Government-Mandated Discriminatory Policies*

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Abstract

This paper provides a simple explanation for why some minority groups are economically successful, despite being subject to government-mandated discriminatory policies. We study an economy with private and public sectors in which workers invest in imperfectly observable skills that are important to the private sector but not to the public sector. A law allows native majority workers to be employed in the public sector with positive probability while excluding the minority from it. We show that even when the public sector offers the highest wage rate, it is still possible that the discriminated group is, on average, economically more successful. The reason is that the preferential policy lowers the majority's incentive to invest in imperfectly observable skills by exacerbating the informational free riding problem in the private sector labor market.

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1 Introduction

Government-mandated discrimination of ethnic or religious groups is a common phenomenon in many places around the world. The most well-known examples are probably the Jim Crow laws in the United States, the South African apartheid system, and the more modest preferential treatment of Blacks during the era of affirmative action in the United States. Sowell (1990) also documents numerous less well-known examples of such policies in other parts of the world. In Malaysia after independence, Chinese were not allowed to hold government positions during the so-called "Malaysianization" movement. The newly independent Philippines in 1954 passed the Retail Trade Act banning the Chinese from retail trade, and also prohibited Chinese to work in the public sector during the Philipinization movement (Juan 1996, Page 14). In other Southeast Asian countries, Chinese have continuously been the subject of official discrimination ranging from minor harassments, such as special taxes for signs written in Chinese, to more significant measures such as bans from a wide range of professions, discriminatory taxation, and bans against Chinese-owned retail and trade (see Purcell 1965). In both middle-age and modern Europe the Jews were heavily restricted and persecuted in their professional endeavors.

While Blacks in the United States and South Africa have suffered dearly from the discriminatory policies, preferential policies do *not necessarily* make the preferred groups perform better economically than the discriminated groups. According to Sowell (1990, P. 51), in Malaysia, "[A]mong private sector doctors, engineers, accountants, architects, and lawyers, the Chinese continued to outnumber the Malays absolutely in 1984, after more than a decade of preferential policies." In fact, the Malay median income has remained a constant fraction (around 50%) of the Chinese median income (Sowell 1990, P. 50). In most of the Southeast Asia, the Chinese minority is significantly wealthier than the natives, and in fact, is the economically dominant group. And Jews, despite economic restrictions and political persecutions in Europe, continued to prosper (Sowell 1996, P. 240).

Why, in spite of the discriminatory policies, are the overseas Chinese and Jews more prosperous than the groups that are preferentially treated by government mandates? At least for the Chinese, an obvious explanation is that immigrants are a selective sample of individuals. Using U.S. data, Borjas (1987, 1994) found that immigrant earnings "overtake" that of native workers within fifteen years after controlling for socioeconomic characteristics. Since there seems to be no particular reason for immigrants to accumulate more human capital than native workers, this evidence suggests that immigrants are more "able" and "diligent". While it is certainly possible that immigrants in the U.S. are more likely to have these productive traits, it does not seem to be the case for Chinese immigrants to Malaysia. Again according to Sowell (1990, P. 46), the Chinese immigrants to

Malaysia were "initially largely illiterate as well as destitute," while the education for Malays were provided for free by the colonial government.

Another rationale is "cultural differences" between groups. The view that cultural differences are important is often supported by appeal to the large persistence in relative performance between different ethnic groups among second and third generation immigrants (see Borjas 1994). Combined with the perception (supported by, e.g., Becker and Tomes 1976) that there is a rather small correlation between acquired skills of parents and children, this suggests that groups somehow differ, which is attributed to cultural differences. In recent work, Landa (1999) suggest a theory of Chinese merchant success, based on the premise that the Confucian code of ethics facilitate cooperation.

While it is convenient to attribute the success of overseas Chinese and Jews to their unique culture, we believe that culture is not exogenous. Our view is therefore that this explanation is at best incomplete, unless cultural differences are explained as an equilibrium phenomenon. Moreover, there are several direct challenges to this sort of explanation for the success of ethnic Chinese. First, the same Confucian heritage was blamed for the backwardness of China in the 1950s (see, e.g., Needham 1956). Second, according to Juan (1996, Page 15), in the Philippines and other Southeast Asian countries, the ethnic Chinese economy achieved rapid growth during the 1970s, at the same time as the propagation of Chinese language and culture started on its swift trend downwards.

In this paper, we provide a simple model of the incentive effects of discriminatory policies. In a nutshell, we show that, in an economy with imperfect information, discriminatory policies, usually viewed as obstacles, may serve as a useful device to overcome an informational free riding problem among the members of the discriminated group. Hence, government-mandated discrimination could actually be the reason for, rather than an obstacle to, economic success.

We study an economy with two sectors, a public sector and a private sector. In the private sector, firms compete (by posting wages) for workers who makes a binary skill investment prior to entering the labor market. A worker has high productivity if she has the requisite skills and low otherwise, but skills are not directly observable to the firms. Instead, firms must rely on informative, but noisy, signals to make inference about workers. This leads to an *informational free riding* problem (see Fang 2001 and Norman 2000). The free riding problem arises because the firms' perception of the fraction of skilled workers in the population is a *public good*.

In contrast, we assume that the skill investment is not important for performance in the public sector. Moreover, the public sector pays higher wages than those in the private sector.[1] Obviously,

[1] It is not necessary for our results that the public sector is better paid than all jobs in the private sector. We

if all native majority workers could be given a public sector job, then the majority would certainly do better than the discriminated minority. But, due to the natural capacity constraints, it seems reasonable to think that public sector jobs are rationed, which we assume in our analysis.

We show that, if a government-mandated preferential policy gives the native majority a positive probability of obtaining public sector jobs, while the minority is completely excluded, it is possible that the minority is, on average, economically more successful than the majority. The intuition is as follows: when the minority is excluded from the public sector, the direct effect is that they suffer a loss due to the wage differential between public and private sector jobs. However, the exclusion also creates better incentives to invest in skills valuable in the private sector by partially alleviating the informational free riding problem among the group members. The latter, indirect equilibrium effect, may dominate the direct effect. Moreover, we show that the magnitude of the wealth differentials that can be generated by the model are potentially substantial.

The main focus of our paper is to provide an alternative explanation for the success of heavily discriminated minority groups, such as the Chinese in Southeast Asia and Jews in Europe. But the conditions that we need for the discriminated minorities to be more successful than the preferred majority also provides us with a possible explanation for the economic hardship encountered by some discriminated minorities. We find that the extent to which government-mandated discriminatory policy applies is most crucial: Exclusion from a small segment of the labor market may help the minority, whereas broader measures are likely to harm (see Section 5).

Our model is most closely related to models of statistical discrimination following the seminal contributions by Arrow (1973), Phelps (1972) and more recently, Coate and Loury (1993). This literature tries to understand how discrimination can arise as an *equilibrium phenomenon,* and this is usually rationalized in models with multiple equilibria. In contrast, discrimination is *by government mandate* in our paper, and while informational externalities similar to those in models of statistical discrimination are crucial for our results, multiplicity of equilibria is not central to our analysis.

The remainder of the paper is structured as follows. Section 2 presents the basic economic environment; Section 3 analyzes the Perfect Bayesian Nash Equilibrium of the model; Section 4 shows that the indirect effects of discriminatory policies on the workers' incentives to invest in skills in the private labor market may dominate the direct effects, and make the discriminated minority economically more successful than the preferred majority; Section 5 demonstrates that the magnitude of the economic force we highlight in this paper can be substantial; Section 6 discusses

make the assumption in the belief that it is most realistic that the politically dominant group excludes minorities from the most attractive professions.

two implications of the model and their supporting evidence and finally Section 7 concludes.

2 The Model

The model is adapted from Coate and Loury (1992) with two main departures: first, we endogenize the wage offers; second, we introduce a public sector that allows us to investigate the effects of government-mandated discriminatory policy.

A. The Private and Public Sectors

Consider an economy with two sectors, called respectively the *private* and the *public* sector.

The private sector consists of two (or more) competitive firms, indexed by $i = 1, 2$. Firms are risk neutral and maximize expected profits, and are endowed with a technology that is complementary to workers' skills. A skilled worker can produce $\beta > 0$ units of output while an unskilled one will, by normalization, produce 0.

The public sector offers a fixed wage g to any worker who is hired, but there is rationing of public sector jobs. If applying, the probability of getting hired is $\rho \in [0, 1]$, where ρ is treated as exogenous in our analysis.[2] Workers who apply for but are unsuccessful in obtaining public sector employment can return to and obtain a job in the private sector without waiting. It is important to note that the "public sector" in our paper is a metaphor for the part of the economy that the government has control over. Hence we can interpret ρ to represent the extent of the economy under governemnt control.

B. Workers

There is a continuum of workers with unit mass in the economy. Workers are heterogeneous in their costs of acquiring the requisite skills for the operation of the firms' technology, denoted by c, which is private information for the worker. In the population, c is distributed according to a continuous cumulative distribution $J(\cdot)$ with support $[\underline{c}, \overline{c}]$.

Workers are risk neutral and do not care directly about whether they work in the public or private sector. If a worker of cost type c receives wage w, her payoff is $w - c$ if she invests in skills, and w if she does not invest.

C. Timing of Events and Information Structure

[2] In a more realistic setup, one can imagine that there is a limited number of public sector vacancies and the probability of being employed in the public sector equals to the ratio of the vacancy and the number of applicants. The main insight of this paper is robust to such a formulation. In fact, in our leading example, every worker wants public sector employment, justifying the assumption.

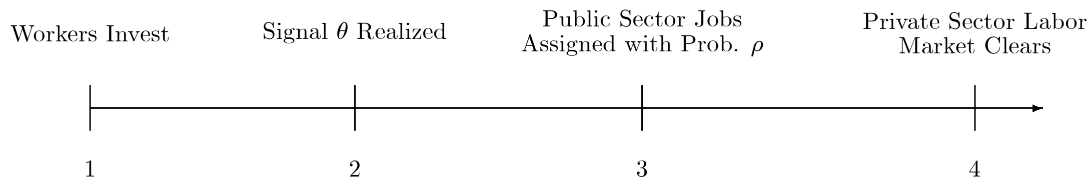

Figure 1: Timing of The Events

It is useful to divide the events in this economy into four stages that we now detail. The timing of events is summarized in Figure 1.

In the first stage, each worker $c \in [\underline{c}, \overline{c}]$ decides whether to invest in the skills. This binary decision is denoted by $s \in \{0, 1\}$ where $s = 0$ stands for no skill investment and $s = 1$ for skill acquisition. If a worker chooses $s = 1$, we say that she becomes *qualified* and hence she can produce β units of output in the private sector; otherwise she is *unqualified* and will produce 0. We write the skill acquisition profile as $S : [\underline{c}, \overline{c}] \to \{0, 1\}$.

It is important that skill acquisitions are *not* perfectly observed by the firms. However, in the second stage, the worker and the firms observe a noisy signal $\theta \in \{h, l\} \equiv \Theta$ about the worker's skill acquisition decision.[3] We assume that a high signal h (and a low signal l, respectively) reveals a qualified (an unqualified, respectively) worker correctly with probability p. That is,

$$\Pr[\theta = h | s = 1] = \Pr[\theta = l | s = 0] = p$$

where, without further loss of generality, $p > 1/2$.

In the third stage, after observing the noisy signal θ, the worker decides whether to apply for the public sector job. If applying, she is accepted for employment in the public sector with probability ρ.

If she did not get employed in the public sector, she will, in the fourth stage, return to the private sector, where firms compete for her services by posting wage offers $w_i : \Theta \to \mathbb{R}_+$. After observing the wage offers, she decides which firm to work for, clearing the private sector labor market.

The primitives of the economy are summarized in Table 1. For notational ease, we let $e = (J, \beta, g, \rho, p)$ denote a generic economy and the set of all admissible economies be denoted by $\mathcal{E}$.

[3]Models of statistical discrimination usually assume that signals are distributed according to a continuous density f_q if the worker invests in skills and f_u if she does not, and that f_q/f_u satisfies the strict monotone likelihood ratio property. We could also follow this route, but prefer the binary formulation for its simplicity.

J :	Continuous CDF of the skill investment costs
β :	Productivity of skilled workers, $\beta > 0$
g :	Wage rate in the public sector, $g > 0$
ρ :	Probability of public sector jobs if one applies
p :	Precision of the noisy signals, $p > 1/2$.

Table 1: Primitives of the Economy.

D. Discussion of the Assumptions

In this section we discuss some of the assumptions:

- Output is not contractible in our model. The informational externality that is driving our results would disappear if workers could be made residual claimants on output, so this assumption is important. One way to justify this is if workers are engaged in team production and only the aggregate, but not the individual, output can be observed by the firm.

- The informational externality would also disappear if the workers can access the production technology. In our model we rule this out by assuming that only the firms have access to the production technology. One way to justify such an assumption would be to appeal to "entrepreneurial ability" as necessary for successful operation of a firm and identify firms with entrepreneurs. Alternatively, one could imagine that there is a minimum efficient scale of production or that the operation of the technology also requires some technical know-how that only the firms have access to.

- We assume that if a worker is unsuccessful in obtaining public sector employment, she can immediately return to the private sector to find a job. Moreover, since the noisy signal is realized before public sector jobs are allocated, workers know exactly what wage they would get in the private sector. These assumptions are made in order not to build in any disguised "matching costs" in the public sector. In other words, our choice of timing guarantees that a worker has nothing to loose from applying to the public sector if the wage is higher there than the wage she would get in the private sector.

- Both the public sector wage g and the probability of obtaining public sector employment ρ are independent of θ. These extreme assumptions are made so that our main idea can be conveyed in the simplest possible fashion. The results are robust to alternative assumptions as long as "luck" is more important in the public sector than in the private sector.

3 Equilibrium

A *Perfect Bayesian Nash Equilibrium* (PBNE) of the economy consists of a skill acquisition profile $S(\cdot)$, job application and offer acceptance decisions by the workers, together with firm wage offer schedules $w_i(\cdot)$, such that every player optimizes against other players' strategy profile for a consistent belief system.[4]

We first analyze the equilibrium wage offers in the fourth stage. A private firm observing a worker with a signal $\theta \in \{h, l\}$ must form a belief about the probability that the worker is qualified. Suppose that at the end of the first stage, a proportion π of the population is qualified. Then in the second stage, a total measure $p\pi + (1-p)(1-\pi)$ of workers receive signal h, among which a measure $p\pi$ is qualified and a measure $(1-p)(1-\pi)$ is unqualified. Similarly, a total measure $(1-p)\pi + p(1-\pi)$ of workers receive signal l, among which a measure $(1-p)\pi$ is qualified and a measure $p(1-\pi)$ is unqualified.

In the third stage, each worker observes her signal. In equilibrium, all workers with the same signals must make identical decisions about whether or not to apply for public sector employment regardless of whether they are qualified or not (unless they are indifferent, in which case a decision independent of qualifications is still optimal). This is true because the continuation payoff in the fourth stage does not depend on the skills. Hence, we conclude that, in the fourth stage, the proportion of qualified workers among workers with signal θ is unaffected by their public sector job application decision in the third stage, even though the total mass of workers with signal θ will be affected.

Therefore, if the proportion of qualified workers in the population at the end of the first stage is π, then in the fourth stage, when a firm sees a worker with a signal θ, its posterior belief that this worker is qualified, denoted by $\Pr[s=1|\theta;\pi]$ where $\theta \in \{h, l\}$, is given by

$$\begin{aligned} \Pr[s=1|\theta=h;\pi] &= \frac{p\pi}{p\pi + (1-p)(1-\pi)} \\ \Pr[s=1|\theta=l;\pi] &= \frac{(1-p)\pi}{(1-p)\pi + p(1-\pi)}. \end{aligned} \tag{1}$$

Note that in (1), π serves as the prior in the application of Bayes' rule. Standard arguments show that the "Bertrand"-type competition between firms for the workers implies that in the fourth stage, each worker will be offered a wage equal to her expected productivity in equilibrium (see, e.g., Moro and Norman 2001). Hence, in the fourth stage, the equilibrium wage for workers with

[4] Due to the noise in the signal, there are no off-the-equilibrium path histories for the firms to observe, so beliefs are fully determined by Bayesian updating. The only place where "perfectness" enters the analysis is that workers in the private sector choose firms optimally after any history of play.

signal $\theta \in \{h, l\}$ when the proportion of qualified workers in the population is π, denoted by $w_\theta(\pi)$, is

$$\begin{aligned} w_h(\pi) &= \beta \Pr[s = 1 | \theta = h; \pi] = \frac{\beta p \pi}{p\pi + (1-p)(1-\pi)} \\ w_l(\pi) &= \beta \Pr[s = 1 | \theta = l; \pi] = \frac{\beta(1-p)\pi}{(1-p)\pi + p(1-\pi)}. \end{aligned} \tag{2}$$

The public sector job application decision in the third stage is now easy to analyze. A worker with signal θ applies to the public sector job if $w_\theta(\pi) < g$ and does not apply if $w_\theta(\pi) > g$. If $w_\theta(\pi) = g$, then she is indifferent and we break ties by assuming that indifferent workers apply for the public sector jobs. Note that both $w_h(\cdot)$ and $w_l(\cdot)$ in (2) are monotonically increasing in π. By defining $\hat{\pi}_\theta$ as the solution to $w_\theta(\hat{\pi}_\theta) = g$ for $\theta = h, l$, which are given by

$$\begin{aligned} \hat{\pi}_h &= \frac{g(1-p)}{g(1-p) + p(\beta - g)} \\ \hat{\pi}_l &= \frac{gp}{gp + (1-p)(\beta - g)}, \end{aligned} \tag{3}$$

it then follows that a worker with signal θ applies for a public sector job if and if $\pi \leq \hat{\pi}_\theta$.

A worker's incentive to acquire skills in the first stage comes from the subsequent expected wage differential between a qualified and an unqualified worker. The wage differential arises because qualified workers are more likely to draw high signals. Denote the expected wage, before the signal is realized, for a qualified and an unqualified worker, respectively by $W_1(\pi, \rho)$ and $W_0(\pi, \rho)$, where π is the fraction of qualified workers in the population and ρ is the probability of being assigned a job in the public sector if one applies. They are given by

$$\begin{aligned} W_1(\pi, \rho) &= p \cdot \max\{w_h(\pi), \rho g + (1-\rho) w_h(\pi)\} \\ &\quad + (1-p) \cdot \max\{w_l(\pi), \rho g + (1-\rho) w_l(\pi)\} \\ W_0(\pi, \rho) &= (1-p) \cdot \max\{w_h(\pi), \rho g + (1-\rho) w_h(\pi)\} \\ &\quad + p \cdot \max\{w_l(\pi), \rho g + (1-\rho) w_l(\pi)\}, \end{aligned} \tag{4}$$

where the max operator in (4) represents the workers' optimal decision of whether or not to apply for a public sector job. The incentive to invest, or, the gain in expected wage from skill investment in the first stage, denoted by $I(\pi, \rho)$, is thus given by

$$\begin{aligned} I(\pi, \rho) &= W_1(\pi, \rho) - W_0(\pi, \rho) \\ &= (2p-1)\{(1-\rho)[w_h(\pi) - w_l(\pi)] + \rho[\max\{w_h(\pi), g\} - \max\{w_l(\pi), g\}]\}. \end{aligned} \tag{5}$$

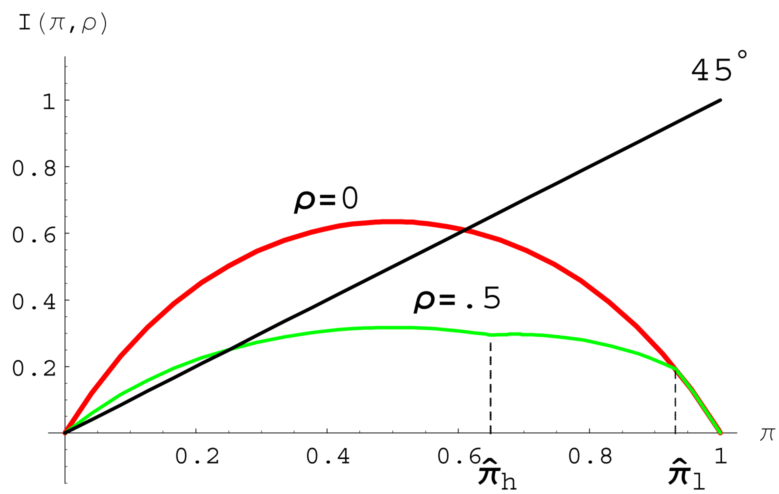

Figure 2: An Illustration of the Function $I(\pi,\rho)$ for $\rho = 0$ and $\rho = .5$.

Alternatively, we can use $\hat{\pi}_\theta$ defined in (3) and, after noting that $\hat{\pi}_h < \hat{\pi}_l$, rewrite $I(\pi,\rho)$ as:

$$I(\pi,\rho) = \begin{cases} (2p-1)(1-\rho)\left[w_h(\pi) - w_l(\pi)\right] & \text{if } 0 \le \pi < \hat{\pi}_h \\ (2p-1)\left\{(1-\rho)\left[w_h(\pi) - w_l(\pi)\right] + \rho\left[w_h(\pi) - g\right]\right\} & \text{if } \hat{\pi}_h \le \pi < \hat{\pi}_l \\ (2p-1)\left[w_h(\pi) - w_l(\pi)\right] & \text{if } \hat{\pi}_l \le \pi \le 1. \end{cases} \tag{6}$$

Figure 2 graphically illustrates the function $I(\pi,\rho)$ for $\rho = 0$ and $\rho = .5$.

The fact that a worker's incentives for the skill investment is a function of π, the proportion of qualified workers in the population, is the source of *informational free riding.* The reason that workers will free ride is obvious: the firms' perception about the proportion of qualified workers in the population, which serves as the prior in the Bayesian updating, is a *public good,* (see Fang 2001 for similar discussions). This informational free riding problem is best illustrated by an extreme case. Suppose that every worker in the economy invests in skills. Then, regardless what signal the firms observe, every worker is paid β, so there is no incentive to acquire skills at all, that is, $I(1,\rho) = 0$.

The incentive to invest depends also on ρ, the probability of public sector employment, which is the reason for a government-mandated preferential (or discriminatory) policy in the public sector to matter for the private sector labor market in our model. Indeed, a higher probability of public sector jobs will unambiguously decrease the investment incentives if $\pi < \hat{\pi}_l$ because

$$\frac{\partial I(\pi,\rho)}{\partial\rho} = \begin{cases} -(2p-1)[w_h(\pi) - w_l(\pi)] < 0 & \text{if } \pi < \hat{\pi}_h \\ (2p-1)[w_l(\pi) - g] < 0 & \text{if } \hat{\pi}_h \leq \pi < \hat{\pi}_l \\ 0 & \text{otherwise.} \end{cases} \tag{7}$$

The intuition is simple: the public sector does not give any edge to qualified workers over unqualified workers.

It is also easy to see that the function $I(\cdot,\rho)$ is continuous in π, and satisfy

$$I(0,\rho) = I(1,\rho) = 0.$$

The reason is that the signal is useless when everyone makes the same investment decision. That is, if the perception is that no one (everyone) in the population is qualified, then the firms will offer a wage equal to 0 (β) to all workers regardless of their signals, implying that there is no advantage to be qualified.

Using the investment incentives characterized in (6) it is obvious that, in the first stage, a worker with cost c will invest in skills if and only if $c \leq I(\pi,\rho)$. A PBNE of the economy is thus fully characterized by a fraction of investors π^* that solves

$$\pi^* = J(I(\pi^*;\rho)) \tag{8}$$

Proposition 1 *There exists at least one PBNE for any economy $e \in \mathcal{E}$.*

Proof. Since J is a continuous CDF and for every $\rho \in [0,1]$, the map $J \circ I : [0,1] \to [0,1]$ is continuous. The existence of fixed points follows from the intermediate value theorem. ■

We let $\Omega(e)$ denote the set of fixed points for economy e. It is easy to see that $0 \in \Omega(e)$ for every e with $\underline{c} \geq 0$, that is there is a trivial equilibrium whenever the investment is costly for all agents. We say that an economy e admits *non-trivial equilibria* if there exist positive elements in $\Omega(e)$ and we will denote the set of non-trivial equilibria of economy e by $\Omega^+(e)$.

4 Exclusion from the Public Sector May Be Beneficial

Suppose that there are two ethnic groups in the economy. A government-mandated discriminatory policy excludes one group from public sector employment (that is, ρ is set to 0), while workers from the other group are employed in the public sector with positive probability. This section demonstrates that the discriminated group nevertheless may be economically more successful than the preferred group.

The main insight is best conveyed in a simple example. We will make several parametric restrictions below and for the rest of this section we assume that the investment cost c is uniformly distributed on the interval $[0,1]$.

<u>ASSUMPTION 1.</u> J is the CDF of Uniform $[0,1]$.

A. EQUILIBRIUM WITH $\rho = 0$

We first analyze the equilibrium outcomes for the discriminated group. From (5) the incentive to invest when $\rho = 0$ can be re-written as

$$I(\pi, 0) = (2p-1)\left[w_h(\pi) - w_l(\pi)\right]. \tag{9}$$

Proposition 2 *The function $I(\cdot, 0)$ is strictly concave in π, with maximum obtained at $\pi = 1/2$.*

Proof. By a direct calculation we obtain

$$\frac{\partial I(\pi,0)}{\partial \pi} = \beta(2p-1)p(1-p)\left\{\frac{1}{H(\pi)^2} - \frac{1}{L(\pi)^2}\right\}, \tag{10}$$

where $H(\pi) \equiv p\pi + (1-p)(1-\pi)$ and $L(\pi) \equiv (1-p)\pi + p(1-\pi)$. Hence,

$$\frac{\partial I(\pi,0)}{\partial \pi}\begin{cases} > 0 \\ = 0 \\ < 0 \end{cases} \text{if } \pi \begin{cases} > \frac{1}{2} \\ = \frac{1}{2} \\ < \frac{1}{2}. \end{cases}$$

Moreover, with simple algebra, we have

$$\frac{\partial^2 I(\pi,0)}{\partial \pi^2} = Z \times \left[-\frac{2H'(\pi)}{H(\pi)^3} + \frac{2L'(\pi)}{L(\pi)^3}\right].$$

where Z is some positive term. The above term is negative since $H'(\pi) > 0$, and $L'(\pi) < 0$. ■

Under Assumption 1, the equilibrium condition (8) simplifies to

$$I(\pi, 0) = \pi. \tag{11}$$

Obviously $0 \in \Omega(e)$. The following proposition establishes the necessary and sufficient condition for unique non-trivial equilibrium.

Proposition 3 *Under Assumption 1, when $\rho = 0$, the necessary and sufficient condition for the existence of a unique non-trivial equilibrium is*

$$\beta > \frac{p(1-p)}{(2p-1)^2}.$$

Proof. From Proposition 2, we know that $I(\cdot, 0)$ is strictly concave in π, hence $I(\pi, 0)$ crosses the 45° line at most twice. Since 0 is already a fixed point, there is at most one non-trivial equilibrium.

Since $I(1,0) = 0$, a non-trivial equilibrium exists if and only if $\partial I(0,0)/\partial\pi > 1$. From (10), we have

$$\frac{\partial I(0,0)}{\partial \pi} = \frac{(2p-1)^2\beta}{p(1-p)}.$$

■

Proposition 3 is intuitive. To induce the workers to invest in skills, the wage differential, which depends on the productivity of a qualified β and the precision of the signal p, has to be sufficient large. The threshold $p(1-p)/(2p-1)^2$ is decreasing in the precision of the noisy signals p (recall that $p > 1/2$). Indeed when the signal is perfect, when $p = 1$, any economy with positive β will admit a non-trivial equilibrium.

We will henceforth focus on non-trivial equilibrium whenever it exists.[5]

Next, we impose a restriction on the parameters that simplifies the analysis tremendously.

<u>Assumption 2.</u> $(2p-1)^2\beta = 1/2$.

This assumption is only for algebraic convenience. As shown in Section 4.D, we can relax this assumption, but the cost of doing so is that our main results can only be demonstrated numerically rather than analytically. Assumption 2 is satisfied by a manifold of economies in $\mathcal{E}$, for example, it is satisfied by $p = 2/3$ and $\beta = 9/2$.

Under Assumption 2, the unique non-trivial equilibrium with $\rho = 0$ is given by $\Omega^{+}(0) = 1/2$ (by substitution into (9) one can check that $I(1/2, 0) = (2p-1)^2\beta$). The reason that this simplifies the analysis is that the restriction makes sure that the equilibrium is at the point where incentives are maximized (see Proposition 2), so $\partial I(1/2,0)/\partial\pi = 0$, which in turn makes the comparative statics easier to handle.

B. Equilibrium with $\rho > 0$: Local Analysis

In this section, we maintain Assumptions 1 and 2, and analyze the non-trivial equilibrium of the economy when ρ , the probability of public sector jobs, is positive. To begin with we consider marginal effects, applicable for ρ sufficiently close to 0.

When $\rho = 0$, workers with signal h receive wage $p\beta$ and those with signal l receives $(1-p)\beta$ in the non-trivial equilibrium, which can be seen from plugging in $\pi = 1/2$ into (2). To make our

[5] The trivial equilibrium exists because $\underline{c} = 0$ in the example. If c can take on negative values, albeit with arbitrarily small probability, then the trivial equilibrium can be eliminated, justifying the selection.

case most interesting, we assume that the wage rate in the public sector is higher than $p\beta$, that is, wages in the public sector is higher than those in the private sector.

<u>Assumption 3.</u> $g > p\beta$.

Given Assumption 3, one can imagine that a government controlled by the political majority notes that the public sector pays higher wages and is under their control, and mandates a preferential policy in favor of the politically influential group. That is, we now assume that the government sets the probability of public sector jobs to be 0 for the discriminated group and set it to be $\rho > 0$ for the preferred group.

We first show that the proportion of qualified workers in the preferred group will be less than that in the discriminated group.

Proposition 4 *Consider any economy $e \in \mathcal{E}$ satisfying Assumptions 1 and 2. For any $\rho > 0$, then the proportion of qualified workers in any non-trivial equilibrium is less than $1/2$.*

Proof. From (7), we know that for all $\pi > 1/2$, if $\rho > 0$, then $I(\pi, \rho) < I(\pi, 0)$. But since the unique non-trivial equilibrium when $\rho = 0$ is at $\pi = 1/2$, it must be that for $\pi > 1/2$, $I(\pi, 0) < \pi$. Hence for all $\pi > 1/2$, $I(\pi, \rho) < \pi$ if $\rho > 0$. ■

Note that Assumption 3 is not required for Proposition 4. Now we establish the necessary and sufficient condition for the existence of non-trivial equilibrium when $\rho > 0$:

Proposition 5 *Under Assumptions 1-3, if $\rho > 0$, then there exists a unique non-trivial equilibrium if and only if $\rho < 1 - 2p(1-p)$.*

Proof. Under Assumption 3, $\hat{\pi}_h$ as defined in (3) is larger than 1/2. Hence for all $\pi \leq 1/2$, the investment incentive function in (6) is given by

$$I(\pi, \rho) = (2p-1)(1-\rho)[w_h(\pi) - w_l(\pi)] = (1-\rho) I(\pi, 0).$$

From Proposition 4, any non-trivial equilibria must lie in the interval $(0, 1/2]$ where $\rho > 0$. Uniqueness follows from the strict concavity of $I(\cdot, \rho)$ in the interval $(0, 1/2]$. Non-trivial equilibrium exists if and only $\partial I(0, \rho)/\partial \pi > 0$, and simple algebra yields that

$$\frac{\partial I(\pi, \rho)}{\partial \pi} = (1-\rho)\frac{(2p-1)^2 \beta}{p(1-p)} = \frac{(1-\rho)}{2p(1-p)},$$

where the last equality follows from Assumption 2. Hence $\partial I(0, \rho)/\partial \pi > 0$ if and only if $\rho < 1 - 2p(1-p)$. ■

Our focus in this section is on how the non-trivial equilibrium depends on ρ, we will then, with some abuse of notation, write the unique non-trivial equilibrium if it exists, when the probability of public sector jobs is ρ, as $\Omega^+(\rho)$.

Now we consider the values of ρ in a neighborhood ε of 0. If ε is sufficiently small, a unique non-trivial equilibrium exists and $\Omega^+(\rho)$ is characterized as solution to

$$\Omega^+(\rho) = I\left(\Omega^+(\rho), \rho\right) = (1-\rho)\, I\left(\Omega^+(\rho), 0\right), \tag{12}$$

where the second equality follows from (6) since any non-trivial equilibrium with $\rho > 0$ satisfies $\Omega^+(\rho) \leq 1/2$ (Proposition 5), and Assumption 3 implies that $\hat{\pi}_h > 1/2$. That is, in the range of possible equilibrium proportions of qualified workers, g is high enough so that everyone applies for public sector employment, implying that the incentive to invest is the same as the incentive to invest without public sector employment, scaled down with the probability of private sector employment.

Hence,

$$\frac{d\Omega^+(\rho)}{d\rho} = -I\left(\Omega^+(\rho), 0\right) + (1-\rho)\frac{\partial I\left(\Omega^+(\rho), 0\right)}{\partial \pi}\frac{d\Omega^+(\rho)}{d\rho}. \tag{13}$$

Under Assumption 2, $\Omega^+(0) = 1/2$ and since $\partial I(1/2, 0)/\partial \pi = 0$ (This is the main algebraic convenience from Assumption 2), we then have

$$\frac{d\Omega^+(0)}{d\rho} = -I\left(\Omega^+(0), 0\right) = -\frac{1}{2}. \tag{14}$$

For any ρ within a small neighborhood of 0, the expected wage in the unique non-trivial equilibrium for a qualified and an unqualified worker before the test signal is realized, $W_1(\Omega^+(\rho), \rho)$ and $W_0(\Omega^+(\rho), \rho)$ as defined in (4), are:

$$\begin{aligned} W_1\left(\Omega^+(\rho), \rho\right) &= \rho g + (1-\rho)\left[p w_h\left(\Omega^+(\rho)\right) + (1-p)\, w_l\left(\Omega^+(\rho)\right)\right] \\ W_0\left(\Omega^+(\rho), \rho\right) &= \rho g + (1-\rho)\left[(1-p) w_h\left(\Omega^+(\rho)\right) + p w_l\left(\Omega^+(\rho)\right)\right]. \end{aligned} \tag{15}$$

We now totally differentiating $W_1(\Omega^+(\rho), \rho)$ and $W_0(\Omega^+(\rho), \rho)$ with respect to ρ and evaluate them at $\rho = 0$. We can obtain, after some simplifications,

$$\begin{aligned} \left.\frac{dW_1(\Omega^+(\rho), \rho)}{d\rho}\right|_{\rho=0} &= \overbrace{g - \left[p w_h\left(\Omega^+(0)\right) + (1-p)\, w_l\left(\Omega^+(0)\right)\right]}^{\text{Direct Effect}} \\ &\quad \overbrace{+(1-\rho)\left.\frac{d\left[p w_h(\Omega^+(\rho)) + (1-p)\, w_l(\Omega^+(\rho))\right]}{d\rho}\right|_{\rho=0}}^{\text{Indirect Effect}}. \end{aligned}$$

Since $\Omega^+(0) = 1/2$, and

$$\frac{dw_h(1/2)}{d\pi} = \frac{dw_l(1/2)}{d\pi} = 4p(1-p)\beta,$$

we can, after using (14), obtain:

$$\left.\frac{dW_1\left(\Omega^+\left(\rho\right),\rho\right)}{d\rho}\right|_{\rho=0} = \overbrace{\left\{g - \left[p^2 + (1-p)^2\right]\beta\right\}}^{\text{Direct Effects}} \overbrace{-2p\left(1-p\right)\beta}^{\text{Indirect Effect}} = g - \beta. \tag{16}$$

Similarly, we can get

$$\left.\frac{dW_0\left(\Omega^+\left(\rho\right),\rho\right)}{d\rho}\right|_{\rho=0} = g - 4p(1-p)\beta. \tag{17}$$

Since $4p\left(1-p\right) < 1$, together with our maintained Assumption 3, $g > p\beta$, we have proved the following proposition:

Proposition 6 *Under Assumptions 1 and 2, if moreover $p\beta < g < 4p(1-p)\beta$, then the expected wage of both qualified and unqualified workers when ρ is positive but small are lower than those when $\rho = 0$.*

The intuition for Proposition 6 is as follows. When the government marginally increases ρ from 0, there are two *direct effects*: first, the group will now have a higher degree of access to a higher paying public sector, captured by the term g in (16); second, they will less likely enter the private sector, captured by the term $-\left[p^2 + (1-p)^2\right]\beta$ in (16). The direct effects are positive since

$$g - \left[p^2 + (1-p)^2\right]\beta = g - \left[p + (1-p)\left(1-2p\right)\right]\beta > g - p\beta > 0,$$

where the last inequality follows from Assumption 3. However, the negative *indirect effect* resulting from the feedback of the increase in ρ on the equilibrium skill investment behavior of the workers in the private sector, captured by the term $-2p\left(1-p\right)\beta$ in (16) more than offsets the positive direct effects. One can similarly understand why $W_0\left(\Omega^+\left(\rho\right),\rho\right)$ can also decrease in ρ.

To satisfy the condition $p\beta < g < 4p\left(1-p\right)\beta$ in Proposition 6, the precision of the test signal p has to be less than 3/4. That the precision in the signal cannot be too high for the equilibrium effects to dominate should be intuitive: A beneficial net effect from being excluded from the public sector can only occur if the informational free riding problem in the private sector is severe enough, and the higher is p the less severe this problem is.

Proposition 6 shows that it is possible that wages for both qualified and unqualified workers decline in the probability of public sector employment. However, for Pareto comparisons we must take into consideration that when ρ changes from 0 to a positive value, some workers *switch* from being qualified to being unqualified, saving on the skill investment cost. But, these workers had the *option* not to invest when $\rho = 0$, so by their *revealed preference*, the decrease in their expected welfare, taking into account the change in their skill investment behavior, must be larger than those who do not invest both before and after the change in ρ. We have thus proved the following:

Proposition 7 *Under Assumptions 1 and 2, if moreover $p\beta < g < 4p(1-p)\beta$, then all workers are economically worse off when ρ is positive but small than when $\rho = 0$.*

D. Equilibrium with $\rho > 0$: Global Analysis

In this section, we maintain Assumption 1 that J is Uniform CDF on $[0,1]$, but dispense with Assumptions 2 and 3. We show that the general message conveyed in Section 4.C. is still valid.

First when $\rho = 0$, we can find the unique non-trivial equilibrium, if it exists, directly by solving Equation (11). The unique solution in $(0,1)$ is

$$\Omega^+(0) = \frac{1}{2}\left\{(1+\beta) - \frac{\sqrt{1+(2p-1)^2\beta(\beta-2)}}{2p-1}\right\}. \tag{18}$$

Note that $\Omega^+(0)$ given by the expression (18) is always less than 1, but to guarantee that it is positive, it must be the case that $\beta > p(1-p)/(2p-1)^2$, confirming Proposition 3.

When $\rho > 0$, in general the incentive function $I(\cdot,\rho)$ given by (6) may not be globally concave in π, but we know that for $\rho > 0$, any non-trivial equilibrium must be smaller than $\Omega^+(0)$ by the same argument as in the proof of Proposition 4.

If we further assume that $\Omega^+(0) < \hat{\pi}_h$ where $\Omega^+(0)$ and $\hat{\pi}_h$ are respectively given by (18) and (3), then arguments analogous to those in the proof of Proposition 5 can show that there exists a unique non-trivial equilibrium if and only if $\rho < 1 - p(1-p)/(2p-1)^2\beta$. We summarize the above discussion as:

Proposition 8 *Suppose that an economy e satisfies Assumption 1. For any $\rho > 0$, if $\Omega^+(0) < \hat{\pi}_h$ holds where $\Omega^+(0)$ and $\hat{\pi}_h$ are respectively given by (18) and (3), then there exists a unique non-trivial equilibrium if and only if $\rho < 1 - p(1-p)/(2p-1)^2\beta$.*

The condition $\Omega^+(0) < \hat{\pi}_h$ plays the role of Assumption 2 in Section 4.C. (in fact, if $\Omega^+(0) = 1/2$, the assumption $\Omega^+(0) < \hat{\pi}_h$ reduces to the condition $g > p\beta$). In general, it requires that

$$g > \frac{\Omega^+(0)\,p\beta}{[1-\Omega^+(0)](1-p) + \Omega^+(0)\,p}.$$

Though the above inequality looks rather complicated once one takes into account that $\Omega^+(0)$ is given by (18), it involves only the primitives of the economy.

One can analytically solve for the unique non-trivial equilibrium when it exists, and it is given by

$$
\begin{aligned}
\Omega^{+}(\rho) \quad = \quad & \frac{1}{2}\Bigg\{1+\beta(1-\rho) \\
& -\frac{\sqrt{(2p-1)^2\left[1+\beta^2(1-\rho)+2\beta(1+\rho)\right]^2+4\left[p(1-p)(4\beta+1)-\beta\right]}}{2p-1}\Bigg\}. \qquad (19)
\end{aligned}
$$

Again it can be readily verified that if we plug in $\rho = 0$ in the expression $\Omega^{+}(\rho)$ above, we immediately get the expression $\Omega^{+}(0)$ in (18). Since (19) fully characterizes the unique equilibrium for any $\rho > 0$ for economies satisfying the condition $\Omega^{+}(0) < \hat{\pi}_h$, we can in principle proceed as in Section 4.C. at this point.

Not surprisingly, it is impractical to try to get analytical results from (19), but the following numerical example demonstrates that the main result of Section 4.C. is robust. Set $\beta = 3, p = 0.73$, and $g = 2.5$. When $\rho = 0$, we can numerically calculate that in the unique non-trivial equilibrium $\Omega^{+}(0) = 0.61$ and the private sector wage for workers with high signal $w_h(\Omega^{+}(0)) = 2.43$, and $w_l(\Omega^{+}(0)) = 1.1$, and $\hat{\pi}_h = 0.65$.

It can be easily verified that all the conditions in Proposition 8 are satisfied. Hence we use the formula given by (19) to calculate the non-trivial equilibrium when ρ is positive. We then plot the expected wages of qualified and unqualified workers in the non-trivial equilibrium associated with different levels of ρ according to (15). Figure 3 and 4 demonstrate that indeed, the expected wage for qualified and unqualified workers are both declining as ρ increase provided that ρ is not too large. By continuity, this guarantees that there is an open set of economies in which positive but small probability of public sector jobs make every worker economically worse off in the subset of economies satisfying Assumption 1.

E. Summary

In this section, we have shown that giving a group preferential access to high paying public sector jobs dampens the incentives for skill investment valuable in the private sector. If the informational free riding problem in the private labor is sufficiently severe, it is possible that the adverse indirect effect due to the exacerbated informational free riding may dominate the favorable direct effects.

Throughout the section we have assumed that the skill investment costs in the population follows a Uniform distribution. The main role of this assumption is that the investment incentive function $I(\pi, \rho)$ is identical (or proportional) to the composite map $J \circ I$. It is clear that any distribution J such that $J \circ I$ has curvature similar to that depicted in Figure 2 will deliver qualitatively similar results.

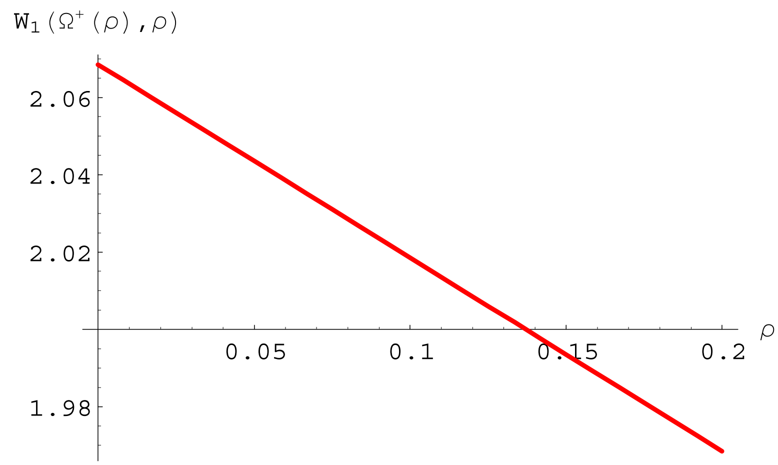

Figure 3: Expected Wage for Qualified Workers as a Function of ρ: $\beta = 3, p = 0.73, g = 2.5$.

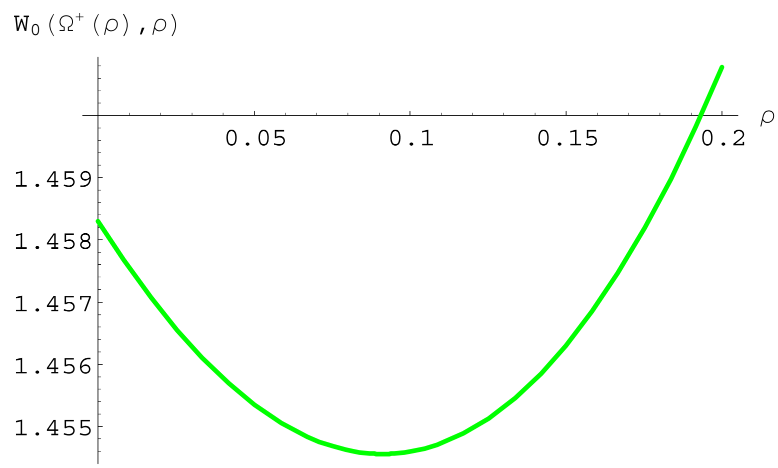

Figure 4: Expected Wage of Unqualified Workers as a Function of $\rho : \beta = 3, p = 0.73, g = 2.5$.

The most crucial assumption is that ρ cannot be too high: given that the public sector by assumption pays a higher wage than the private sector, if the government could set $\rho = 1$, then of course the preferred group as a whole will be made better off economically.

We believe that a small ρ is not an unreasonable assumption. In Southeast Asian countries, for example, the native majority started to give themselves preferential treatment in the public sector after their independence in the 1950s (see Sowell 1990). However, there was a natural capacity constraint in the number of public sector positions, hence not every applicant could be given a job.

5 The Effects of Discriminatory Policy May be Large

In Section 4 we have shown that giving a group preferential access to the public sector jobs may make them economically worse off. Here we demonstrate that it is possible to construct economies in which that the magnitude of the adverse effects on the preferentially treated group is actually quite large.

To construct such examples in the simplest possible fashion, we maintain Assumption 2 in Section 4.C.. Furthermore, we assume that the distribution of the skill investment cost c in the population is Uniform on the interval $[a, 1-a]$ where $0 \leq a < 1/2$.

The equation characterizing non-trivial equilibria in this environment is:

$$\pi = \frac{(1-\rho) \cdot I(\pi, 0) - a}{1-2a}. \tag{20}$$

Claim 1 *Under Assumption 2, when* $\rho = 0$, *the unique non-trivial equilibrium is* $1/2$ *for any* $a \in (0, 1/2)$.

Proof. Note that under Assumption 2, $1/2$ is the equilibrium when $\rho = 0$ and $a = 1$, hence $I(1/2, 0) = 1/2$. Plug this into the right hand side of (20) we obtain $1/2$. Hence $1/2$ is a non-trivial equilibrium for any $a \in (0, 1/2)$ when $\rho = 0$. The uniqueness follows from the strictly concavity of $I(\cdot, 0)$. ■

Now let $\rho > 0$. Suppose that there is a non-trivial equilibrium, the same argument as that in the proof of Proposition 4 shows that it must be less than $1/2$. Hence it must be that for some $\pi' \in (0, 1/2), (1-\rho) I(\pi', 0) > a$. By Proposition 2 we know that $I(\pi', 0) < I(1/2, 0) = 1/2$. Hence if

$$\frac{1-\rho}{2} < a$$

then there exists no $\pi' \in (0, 1/2)$ such that $(1-\rho) I(\pi', 0) > a$. Therefore we have the following claim:

Claim 2 *Fix $\rho \in (0,1)$. The unique equilibrium of all economies satisfying Assumptions 2 and 3 is the trivial equilibrium if $a \in ((1-\rho)/2, 1/2)$.*

What Claims 1 and 2 have shown is that for any $\rho > 0$ we can find a set of economies in which the unique equilibrium is the trivial no-investment equilibrium, while for an identical economy if ρ is instead set to 0, there exists a unique non-trivial equilibrium at 1/2.

We now compare the *average economic surplus* in the maximal equilibrium (i.e. the equilibrium with the maximal element in $\Omega(e)$) for these economies under $\rho = 0$ and $\rho > 0$. We index the equilibrium average economic surplus by ρ and write it as $U(\rho)$.

When $\rho = 0$, in the non-trivial equilibrium of economies satisfying conditions of Claim 2, half of the workers draw high signals and obtain a wage $w_h(1/2) = p\beta$ and half of the workers draw low signals and obtain a wage $w_l(1/2) = (1-p)\beta$. At this equilibrium the average economic surplus, taking into account the skill investment cost, is

$$\begin{aligned} U(0) &= \frac{1}{2}\beta - \int_a^{\frac{1}{2}} \frac{c}{1-2a} dc \\ &= \frac{1}{2}\beta - \frac{1+2a}{8}. \end{aligned} \tag{21}$$

When $\rho > 0$, if we choose a to be in the interval of $((1-\rho)/2, 1/2)$, then by Claim 2, the economy will only admit a trivial equilibrium. Hence no one invests and a proportion ρ of the population earns g and the remaining earns 0. The average economic surplus is

$$U(\rho) = \rho g \text{ for all } \rho > 0, \text{ if } a \in \left(\frac{1-\rho}{2}, 1/2\right). \tag{22}$$

Let $K(\rho) = U(0)/U(\rho)$, that is,

$$K(\rho) = \frac{4\beta - (1+2a)}{8\rho g}.$$

$K(\rho)$ denotes the ratio the average economic surplus of the discriminated group over the preferred group. We now ask the following question: what is the upper-bound of K, denoted by $\bar{K}$, for different levels of ρ if we impose all the restrictions that are required for the validity of Claims 1 and 2? This upper-bound can inform us about the extent of the wealth differentials between the discriminated minority and the preferred majority that can be rationalized by the economic forces highlighted in this paper. The first restriction is that $a \in ((1-\rho)/2, 1/2)$; the second restriction comes from Assumption 3, i.e., $g > p\beta$ and the third comes from Assumption 2, $(2p-1)^2 \beta = 1/2$, i.e., $p = \left(1 + 1/\sqrt{2\beta}\right)/2$. Taking into account these three restrictions, we obtain

$$K(\rho) \overset{\boxed{\text{Restriction 1}}}{<} \frac{4\beta - 2 + \rho}{8\rho g} \overset{\boxed{\text{Restriction 2}}}{<} \frac{4\beta - 2 + \rho}{8\rho p\beta} \overset{\boxed{\text{Restriction 3}}}{=} \frac{4\beta - 2 + \rho}{4\rho\beta\left(1 + \frac{1}{\sqrt{2\beta}}\right)}.$$

		β								
		1	2	3	4	5	6	7	8	9
	.01	29.4	37.6	37.5	36.3	34.9	33.6	32.4	31.3	30.3
	.06	5.03	6.31	6.28	6.06	5.83	5.61	5.40	5.22	5.05
	.11	2.81	3.47	3.44	3.32	3.19	3.07	2.95	2.85	2.76
	.16	1.98	2.41	2.38	2.29	2.20	2.11	2.03	1.96	1.90
	.21	1.54	1.85	1.82	1.75	1.68	1.61	1.55	1.50	1.45
ρ	.26	1.27	1.50	1.48	1.42	1.36	1.31	1.26	1.21	1.17
	.31	1.09	1.27	1.25	1.20	1.14	1.10	1.06	1.02	0.98
	.36	0.96	1.10	1.08	1.03	0.99	0.95	0.91	0.88	0.85
	.41	0.86	0.98	0.95	0.91	0.87	0.83	0.80	0.77	0.75
	.46	0.78	0.88	0.85	0.81	0.78	0.74	0.72	0.69	0.67
	.51	0.72	0.80	0.77	0.74	0.70	0.67	0.65	0.62	0.60

Table 2: The Value of $\bar{K}$ for Combinations of ρ and β.

Hence, subject to the assumption that the skill investment cost c is distributed as a Uniform distribution, the upper-bound of wage differential between the discriminated minority and the preferred majority that are consistent with this model is

$$\bar{K}(\beta,\rho) = \frac{4\beta - 2 + \rho}{4\rho\beta\left(1 + \frac{1}{\sqrt{2\beta}}\right)}. \tag{23}$$

In Table 2, we calculate the values of $\bar{K}$ for different combinations of β and ρ. These numbers demonstrate that our model is consistent with a Southeast Asian phenomenon where the discriminated Chinese minority is economically substantially more successful than native majority. Table 2 also reveals two interesting features of $\bar{K}$: first, for a fixed β, it decreases with ρ; second, for any ρ, it first increases, then decreases with β.

A model as simple as ours can't be expected to explain which groups will suffer and which groups will be successful under government-mandated discrimination. Having said that, we find it interesting to note that ρ is a key parameter that determines how much better or worse off the discriminated group can be in equilibrium. This is interesting, because ρ can be thought of as representing the extent of the labor market the government can control with legislation. While we don't know how to quantify it, it seems that the exclusionary policies in southeastern Asia was mainly in "elite professions" (small ρ), whereas American Jim Crow laws were broader measures

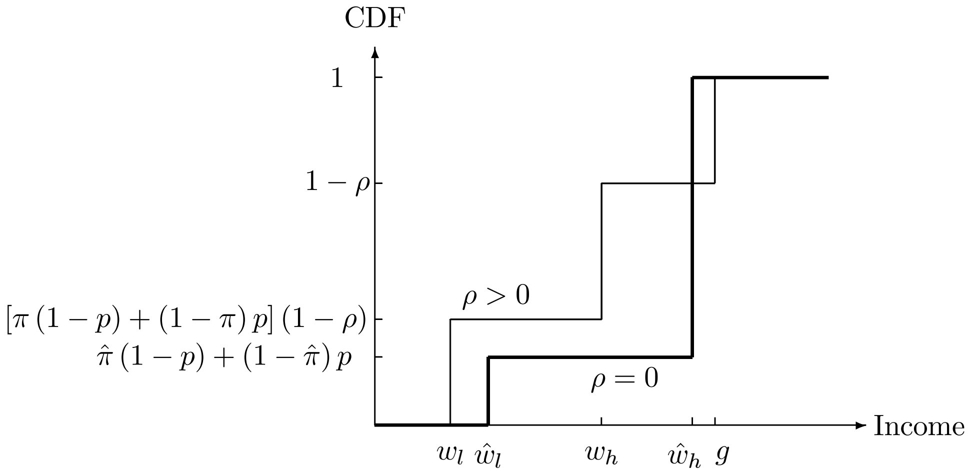

Figure 5: The CDF of the Income Distributions.

(large ρ).

Table 2 informs us whether the discriminated group can be better off than the preferred group under different parameter configurations. The average surplus for the discriminated group is (at best) less than that of the preferred group when either ρ is substantial (over .36, for example) or β is sufficiently high. The reason that when ρ is substantial, the preferred group is going to do better is simply that we have assumed in calculating these bounds that the public sector pays more than the highest wage in the private sector, i.e., $g > p\beta$.[6]

6 Discussion: Two Implications of the Model

Our model predicts that income inequality among the preferred majority will increase following the adoption of preferential policies. Figure 5 depicts the cumulative density of the income distributional for $\rho = 0$ and $\rho > 0$, where the hatted variables are for the case $\rho = 0$. It demonstrates that the income distribution when $\rho = 0$ first order stochastically dominates that when $\rho > 0$, which implies that the Gini Index in the preferred majority increases following the preferential policy.

This implication is supported by the evidence in Malaysia. Sowell (1990, P. 48), citing the study by Puthucheary (1983), stated that: "Income inequality among Malays increased under preferential policies, with the income share of the top 10 percent rising from 42 percent to 53

[6] The reason that when β is sufficiently high, the preferred group does better is less interesting. The Table maintains Assumption 2, $(2p-1)^2\beta = 1/2$. Hence, the comparative static comes from the fact that the precision in the test signal is reduced as β increases.

percent of all income received by Malays." This pattern, as Sowell stated, was "by no means confined to Malaysia."

Second, our model provides an alternative explanation to the experience of overseas Japanese on the mainland U.S. and Hawaii. As Sowell (1996, P. 119) states: "Ironically, the Japanese on the mainland, who historically faced more discrimination, as well as wartime internment, achieved higher incomes and occupational levels than those in Hawaii. The Japanese in Hawaii were also much more active politically, and by 1971 had a majority in the state legislature." Sowell explains this phenomenon through immigration selection: "Historically, the Japanese who immigrated to Hawaii came from poorer regions and poorer classes in Japan than did those who went to the U.S. mainland," but he failed to explain why such a pattern of immigration selection emerged. This phenomenon, however, arises naturally in our model.

7 Conclusion

Some minorities, notably overseas Chinese in Southeast Asia and Jews in Europe, have performed economically better than the native majorities, despite being subject to government-mandated discriminatory policies. We provide a simple explanation based on the incentive effects generated by preferential policies, which we think complements the most commonly invoked explanations based on immigration selection and cultural differences.

We study an economy with private and public sectors in which workers invest in imperfectly observable skills that are important to the private sector but not to the public sector. A law allows the native majority to be employed in the public sector while excluding the minority from it. Even when the public sector offers the highest wage rate, it is still possible that the discriminated group, on average, is economically more successful. The reason is that the preferential policy will indirectly lower the majority's incentive to invest in imperfectly observable skills by exacerbating the informational free riding problem in the private sector labor market.

The model also has other testable implications. For example, following the adoption of preferential policies, the income inequality among the preferred group will increase, which is consistent with empirical observations from Malaysia and other Southeast Asian countries.

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