(\bar{c}_{BPS}, \bar{c}_{MPS})$. If firms adopt the BPS an equilibrium exists if and only if $\lambda \geq \rho$, which is also unique and stable. In this equilibrium N firms hire both B and W workers, P firms hire W workers only, and the equilibrium wages and unemployment rates of B and W workers are the same. If firms adopt the MPS instead, an equilibrium exists if and only if $\lambda \geq \bar{\lambda}$, which is again unique and stable. In this equilibrium no B workers are hired by any firm.

This result tells us that if the taste for discrimination on the part of P firms is significant, i.e., if c is large, then the unique equilibrium when firms condition their hiring strategies on a worker's past record is to have an extreme discriminatory outcome in the form of total exclusion of B workers from the labor market, even by firms who have no taste for discrimination. The presence of P firms exerts an externality on the hiring decision of N firms under such hiring strategies. As mentioned before, there are two reasons for working under such strategies, first to enjoy high wages and not be fired by the current employer, and second, keeping a good record which will help get a job more easily in the event of an exogenous split. Both B and W workers will meet with the same fate if they shirk and get a bad record. But if they work and maintain good record, B workers face a lower probability of re-employment in the event of an exogenous split because of the presence of P firms. This reduces their incentive to work relative to W workers for the same wage rate. Thus to induce them to work N firms have to make a compensating increase in their wages, which however reduces their incentive hire B workers, further worsening the problem. This form of strategic complementarity is absent however when firms don't look at a worker's past record. Then the only reward for working is the high wage enjoyed (relative to income earned while unemployed) in a job, and the only punishment for shirking is unemployment for one period, and then being re-employed with some probability. The lower are a worker's chances of re-employment, the greater is the punitive impact of being fired so that such a worker will be willing to work at a lower wage. This makes her attractive to employers and undoes the effect of presence of firms with a taste for discrimination. This is very much in the spirit of Becker (1957) who considered a labor market without frictions (in particular, no moral hazard) and argued that so long there were enough non-prejudiced firms, there will not be any discrimination in equilibrium. Our model shows that this intuition carries through even in the presence of frictions in the labor market so long as firms do not condition their hiring decisions on the basis of the past record of a worker with other employers.

Recall that according to **Proposition 3** BPS involves a higher wage rate than MPS (when $\sigma > \bar{\sigma}$) and hence are less preferred from the point of view of firms. An interesting implication of **Proposition 4** is that this result continues to hold when we allow for the presence of P firms :

Proposition 5 : Suppose $c > \max(\bar{c}_{BPS}, \bar{c}_{MPS})$. Then if $\sigma > \bar{\sigma}$ and $\lambda \geq \max(\rho, \bar{\lambda})$, *both* the discriminatory equilibrium under the MPS and the non-discriminatory equilibrium under the BPS exists, but the equilibrium wage is strictly higher in the latter case..

Proof : In the discriminatory equilibrium under the $MPS, p(W) = \frac{q}{\lambda \frac{n}{m} - 1}$. In the non-discriminatory equilibrium under the BPS, $p(B) = p(W) = \frac{q}{\frac{\lambda}{\rho + \alpha(1-\rho)} \frac{n}{m} - 1} = \frac{q}{\frac{n}{m} - 1}$ as $\alpha = \frac{\lambda - \rho}{1 - \rho}$. By **Proposition 3** $w^{BPS}(i)$ is increasing in p_i and $w^{MPS}(i)$ is decreasing in p_i. Also $w^{BPS}(0) = w^{MPS}(0) = \bar{w} + e + e\frac{1-\delta+\delta q}{\delta(1-q)}$. Hence $w^{MPS}(\frac{q}{\lambda \frac{n}{m} - 1}) < w^{BPS}(\frac{q}{\frac{n}{m} - 1})$.$\blacksquare$

This implies that even if firms could decide whether to choose MPS or the BPS, they would always choose the MPS because it is more efficient even though it could lead to extreme discriminatory outcomes. This suggests that there does not exist 'costless' policy interventions that can make everyone better off by solving coordination problems.

So far we assumed that the taste for discrimination on the part of P firms is large. If this assumption does not hold then we can have other equilibria than the two described in **Proposition 4.**

If firms adopt the BPS, then it is possible two types of equilibria depending on whether or not $\lambda \geq \rho$. If $\lambda \geq \rho$ then the non-discriminatory equilibrium described above is still the unique equilibrium.. If instead $\lambda < \rho$, then the equilibrium discussed in **Case 4** is the unique equilibrium where the equilibrium wages of W workers is higher than that of B workers by an amount c, P firms are indifferent between hiring B and W workers, while N firms hire B workers only.

If firms adopt the MPS instead, then it is possible three types of stable equilibria.. Moreover, now it is possible to have multiple equilibria.. The equilibrium discussed in **Case 4** always exists. In this equilibrium, the wage of W workers is higher than that of B workers by an amount c, P firms are indifferent between hiring B and W workers, while N firms hire B workers only. If $\lambda > \bar{\lambda}$ then the equilibrium described in **Proposition 4** also exists under which all firms hire W workers. If $\lambda < 1 - \bar{\lambda}$, then the equilibrium described in **Case 2** exists as well where all firms hire B workers only. Finally, if $\bar{\lambda} < \frac{1}{2}$ then all three types of equilibria exists for $\lambda \in (\bar{\lambda}, 1 - \bar{\lambda})$.

5 Conclusion

Economists seem to have an apparently contradictory attitude about economic efficiency in economies dominated by close-knit social networks, such as in villages. Within such social networks people have a lot of information about each other which is efficient from the point of view of reducing transaction and coordination costs. At the same time all kinds of social norms and attitudes which restrict economic enterprise and mobility seem to abound in such environments, which are often cited as major cause of their economic backwardness. Our results suggest that better information flows can be a double-edged sword and hence, can be interpreted as a way of reconciling these two seemingly opposite views.

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