

Discrimination Without Taste - How Discrimination Can Spillover and Persist

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We introduce coordination failures driven by beliefs regarding the presence of taste discriminators as a channel of discrimination in activities requiring the input of more than one individual for production to occur. We show discrimination can persist under perfectly observable ability, when taste for discrimination has died out, and under absence of discriminatory social norms. Empirically, we analyze an activity requiring inputs from multiple sources - self-employment. Consistent with the theoretical predictions, beliefs about discrimination are a significant correlate of self-employment rates, as well as the cost and success of establishing productive relations for blacks in the US.

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I. Introduction

Discrimination against certain social groups over long time periods has been a historical feature of many societies. For instance, in the US discrimination in the form of slavery officially ended in 1865 after more than two centuries, though racial segregation was maintained in the form of Jim Crow laws until 1965.¹ Starting with the civil rights movements in the early 1960's, one has seen significant advances in the rights and outcomes of the black population. However, today the black population still lags behind whites in a range of socio-economic characteristics. In India, caste, which is inherited by birth, was a marker for social discrimination for centuries. At independence in 1947, the practice of untouchability was made illegal and affirmative action was enshrined in the constitution for disadvantaged groups. However, the lower castes continue to trail significantly behind other social groups in terms of most socio-economic indicators. What contributes to the gap between groups that faced discrimination over long time periods and those that did not? In what outcomes and why might we observe persistent gaps? Could discrimination persist due to more subtle channels than the traditionally assumed channels of taste based discrimination, statistical discrimination, and discriminatory social norms?

In this paper, we posit a channel of discrimination, where even under perfect observability of individual ability, the absence of discriminatory social norms, and when taste for discrimination has already died out, to discriminate can be the optimal response. The theoretical mechanism put forth rests on the existence of beliefs about discrimination by others in society, and on distinguishing between activities characterized by the need for *interlinkages* versus *no* need for interlinkages. In our model, activities with interlinkages require coordinated actions. If an individual decides to establish interlinkages, she requires the input of two principals to form a productive unit. The success and return for all, the individual and the two principals, is contingent on the participation of all three in the venture. The coordination failure results from the belief that somebody else might discriminate and refuse to participate in the venture, which imposes losses due to the complementarity of inputs in the production process.

¹Note that slavery had existed in colonial America since the 17th century but the United States as an independent nation state came into existence in 1774 and slavery ended 91 years later.

The classic example would be the case of entrepreneurs who need to establish multiple interlinkages (productive relations) to be able to start and operate a venture (Basu, 2010). In the theoretical model, individuals choose between entering activities which require establishing productive relations and those that do not. Individuals intending to enter activities involving interlinkages are randomly matched with a pair of “principals”, for instance a lender and a distributor, with whom they need to establish interlinkages to form a productive unit. The individual cannot produce without capital and cannot sell without a distributor. In case one of the principals agrees to participate and the other does not, the investment of the first principal is held up and imposes a fixed cost. We show how in the presence of beliefs about discrimination against a certain group, principals without a taste for discrimination also discriminate against that group in equilibrium.

To clarify the theoretical mechanism, picture the following situation: Both the lender and the distributor have no preference for discrimination against the individual and know she has the requisite ability to be an entrepreneur. However, the lender does not know whether the distributor is a discriminator because historically principals had been discriminating against individuals of her type. The lender has a belief about the presence of taste discriminators, which he has been updating through Bayes rule based on past observations. If the lender believes with a sufficiently high probability that the distributor has a preference for discrimination, he will reject the loan application. Now, if alternatively the distributor had signed the contract to distribute the goods but the individual has not obtained a loan to produce, the distributor loses out, because by setting up the productive relation he has foregone an alternative investment. Therefore, in the future the distributor will account for the possibility of the individual being matched with a taste discriminator. The individual also faces a cost because she invested time and effort to become self-employed but did not manage to do so. Consequently, people from her type might also refrain from attempting to become self-employed. This leads us to a persistent equilibrium in which able people are not becoming self-employed due to past discrimination and the resulting coordination failure based on beliefs, leaving everybody worse off.

Under certain conditions, the model predicts lower participation rates and higher cost of

establishing interlinkages for the discriminated group relative to the non-discriminated group in equilibrium, leading to an overall welfare loss for society. The model also establishes conditions under which the steady-state equilibrium is characterized by the existence of discrimination due to beliefs about the existence of taste discriminators, although there are no taste discriminators left in society. The persistence of beliefs regarding discrimination in the steady state are rationalized by presenting evidence that these can be interpreted as inter-generational transmission of beliefs in the sense of *collective memories*, consistent with utility maximizing or cultural trait preserving strategies.

The theoretical framework identifies occupational choice, such as self-employment, as markets characterized by interlinkages, making it a suitable candidate for empirical scrutiny. We examine the market for self-employment of blacks and whites in the United States. It is first shown that the outcomes regarding representation and payoff for the discriminated group in self-employment, as well as the probability and cost of establishing interlinkages, are in line with our theoretical predictions.

Next using data from the General Social Survey (GSS) from the years 1972-2012 (Smith et al., 2012), we create proxies of beliefs about and tastes for discrimination against blacks for every year and region to determine whether the presented belief-based mechanism finds any support in the data. The time trends of taste for discrimination and beliefs about discrimination from the GSS and the self-employment rates for blacks and whites from the Current Population Survey (CPS) for the time period 1972-2012 are shown in Figure 1.² Taste for discrimination against blacks linearly declines over the observed period, whereas beliefs about discrimination against blacks as well as the gap between the self-employment rates for blacks and whites remain remarkably constant over the same time period. Figure 1 captures the mechanism and the role of *sticky or unchanging* beliefs highlighted by the theoretical model in a snapshot. The unchanging beliefs perfectly correspond to the invariant gap in self-employment rates over the period analyzed, as predicted by the theoretical framework. Using a logit model, we find our proxy for beliefs about presence of discrimination to be a significant and negative correlate of the probability of becoming self-employed for blacks in the US.

²See Section III.B for how the measures of taste and beliefs about discrimination are constructed.

The results are robust to the inclusion of a race dummy to account for other unobservable characteristics of racial groups, as well as year and region fixed effects. Furthermore, using the National Survey of Small Business Finances of 1998 and 2003, we show that beliefs about discrimination also explain other features predicted by our model, namely that beliefs are a significant and positive correlate of blacks having their loan application rejected, the interest rates charged, and blacks reporting that they do not apply for a loan due to fear of rejection. The presented statistical associations are persistent across a variety of specifications and present strong evidence in favor of the theoretical framework, though no causal claims can be made on the basis of the available data.

The literature of the economics of discrimination was pioneered by the seminal work of

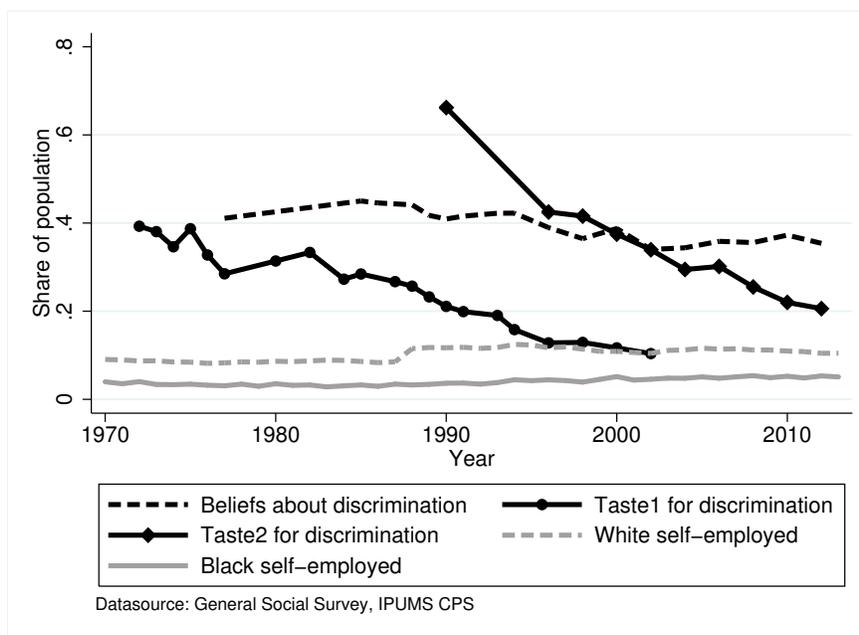


Figure 1. : Self-employment rates by race and beliefs and taste regarding discrimination in the US

Becker (1957). In the setting envisaged, employers hold a taste for discrimination, such that working with members of a particular group imposes a cost on them, and hence these workers have to compensate the employer by either being more productive or accepting lower wages. Extensions involving mechanisms based on consumer discrimination (Borjas and Bronars

1989; Nardinelli and Simon 1990) are again contingent upon the presence of consumers who dislike purchasing or interacting with members of another race, or in other words individuals possessing a taste for discrimination. The class of models of statistical discrimination (Phelps 1972; Arrow 1973; Aigner and Cain 1977; Lundberg and Startz 1983, 1998; Coate and Loury 1993; Rosén 1997) and categorical thinking (Fryer and Jackson 2008) rely on the imperfect observability of worker productivity. In absence of complete information employers base their decision on easily observable characteristics, such as race or gender, to infer the expected productivity of the worker. Mailath, Samuelson and Shaked (2000) present a model of endogenous discrimination arising from the search decision of firms. The asymmetric discriminatory equilibrium is supported due to the belief that there are more skilled available workers of a particular type, which is borne out in equilibrium. The third class of models is that of Akerlof (1976, 1985) and Peski and Szentes (2013), where not following the established norm of discrimination against certain groups might result in imposition of social sanctions which cause economic losses, making discrimination a rational response. Lang, Manove and Dickens (2005) present a model of labor market characterized by wage postings where even weak discriminatory preferences can lead to large wage differences and labor market segregation. Similar in spirit to our work, they discuss how beliefs among blacks regarding the presence of discriminators are sufficient to sustain a discriminatory equilibrium. The crucial distinction is that in our model the equilibrium is stable, while in their setting a trembling hand would lead to an unraveling of the self-confirming equilibrium.

Our model contributes a new mechanism as to how discrimination can persist. In our setting the distribution of ability within the two groups is identical ex-ante and ex-post, there is perfect observability of ability, and there are no social norms to discriminate. Moreover, the nature of the coordination failure highlighted does not allow for a single principal who does not discriminate to reap the unrealized profits, a possibility traditionally assumed by Becker (1957), therefore providing a theoretical rationale as to why discrimination can persist. To our knowledge, we are also the first to provide empirical evidence, albeit correlational, concerning the channel of discrimination presented theoretically.

II. The model

The society consists of individuals i of two types $s_i \in \{A, B\}$. The types A and B form social groups based on visible characteristics which do not influence performance (e.g., race, gender). Individuals of type A and B belong to the finite, large sets \mathcal{A} and \mathcal{B} , respectively.³ Individuals have an ability a_i , where a is distributed uniformly over $[0, 1]$. Ability $a_i \in [0, 1]$ reflects productive capacity and is perfectly observable to all. For sake of simplicity we are dropping the index i in what follows.

Those referred to throughout the paper as “individuals” can opt to engage in one of the two possible kinds of productive activities in the economy ($L \in \{0, 1\}$) - activities that involve establishing *interlinkages* ($L = 1$) with other agents, who are referred to as “principals” $P \in \{p_1, p_2\}$, and activities that do *not* establish interlinkages ($L = 0$). In case individual i of type s decides to engage in an activity that does not involve establishing interlinkages with other principals in the economy, she earns a net income on her activity equal to the level of her productivity, which is given by:

$$(1) \quad W = G_{NL}(a) = a,$$

where G_{NL} is the production function of activities not involving interlinkages. On the other hand, individuals have the option of engaging in an activity which involves establishing interlinkages with other principals, and earn a gross income equal to:

$$(2) \quad W = G_L(a, C) = \lambda c_{p_1} c_{p_2} a,$$

where $\lambda > 1$. The production function G_L captures the notion of *interlinkages*. Activities requiring interlinkages imply that the gross income from this activity not only depends upon the individual’s own ability a , but also on C . The component $C = (c_{p_1}, c_{p_2})$ captures the interlinkages or productive relations individual i is able to establish with the principals in

³The assumption of large sets is to ensure that no single individual has any market power and collusion cannot take place.

the economy. Interlinkages refer to the fact that the production in such activities is a joint process and requires input from multiple sources.

We denote by $c_P \in \{0, 1\}$ the decisions by the principal $P \in \{p_1, p_2\}$ of whether to establish productive relations. Thus, we only allow for pure strategies, such that the two principals decide whether to establish the relation ($c_P = 1$) or not ($c_P = 0$). Moreover, it is assumed that in case the principals decide to establish a productive relationship with the individual, they need to make an investment, which is normalized to unity. The incentive for engaging in activities that involve establishing interlinkages arises as complementary investment by the principals results in a boost to productivity, captured by the factor $\lambda(> 1)$ in the production function G_L .

A simple example to fix ideas for activities that are characterized by the need to establish interlinkages, is the market for self-employment.⁴ For example, an entrepreneur might require capital in the form of a loan from a bank (lender) to produce goods and also may need to have an agreement with a distributor willing to distribute her goods. The example with the requirement of productive relations with two principals, a distributor and a lender, is only for illustrative purposes and tractability, and could be extended to n -players by including any other contact necessary to setup a successful enterprise (e.g., supplier, landlord to rent office).

The functional form in (2) exhibits an extreme form of complementarity in the actions of the principals P , implying $G_L(a, C) = G_L(a, (c_{p_1}, 0)) = G_L(a, (0, c_{p_2})) = 0$. The intuition is that establishing a relationship with both principals $P \in \{p_1, p_2\}$ is required for the individual to produce, as neither component (loan, distribution route) can be substituted through ability.

A. The static game

Individuals i decide whether they want to enter an activity that involves no interlinkages, or whether to enter into activities involving interlinkages by trying to establish productive relations with the principals.

Individuals wanting to enter activities involving interlinkages are randomly matched with a pair of principals in the market, p_1 and p_2 , to try to establish productive relations. Principals

⁴In Section III.C we outline alternative applications of the model beyond self-employment.

have an outside opportunity of a risk free investment yielding interest r per unit invested. To establish a productive relationship, and in return for the investment in their activity by the principals, the individual's offer an amount σ_P to each of the principals as repayment for the investment. In case this offer is rejected by any one of the principals, the attempt to enter the activity with interlinkages fails and the individual i faces a fixed cost δ from the effort exerted. She then enters the activity not involving interlinkages and earns a net income of $(a - \delta)$.

The offer, denoted by σ_P , made by the individual to the principal arises as a solution of a Nash bargaining process over the surplus generated from the activity involving interlinkages compared to the alternative involving no interlinkages. The bargaining takes place between each principal and the individual separately, without communication between p_1 and p_2 .⁵ In light of the production function given by (2), the outcome is dependent on what decision the other principal (henceforth denoted by $-P$) makes. Hence, P has a belief concerning the likelihood of the other principal accepting the offer as well.⁶ If P accepts an offer which the other principal rejects, then he is not able to obtain r from the risk free investment in the given period due to his capital being bound and not yielding any interest.

The production function given by (2) implies that production can take place only if the grand coalition, i.e. of the two principals and the individual, forms. This implies returns to bilateral agreements are zero and hence in the absence of a grand coalition, the individual prefers to enter the activity involving no interlinkages and the principals prefer investing in the risk-free asset. Thus, the disagreement points are exogenously given by their outside option and, contrary to Bennett (1997) and Burguet and Caminal (2011), do not depend on what the individual can achieve in the alternative negotiation. The interaction between the individual and the principal is characterized by a monopoly versus monopsony, commonly referred to as bilateral monopoly. Both have one shot at earning a surplus compared to their

⁵Communication could be allowed between the two principals and would not change our results if we assume costly communication or no reputation effects. Without reputation effects moral hazard problems would arise as there would be no gain from admitting when one is not willing to establish the productive relation.

⁶We disregard higher order beliefs (as in, the lender believes that the distributor believes that etc.), even though they would additionally speed up the contagion-effect.

outside option. Assuming equal bargaining power, linear utility functions in payoffs and that i makes the same offer to the two principals, such that $\sigma_P = \sigma_{-P}$, the Nash bargaining solution is defined as:⁷

$$(3) \quad \sigma^N(a) = \frac{(\lambda - 1)a + r + \delta + 1}{3}.$$

This Nash bargaining solution is an increasing function of a , which we denote as $\sigma^N(a)$. In order for P to accept this offer, we require the amount he expects to be repaid to be at least what he can earn through the risk free investment, i.e. $(1 + r)$. However, in the optimization problem facing the individual we allow the individual to offer an amount greater than the Nash bargaining solution in case it maximizes her utility. In other words, if an offer of $\sigma^N(a)$ is acceptable to the principal, so is any offer $\sigma \geq \sigma^N(a)$, as it gives the principal a share of the surplus more than commensurate to his bargaining power.

The Nash bargaining solution in (3) allows us to calculate the lowest ability individual, denoted by a' , who can offer the principal a share dominating the risk free investment, and is given by:

$$(4) \quad \sigma^N(a) \geq 1 + r \Rightarrow a' = \frac{2(1 + r) - \delta}{\lambda - 1}.$$

The participation constraint of the individual implies that to enter activity involving interlinkages, we require $\lambda a - 2\sigma^N(a) \geq a$,

$$(5) \quad \Rightarrow a^* = \frac{2(1 + r + \delta)}{\lambda - 1}.$$

Since $a^* > a'$ only individuals with $a \geq a^*$ will intend to enter activities involving interlinkages and, as long as there is no taste for or belief about discrimination, will be accepted.⁸

⁷Note that the disagreement point given by the outside option is $d = (d_i, d_P) = (a - \delta, 1 + r)$.

⁸Similar to Lucas Jr (1978), in our model only the most able want to enter the activity involving interlinkages such as entrepreneurship.

B. Discrimination in the static framework

The static game outlines the decision-making process and identifies the lowest ability type a^* from both groups $s \in (A, B)$ who enter into activities involving interlinkages without discrimination.

Now assume that individuals and principals believe that there exist principals with a taste for discrimination. Taste for discrimination can be understood as a cost/disutility, which principals with taste for discrimination face when they decide to establish a productive relation with a B -type individual in society, and is captured by the parameter $b(> 0)$.

The belief regarding the presence of taste discriminators implies that the probability of discrimination occurring has to be taken into account while deciding on the optimal course of action. Due to the random matching, the assigned probability of meeting a principal with a taste for discrimination is equal to what is believed to be the share of total taste discriminators among principals. As the share is not observable, decisions are conditioned on beliefs shared by the principals and individuals about the fraction of discriminators amongst principals, which is assumed to be equal to φ .

Imagine a scenario in which no principal has a taste for discrimination but everybody believes that taste discrimination exists in society.⁹ When facing an individual of the B -type that offers $\sigma^N(a)$, principals compare their expected payoff from accepting the offer to the certain payoff from the risk free investment:

$$E[V_P(x)] = \begin{cases} (1 - \varphi)\sigma^N(a) + \varphi & \text{if } c_P = 1 \\ 1 + r & \text{if } c_P = 0, \end{cases}$$

and choose the option that gives them the greater expected payoff. The expected payoff from establishing a link with an individual for the principals depends upon φ , i.e. their beliefs regarding the fraction of discriminators amongst principals. Thus even principals without taste for discrimination need to account for their beliefs while deciding on the optimum course

⁹How this belief can arise and sustain itself even after all principals with taste for discrimination have died out is discussed in the next subsections.

of action due to the complementariness of the production process.¹⁰ In case the principal P accepts and the counterpart $-P$ rejects the individual's offer, the principal P will lose his risk free return r . Thus, the principal P , due to the belief that the individual might face discrimination from principal $-P$, also ends up discriminating against the individual of type- B .

Observe that taste for discrimination against B -type individuals does not affect the A -types in the market. The A -types play the identical game as in the static framework without discrimination. All individuals of the A -type with $a \geq a^*$ still offer $\sigma^N(a)$ and are accepted.

DEFINITION 1: *An offer of $\sigma^N(a) > 1 + r$, which is rejected by any principal, is defined as a case of discrimination.*

For the B -types, first observe that for a given ability level of $a > a^*$ the expected payoff in the presence of discrimination, ceteris paribus, will always be less or equal than in the absence of discrimination.¹¹ This implies the lowest ability B -type who wants to apply for interlinkages while offering his Nash bargaining solution, has ability $a > a^*$, which we denote by a_d .¹²

Now let us define a_h as the ability level for which the Nash Bargaining solution $\sigma^N(a_h)$ is equal to $(1 + r + b)$. An individual with ability a_h is thus the lowest ability B -type who will never face any discrimination as her Nash Bargaining offer compensates for the taste for discrimination. Finally, define as a_m the B -type who is indifferent between offering $(1 + r + b)$ to each of the principals and escaping potential discrimination, and entering an activity not involving interlinkages.

To get an intuitive understanding of the effects of discrimination consider Figures 3a and 3b. The figures show the various ability levels, as defined above, on the 0-1 line and exhibit which types enter an activity involving interlinkages. The B -type individuals, who are likely to face discrimination when offering their Nash bargaining solution, lie in the range $a_d \leq a < a_h$.

¹⁰When discussing policy interventions in Section IV, we show that discrimination under certain interventions can even spillover to the A -type as well.

¹¹This is true as the payoff without discrimination ($\lambda a - 2\sigma^N(a)$) is strictly greater than with discrimination ($(1 - \varphi)^2(\lambda a - 2\sigma^N(a)) + (1 - (1 - \varphi)^2)(a - \delta)$) for any $a > a^*$ and $\varphi > 0$.

¹² $a_d = \frac{3\delta\chi + 2(1+r+\delta)}{\lambda - 1}$, where $\chi = \frac{[1 - (1 - \varphi)^2]}{[1 - \varphi]^2}$.

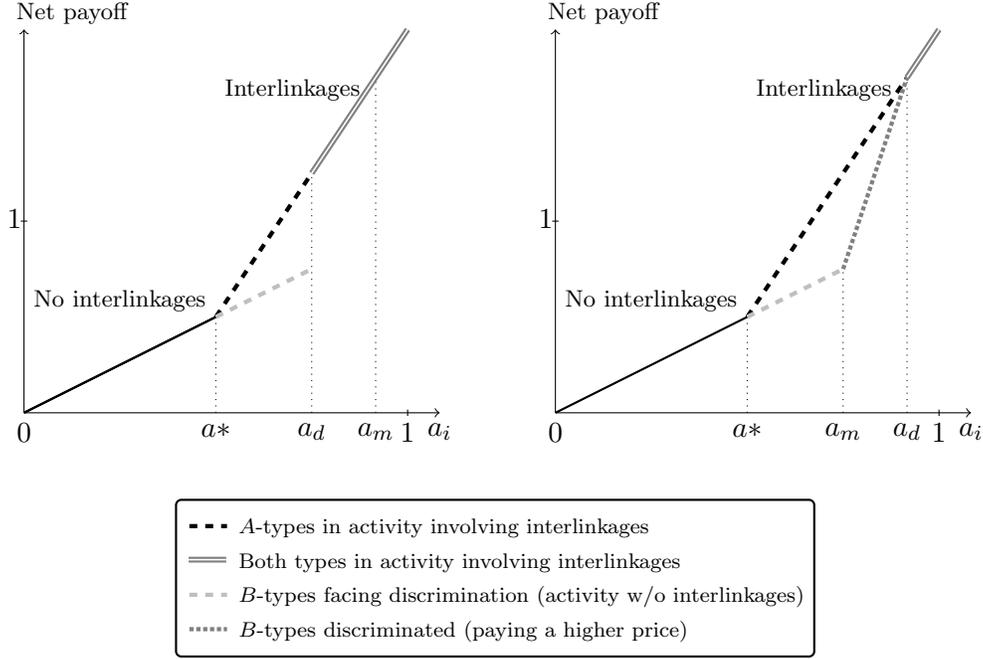


Figure 2. : Ability types and who enters activities involving interlinkages

Now consider the case depicted in Figure 3a, where $a_d < a_m$.¹³ All individuals of type B with ability levels $a > a_d$ apply offering their Nash bargaining solution and are accepted, as indicated by the black line. On the other hand, for the individuals of type- A , as before, all individuals with $a > a^*$ apply and are accepted, as indicated by the dashed black line. The doubled gray line indicates the ability levels for which both, the A and B -type, offer their Nash bargaining solution and enter activities involving interlinkages. Thus discrimination in this setting reduces the B -types entering activities involving interlinkages by those with ability $a^* \leq a < a_d$, denoted by the dashed gray line.

Figure 3b depicts the situation where $a_d > a_m$. Now recall a_m refers to the B -type who is indifferent between offering $(1 + r + b)$ to each of the principals and escaping potential discrimination, and entering an activity not involving interlinkages. As the surplus is increasing in a , this implies that all individuals in the range $a_m < a < a_d$ are strictly better off offering

¹³Note that $a_m = \frac{2(1+r+b)}{\lambda-1}$ and $a_d = \frac{3\delta\chi+2(1+r+\delta)}{\lambda-1}$, thus whether $a_d \geq a_m$ depends on the parameters φ , δ and b and both are possible.

$(1 + r + b)$, escaping potential discrimination, and entering the market with interlinkages. On the other hand, all individuals with $a > a_d$ apply offering their Nash bargaining solution and are accepted. In this case discrimination manifests itself in two ways: (1) the B -types with ability $a^* < a < a_m$ denoted by the dashed gray line enter the activity without interlinkages, whereas A -types in the similar ability range enter the activity involving interlinkages and enjoy the associated surplus; (2) individuals of type- B in the ability range $a_m < a < a_d$, denoted by the dotted gray line, enter activities involving interlinkages but pay $(1 + r + b)$, an offer strictly greater than their Nash bargaining offer. As before, A -types with $a \geq a^*$, denoted by the dashed black line, offer their Nash bargaining solution and enter the activity involving interlinkages.

C. *The dynamic game and the belief updating process*

In the previous subsection, we assumed that there was an exogenously given belief regarding the probability of meeting a taste discriminator in society. In light of this assumption, we characterized the optimal decisions in a static framework. The logical questions that arise are whether these beliefs are consistent with a model of rational decision makers in a dynamic setting in which beliefs are updated, and how these beliefs regarding taste for discrimination can persist when there are no taste discriminators left in society.

In order to address these questions, we now extend the framework and allow for the game to be repeated every period. Assume that the taste for discrimination arises due to a shock to the taste of a subset of principals in society at time t_0 . It is assumed that π_0 proportion of principals develop a taste for discrimination equal to $b(> 0)$ against establishing a productive relation with B -type individuals.¹⁴ The origins of the shock which create a taste for discrimination among a subset of principals is not the focus of the paper. An example could be the incidents of September 11th 2001, which resulted in discriminatory actions against Muslims in the US (e.g., Kaushal, Kaestner and Reimers 2007).¹⁵

¹⁴Allowing principals to have different tastes for discrimination leaves our results essentially unchanged. The case for two different levels of taste for discrimination, b_h (high) and b_l (low) is provided in the Online Appendix.

¹⁵The assumption that shocks do not work the other way, i.e. people immediately forget the past existence of discrimination due to sudden events today, is justified by the literature on trust and beliefs

In the dynamic game we assume time to be discrete and indexed by t . A principal P exits the market with exogenous probability ω every period. The probability ω is not known to anybody in society. A principal without a taste for discrimination replaces the exiting principal, such that at some point no principals with a taste for discrimination will be left. Therefore, if we define the share of principals with a taste for discrimination in period $t = 0$ to be π_0 , the share of principals π_t with taste for discrimination in period t is $\pi_0(1 - \omega)^t$.

Since neither π_t nor ω are common knowledge, decisions are conditioned on beliefs about the share of discriminators amongst principals, which are updated through observations of discrimination in the market.¹⁶ We assume that the event which creates a taste for discrimination initially results in creating a common prior among individuals and principals.¹⁷ The common prior is assumed to have a distribution denoted by η_0 , capturing the probability of meeting a principal with a taste for discrimination. The common prior η_0 is modelled as having a beta distribution. More specifically, it is assumed that individuals and principals believe that the share of principals with taste b has a beta distribution with parameters α_0 and β_0 . Moreover, we denote the density of the distribution η_0 by θ .

The beta distribution gives us a density on $[0, 1]$, which captures the beliefs held by individuals and principals regarding η_0 . As individuals and principals need to decide on optimal actions based on their beliefs, and all individuals and principals are assumed to be risk neutral, individuals and principals use the expected value of the beta distribution which is given by:¹⁸

$$(6) \quad E(\eta_0) = \frac{\alpha_0}{\alpha_0 + \beta_0}.$$

which shows how persistent past beliefs are in shaping today's action. See section II.E for discussion and references.

¹⁶The definition of a case of discrimination is provided in Definition 1.

¹⁷The importance of the initial prior is negligible as we envisage a setting with long term discrimination, thereby reducing the weight the initial prior has in long run beliefs. In an earlier version of the paper beliefs were updated following a frequentist approach as in case-based decision theory by Gilboa and Schmeidler (1995).

¹⁸This is the point at which the density of the distribution takes its highest value.

The belief updating process of principals and individuals is characterized by a standard Bayesian approach. Assume that in period 1, n_1 individuals of the B-type applied and k_1 cases of discrimination were observed in the market. Out of the total of n_1 cases, assume that $n_{1b}(\leq n_1)$ cases involve offers $\sigma \geq \sigma^N(a)$, such that $(1+r) \leq \sigma < (1+r+b)$. This implies the total number of people who could potentially be discriminated against is n_{1b} .

Assuming that all market transactions in terms of the offers made and rejected are common knowledge, we can define the posterior density function for the individuals and principals in society.¹⁹ The posterior function for $\theta(\eta_0)$ is given by $\theta(\eta_1|k_1) \sim \text{beta}(\alpha_0 + k_1, \beta_0 + n_{1b} - k_1)$. More generically, for any period $t > t_0$, we can calculate the point probability estimate used by individuals and principals to make their optimal decision, given the total number of B-type individuals who make offers $\sigma^N(a)$, such that $(1+r) \leq \sigma^N(a) < (1+r+b)$, in order to become entrepreneurs, and the cases of discrimination observed in the market. The probability estimate used by individuals is given by:

$$(7) \quad E(\eta_t) = \frac{\alpha_0 + \sum_{j=1}^t k_j}{\alpha_0 + \beta_0 + \sum_{j=1}^t n_{jb}},$$

leading to the following definition.

DEFINITION 2: *Let $\varphi_t = E(\eta_{t-1})$, such that φ_t is the probability that individuals and principals assign to the existence of a principal with taste for discrimination b in period t .*

The decision-making rules of individuals and principals imply that the probability of entering an activity involving interlinkages for a B-type individual in any period t will depend upon her ability a , the actual share of taste discriminators $\pi_0(1-\omega)^t$, and the beliefs φ_t regarding the share of taste discriminators in society. We can thus express the probability of entering an activity involving interlinkages for a B-type individual as a function of the above three factors, i.e. $f(a, \pi_0(1-\omega)^t, \varphi_t)$. It is easy to see that the probability of entering an activity involving interlinkages is increasing in ability and declining in the actual share and the belief regarding the proportion of taste discriminators in society, i.e. $f_1 > 0$, $f_2 < 0$, and $f_3 < 0$,

¹⁹We relax this assumption in the Online Appendix to allow individuals and principals to observe only a subset of all the market transactions and show that the results remain essentially unchanged.

where the subscripts refer to the first, second, and third argument of the function. In Section III we explicitly test for the predictions of our model using the above function f .

D. Steady-state equilibria under no remaining taste for discrimination

The channel of discrimination that we put forth works on the premise that even once all principals with taste for discrimination have died out, to discriminate against members of group B may remain as the optimal action. In what follows we address whether discrimination can exist, and if it can, under what conditions does it exist, for how long does it persists, and in what form does it manifest itself. Let us denote by T the first period in which no principals with taste for discrimination remain in the economy. The probability density function, given the beliefs and the Bayesian updating rule used, for meeting a principal with a taste for discrimination is given by:

$$(8) \quad \text{beta}\left(\alpha_0 + \sum_{t=1}^{T-1} k_t, \beta_0 + \sum_{t=1}^{T-1} n_{tb} - \sum_{t=1}^{T-1} k_t\right).$$

The associated probability point estimate for meeting a discriminator is given by

$$(9) \quad \varphi_T = \frac{\alpha_0 + \sum_{t=1}^{T-1} k_t}{\alpha_0 + \beta_0 + \sum_{t=1}^{T-1} n_{tb}}.$$

It is clear that all B -type individuals with $a \geq a_h$ will offer their Nash bargaining solution and be accepted.²⁰ The form of discrimination and the length for which it will persist after all principals with taste for discrimination have died out will depend on φ_T , i.e. the belief on the probability of the individual meeting a taste discriminator.

The point probability estimates in period T are a function of the initial beliefs (α_0, β_0) , the actual share of taste discriminators π_0 , and the rate ω at which principals with a taste for discrimination exit the market in every period. If we assume that the initial beliefs are a function of the actual share of taste discriminators, i.e. $\alpha_0(\pi_0)$ and $\beta_0(\pi_0)$, then we can write $\varphi_T = z(\pi_0, \omega)$. In the proposition that follows, we highlight the various forms in which

²⁰Recall $\sigma^N(a_h) = 1 + r + b$ and $\sigma^N(a)$ is increasing in a .

discrimination manifests itself and persists in the multiple steady state equilibria depending on φ_T after no principals with a taste for discrimination are left.

PROPOSITION 1: 1) Let φ_T be such that no individual of the type B in the range $a^* \leq a < a_h$ prefers the Nash bargaining solution to wage employment at time T . In such a scenario discrimination based on beliefs persists forever. Discrimination manifest itself in two forms: (i) B -types being underrepresented, relative to A -types, in activities involving interlinkages at the lower tail of the ability distribution and (ii) B -types, in the middle ability ranges, pay a strictly higher fee to establish interlinkages than the A -types with similar ability.

2) Let φ_T be such that some individual of B -type with ability in the range $a^* \leq a \leq a_h$ strictly prefers the Nash bargaining solution to obtaining wage employment. This implies that in the long run discrimination will not persist. However, B -types are penalized in the form of lower participation rates relative to A -types for a finite duration before beliefs about discrimination disappear from society.

Proof in the Appendix.

The equilibrium outcome in which discrimination persists forever crucially depends on who is the lowest B -type deciding to apply for the activity involving interlinkages when the last principal with taste for discrimination dies out. This occurs when all individuals of the B -type, whose Nash bargaining solution is not sufficiently high to compensate the taste for discrimination, i.e. $a < a_h$, decide to enter activities involving no interlinkages rather than seek to establish productive relations. Even if an offer which could be subject to potential discrimination were to be made, it would be rejected due to beliefs about discrimination being prohibitively high. Therefore, this equilibrium is stable even under the trembling hand. This in turn implies that beliefs remain frozen at the current level and hence all B -type individuals with ability levels $a^* \leq a < a_m$ will always prefer entering activities involving no interlinkages.

However, if when the last principal with taste for discrimination dies out, the lowest B -type who decides to enter an activity involving interlinkages is one whose Nash bargaining solution is not sufficient to compensate the taste for discrimination, i.e. $a < a_h$, implies discrimination

will not persist in the long run. Now that all principals with taste for discrimination have died out and beliefs are not prohibitively high, all offers made by individuals seeking to establish productive relations will be accepted. As this includes individuals whose offers could have been subject to potential discrimination, but are not (as no taste discriminators are left), the next period beliefs about discrimination will be lower after beliefs have been updated. As every period all offers are accepted, in the long run the belief about discrimination will converge to zero. [AER, reviewmode] AEA_{chris}

E. Persistence of beliefs as collective memories

The model presented above assumes that once the equilibrium set of beliefs have been established they can persist over time under certain conditions. The crucial question then arises as to how and why beliefs regarding the presence of discrimination might tend to persist? We interpret transmission of beliefs in our model as happening through intergenerational transmission of collective memory regarding discrimination.

The contemporary usage of the term collective memory can be traced back to Emile Durkheim (1859-1917), and his student Maurice Halbwachs (1877-1945), who published the seminal study titled *The social framework of memory* in 1925. The concept of memory has been constructed in the literature as to how the mind works in a society and how their operations are structured by social arrangements. Halbwachs argues: “It is in society that individuals normally acquire their memories. It is also in society that they may recall, recognize and localize their memories” (Halbwachs 1992, 38). Formulation of memories regarding the past are hence affected by transmission of cultural beliefs and norms in society.

Beliefs regarding discrimination can be seen to fulfill the two important criteria to be categorized as collective memories. First, events which influence collective memory are widely documented and recorded in these societies (Griffin and Bollen 2009). For the case of discrimination against blacks in the US or Dalits in India, these events have been widely recorded and recollected. Second, a consensual view of the recollected past. The presence of affirmative action policies in the US and India serve as clear signals of consensus among policymakers and the public at large concerning the need to address previous wrongs.

Beliefs regarding discrimination being transmitted as collective memory through generations can also be rationalized by economic models of cultural transmission such as in Bisin and Verdier (2001) and Dessí (2008). They show that transmission of existing beliefs by parents to their offspring would be consistent with maximizing the utility of children or preserving their cultural traits. Finally, the importance of history, culture, and past events such as discrimination in shaping today's beliefs, behavior, and outcomes, has also been demonstrated in the empirical literature (Nunn and Wantchekon 2011; Voigtländer and Voth 2012; Alesina, Giuliano and Nunn 2013) and brought forth theoretically in Argenziano and Gilboa (2012).

The above discussion highlights that beliefs regarding discrimination could be understood as collective memories that are passed on from one generation to another, which can be remarkably similar for long stretches of time.

III. Data and empirics

As foreshadowed in our discussion in the theoretical section, we empirically investigate the market for self-employment in the US, an occupation characterized by the need to establish interlinkages across markets. We first show that for the discriminated group representation in activities involving interlinkages, income earned in such activities, the probability of fearing rejection and therefore not applying for a loan, successfully establishing interlinkages, and the cost of establishing interlinkages are all in line with our theoretical predictions. We then take a step further and show that the outlined belief-based mechanism also finds strong support in the data.

A. *The theoretical predictions and the characteristics of the market for self-employment - a comparison*

The first two theoretical predictions of our model state that the discriminated group (black individuals in the United States) are, first, less likely to be self-employed, and second, the returns from self-employment are lower for the discriminated group. The model also predicts that the gaps in representation and earnings between the discriminated and non-discriminated

group are decreasing in ability.

To examine the gap we use the 2006 American Community Survey (ACS) provided by the Integrated Public Use Microdata Series (IPUMS) (King et al. 2010).²¹ As ability is not directly observable, we use education as a proxy for ability, and classify individuals possessing a college degree or more as high ability and others as low ability. The first columns of Table 1 show the odds ratios of a logistic regression with self-employment as dependent variable, while controlling for age, age squared, gender, and state fixed effects. College graduates are more likely, whereas blacks are less likely to be self-employed.²² The gap for blacks with a college degree is smaller, as indicated by the statistically significant coefficient of the interaction term, which is larger than unity. In the second column of Table 1, we restrict the sample to those that are self-employed and explain the log of total earnings, while including the same controls as in the first column. Again, we find a significant positive gap in earnings for those with a college degree and a significant negative gap for blacks. Notice that in line with our theoretical prediction the gap for blacks with higher ability, as proxied by possessing a college degree, is relatively smaller.

We next turn to the outcomes regarding the probability of having a loan application rejected, not applying for a loan due to fear of rejection, and the cost of establishing interlinkages by race, using the National Survey of Small Business Finances (NSSBF) of 1998 and 2003. The first outcome we consider is whether the probability of rejection of a loan application differs by race and ability of the applicant. In order to account for any unobservable characteristics that might be responsible for these differences in the probability of loan rejection, we account for an extensive set of measures of creditworthiness as well as firm, loan, and owner characteristics, as in Blanchflower, Levine and Zimmerman (2003), and restrict the sample to blacks and whites.²³ Column (3) of Table 1 shows that, consistent with our theory, blacks are 18.7 percentage points more likely, *ceteris paribus*, to have their loan application rejected. Also, in line with our theoretical prediction, we find that a loan rejection is less likely at the

²¹We use the year 2006 as we want to exclude the effects of the Great Recession.

²²The coefficient of 0.459 for the black dummy means that, everything else equal, blacks are less than half as likely to be self-employed.

²³Refer to the note in Table 1 for the set of controls included.

Estimation:	Logit	OLS	OLS	OLS	OLS
	(Self-emp.)	(ln(Earnings))	(Loan rejected)	(Fear rejection)	(Rate charged)
Black	0.459*** (0.001)	-0.408*** (0.029)	0.187*** (0.021)	0.153*** (0.035)	1.146*** (0.309)
College	1.073*** (0.001)	0.516*** (0.011)	0.013*** (0.005)	-0.028*** (0.008)	-0.443*** (0.074)
Black x College	1.100*** (0.003)	0.179*** (0.048)	-0.097*** (0.033)	-0.086 (0.054)	0.924* (0.477)
Other controls	Yes	Yes	Yes	Yes	Yes
Observations	1,338,506	56,781	7,925	7,925	7,925

Note: *, ** and *** significant at 10, 5, and 1 % significance level, respectively. Standard errors are in parentheses. Regressions (1) and (2) include a constant, age, age squared, gender, and state fixed effects. For the logistic regression in the first column odds ratios are presented. In column (2) the dependent variable is log earnings of those that are self-employed. The dependent variable for column (3) is having had a loan application rejected, for column (4) is not having had applied for a loan at least once in the last three years due to the fear of being rejected, and for column (5) is the rate charged on the current loan. For columns (3)-(5), the controls included are the owner/entrepreneur's age and age squared, a dummy each for whether or not the firm or owner have been delinquent in a personal or business loan or declared bankruptcy, whether the owner has judgments against him/her, whether the owner is a homeowner, the firm's sales, profits, assets, inventory, cash holdings, value of land, and liabilities, the owner's gender, years of experience, and share of ownership, whether the firm already had a line of credit with the bank, total employment, firm age, a urban dummy, whether firm's market was regional, national, or international, dummies for type of organization and industry, the Dunn and Bradstreet credit rating.

Source: ACS 2006 for column (1)-(2), NSSBF 1998, 2003 for column (3)-(5).

Table 1—: Features of the market for self-employment - Effect of social identity and ability

top end of the ability distribution as blacks with a college degree are only nine percentage points more likely to have their loan application rejected than a white with a college degree.

Column (4) considers whether blacks are more likely to fear rejection of a loan application and therefore do not apply for a loan. This corresponds to the theoretical prediction that individuals of the B -type in the ability range of $a^* \leq a < a_m$ in Figure 3b do not apply to establish interlinkages, whereas individuals of the A -type in the same ability range do so.²⁴ The results again are in line with our predictions. Blacks are 15.3 percentage points more likely to fear rejection and consequently do not apply for a loan. The coefficient of the interaction term of the black dummy and a college degree is negative, again indicating that gaps between the two social groups is reducing in ability, though the interaction term is statistically insignificant.

²⁴Alternatively, it refers to the ability range $a^* < a < a_d$ in Figure 3a.

The final outcome variable we consider is whether the interest rate charged differs by race after controlling for observables. This prediction refers to the types $a_m < a < a_d$ in Figure 3b, identified as the *B*-type individuals who pay a strictly higher fee for establishing interlinkages compared to *A*-types with the same ability level. Column (5) of Table 1 shows that black entrepreneurs are charged 1.15 percentage points more than comparable whites, while blacks with a college degree, in contrast to the theory, actually are charged 2.07 percentage points more than a comparable white individual with a college degree.

It is important to note that some of the preceding results, such as differences in participation and returns between ethnic groups in self-employment, as well as the probability of rejection of a loan application and rates charged, have already been put forth by the empirical literature dealing with discrimination and self-employment in the US (Moore 1983; Borjas 1986; Bailey and Waldinger 1991; Fairlie 1999; Fairlie and Meyer (1996, 2000); Blanchflower, Levine and Zimmerman 2003; Fairlie and Robb 2008; Blanchflower 2009). Our objective was to establish that the numerous documented features of the market for self-employment are consistent with the mechanism outlined by us, while also documenting that additional features predicted by our theory, namely, that the gaps are smaller at the top end of the ability distribution and blacks are more likely to fear rejection, are also borne out in the data. However, the question whether the belief-based mechanism presented in Section II could be responsible for the observed outcomes remains open, as conceivably other mechanisms could reproduce the observed features. This task we turn to in the next section.

B. Evidence for the belief-based mechanism of discrimination

We use the General Social Survey (GSS) from 1972-2012 along 29 questionnaires to provide empirical support for the belief based mechanism presented in section II. Crucially, the GSS allows us to construct proxies for the belief about and taste for discrimination parameters in our model. We construct two proxies of taste for discrimination by computing the share of whites by year and region that express taste for discrimination. We define taste discriminators to be:

- 1) Whites answering “yes” to “Do you think there should be laws against marriages of

Blacks and Whites?”

- 2) Whites who are “very” or “somewhat opposed” when asked “What about having a close relative marry a Black person?”

In order to construct a proxy for beliefs regarding discrimination, we take the share of the sample, for each year and region, answering the following question with “yes”:

- “On the average Blacks/African-Americans have worse jobs, income, and housing than White people. Do you think these differences are mainly due to discrimination?”

Unfortunately, neither of these questions is asked throughout all survey years, which, depending on the specification, restricts our sample size to between 14,719 and 26,339 observations. In Figure 1 the two measures of taste for discrimination, beliefs about discrimination, and the self-employment rates of blacks and whites are plotted from 1972-2012 for those years where the corresponding questions were included in the surveys. The discrimination measures are from the GSS dataset, whereas for expositional purposes self-employment rates by race are obtained from the Current Population Survey (CPS) March supplement provided by IPUMS (King et al. 2010).

Tastes for discrimination seem to decline linearly. Beliefs about discrimination, on the other hand, have remained remarkably stable, just as the gap in self-employment rates between blacks and whites. Not decomposing by region, beliefs about discrimination among whites peak in 1985 at 45% and reach its lowest point in 2004 at 34%. Our first measure for taste for discrimination among whites declines from 39% in 1972 to 10% in 2002. The second measure declines from 66% in 1990 to 21% in 2012.²⁵

The usage of survey responses is susceptible to the problem that responses to delicate questions, such as those concerning discrimination, can be subject to a social desirability bias. A respondent might claim not to have discriminatory taste due to social desirability, which might not reflect real preferences. In order to validate that we are capturing a real trend in discriminatory taste, in Figure 3 we plot our second measure of taste for discrimination at the aggregate level against a range of racially-motivated hate crimes committed in the

²⁵In the Online Appendix we present the time trends of belief about discrimination by region.

US against blacks (namely the number of total victims, murder and manslaughter, forced rape, aggravated assault, simple assault, and intimidation).²⁶ The hate-crime statistics are obtained from the Federal Bureau of Investigation (FBI) Uniform Crime Reports for the years 1996-2012.²⁷ The proxy for taste for discrimination aggregated at the national level (gray dashed line) follows a downward trend closely resembling the downward trend for all racially-motivated hate crimes against blacks with correlations ranging between 0.76 for forced rape to 0.91 for murder and manslaughter. Racially-motivated hate crimes could be seen as extreme expressions of discriminatory taste, wherefore the exhibited patterns strengthen the validity of our taste for discrimination measure.²⁸

SELF-EMPLOYMENT

The first outcome we consider is the difference in self-employment rates between blacks and whites, or in other words the representation of the two social groups in activities involving interlinkages. Following the theoretical framework, we estimate the probability of being self-employed as a function of ability a , the proportion π_{tqs} of principals with a taste for discrimination at time t in region q against group s , the proportion φ_{tqs} with beliefs about discrimination at time t in region q against group s , and a vector of individual characteristics X_i with associated parameter vector γ . As a proxy for ability we use years of schooling.

The proportion of principals with a taste for discrimination π_{tqs} and the proportion with beliefs about discrimination φ_{tqs} take the value zero for white individuals, i.e. for $s = A$. We restrict our sample to white and black respondents who are not students or retired, while

²⁶We do not plot the first measure for taste for discrimination because it only overlaps with the available hate crime statistics for four years. However, the correlations are similarly high ranging from 0.49 to 0.96 and are available upon request.

²⁷For FBI hate-crime statistics against blacks see Table 7 of the reports to be found at <http://www.fbi.gov/about-us/cjis/ucr/hate-crime>.

²⁸This downtrend could potentially reflect an overall downward trend in criminal activity. In order to reject this hypothesis, we normalize the occurrence of racially motivated hate crimes by the total frequency of arrests of white individuals for murder and manslaughter as well as aggravated assault. Unfortunately, we do not have data on arrests for all of the before mentioned crimes. As can be seen in the Online Appendix, the patterns corroborate the assumption that our measure is a reasonable proxy for taste for discrimination by exhibiting high correlations between taste for discrimination and the normalized hate-crimes of 0.89 and 0.85.

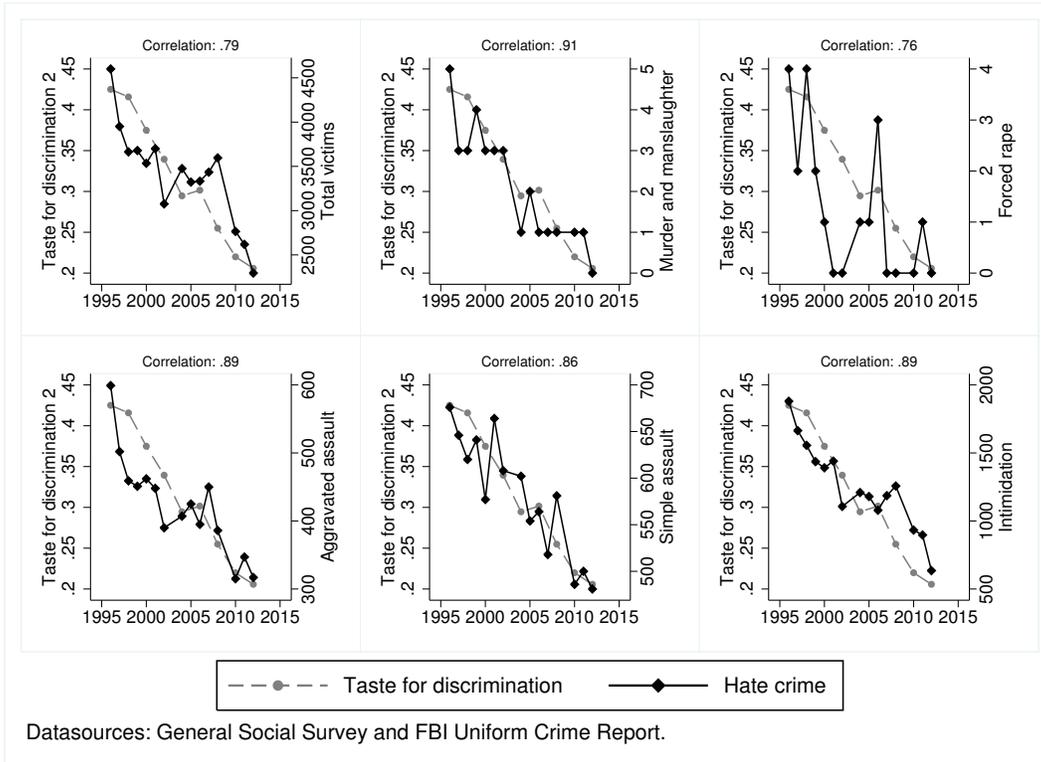


Figure 3. : Racially-motivated hate crimes versus taste for discrimination

assuming no differences in preferences to become self-employed.²⁹ We estimate a logit model and control for gender, age, age squared, and whether the father was self-employed. All specifications include time and region fixed effects.

The results of the baseline regression are reported in Table 2. Years of schooling, our proxy for ability, and all controls have the expected sign and are significant at the 1% level in all specifications. The probability of being self-employed is increasing in years of schooling, hump shaped in age, females are less likely to be self-employed, and having a father that was self-employed increases the probability of self-employment.

In columns (1) and (2), we show that either proxy for taste for discrimination against

²⁹In the International Social Survey on Work Orientation III, we find that 71% of blacks versus 58% of whites in the labor force in the US would choose self-employment if they could choose between different kinds of jobs, suggesting that our estimates might even be underestimating effects of discrimination.

Dependent variable: Self-employment						
	(1)	(2)	(3)	(4)	(5)	(6)
Belief about discrimination			-1.734***	-2.579***	-2.961**	-2.207
			(0.452)	(0.668)	(1.476)	(1.771)
Taste for discrimination 1	-1.474***		0.027		-0.342	
	(0.260)		(0.710)		(0.835)	
Taste for discrimination 2		-1.307***		0.749		0.852
		(0.249)		(0.556)		(0.716)
Years of schooling	0.035***	0.037***	0.048***	0.036***	0.048***	0.036***
	(0.007)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Female	-0.822***	-0.692***	-0.694***	-0.692***	-0.694***	-0.692***
	(0.041)	(0.052)	(0.051)	(0.052)	(0.051)	(0.052)
Age	0.092***	0.095***	0.098***	0.095***	0.098***	0.095***
	(0.008)	(0.011)	(0.010)	(0.011)	(0.010)	(0.011)
Age squared x 1,000	-0.697***	-0.692***	-0.764***	-0.698***	-0.764***	-0.697***
	(0.083)	(0.109)	(0.106)	(0.109)	(0.106)	(0.109)
Father was self-employed	0.667***	0.615***	0.626***	0.613***	0.628***	0.613***
	(0.042)	(0.055)	(0.052)	(0.055)	(0.052)	(0.055)
Black					0.552	-0.174
					(0.629)	(0.767)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.070	0.063	0.065	0.065	0.065	0.065
Observations	26,339	14,719	16,104	14,719	16,104	14,719

Note: *, ** and *** significant at 10, 5, and 1 % significance level, respectively. Standard errors are in parentheses. All regressions include a constant.

Source: General Social Survey.

Table 2—: Baseline logistic regression

blacks is a significant negative correlate of self-employment only as long as the proxy for belief about discrimination does not enter the model. Once belief about discrimination enters the model, either proxy for taste for discrimination becomes insignificant as can be seen in columns (3) and (4). The variable representing belief about discrimination is significant at the 1% level when paired with taste for discrimination. In columns (5) and (6), we add a race dummy for blacks to validate that unobservable characteristics correlated with being black are not responsible for the observed outcomes. The race dummy turns out to be insignificant, whereas belief about discrimination remains a significant negative correlate at the 5% level in column (5), but becomes insignificant in column (6).

If we were to interpret the correlation as causal, eliminating the effects of belief about discrimination and unobservables correlated with race from the estimation in column (5), the average self-employment probability for blacks increases from 6.4 to 10.6%, which is a substantial increase of 66%. However, this is still lower than 13.4%, the average probability

for whites. The remaining gap can be attributed, amongst other things, to lower levels of education and demographic factors.

LOAN REJECTIONS, FEAR OF REJECTION, AND RATES CHARGED

To provide further evidence of the highlighted mechanism, we next return to the outcomes regarding loan rejection, fear of loan rejection, and the interest rates charged on loans from the NSSBF 1998 and 2003 and link them to our measures for taste and belief about discrimination by year and region derived from the GSS.³⁰ To account for other determinants of loan acceptance, fear of loan rejection, and interest rates charged, we include a rich set of controls in all specifications, which are outlined in the notes of Table 3.

Columns (1) and (2) of Table 3 examine the dependent variable of whether a loan application was rejected. We introduce our proxies for taste and belief about discrimination as explanatory variables, and find that in line with our theory, belief about discrimination increases the probability of failure of the discriminated group's attempt to establish an inter-linkage. The black dummy is actually negative. However, when adding up the effect of the black dummy with belief about discrimination and taste for discrimination, which both have a positive sign, blacks are still more likely to have loan applications rejected. The fact that we control for an extensive set of controls regarding credit worthiness and past firm performance, as well as a race dummy for other unobservable characteristics affecting probability of repayment, and still find proxies for beliefs about and taste for discrimination to be significant correlates of obtaining a loan suggest that explanations based on discrimination rather than credit rationing explanations à la Stiglitz and Weiss (1981) might be more relevant in the above setting.

Columns (3) and (4) consider the dependent variable of whether an individual at any point during the last three years did not apply for a loan due the fear of rejection despite requiring credit at that moment, and columns (5) and (6) in turn consider the rate of interest charged by the lenders to firm owners. The results are very similar to the ones observed in columns

³⁰In order to increase the sample size, gap years from the GSS are extrapolated.

Dependent variable:	Loan application rejected		Fear of application rejection		Rates charged	
	(1)	(2)	(3)	(4)	(5)	(6)
Belief about disc rim.	4.085*** (0.268)	4.258*** (0.272)	2.075*** (0.448)	2.762*** (0.456)	26.817*** (3.951)	24.069*** (4.005)
Taste discrim. 1	0.908*** (0.165)		2.683*** (0.275)		0.869 (2.430)	
Taste discrim. 2		0.344** (0.152)		1.523*** (0.255)		-7.779*** (2.241)
Black	-1.252*** (0.091)	-1.318*** (0.113)	-0.851*** (0.153)	-1.276*** (0.190)	-7.691*** (1.346)	-3.976** (1.665)
College	0.011** (0.005)	0.012** (0.008)	-0.032*** (0.008)	-0.029*** (0.074)	-0.440*** (0.074)	-0.450*** (0.074)
Black x College	-0.070** (0.033)	-0.088*** (0.032)	-0.026 (0.054)	-0.081 (0.054)	1.017** (0.479)	0.988** (0.476)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.305	0.302	0.330	0.326	0.248	0.248
Observations	7,895	7,915	7,895	7,915	7,895	7,915

Note: *, ** and *** significant at 10, 5, and 1 % significance level, respectively. Standard errors are in parentheses. All regressions include a constant, owner age and age squared, a dummy each for whether or not the firm or owner have been delinquent in a personal or business loan or declared bankruptcy, whether the owner has judgements against him/her, whether the owner is a homeowner, the firm's sales, profits, assets, inventory, cash holdings, value of land, and liabilities, the owner's years of experience and share of ownership, whether the firm already had a line of credit with the bank, total employment, firm age, a urban dummy, whether firm's market was regional, national, or international, dummies for type of organization and industry, the Dunn and Bradstreet credit rating, and year and region fixed effects.

Source: General Social Survey, National Survey of Small Business and Finance.

Table 3—: OLS of loan application

(1) and (2) of Table 3. Belief about discrimination increases the probability that a member of a discriminated group does not apply for a loan due to fear of rejection. Therefore, blacks have lower probability of even attempting to establish an interlinkage due to fear of rejection as compared to a white individual. Similarly, controlling for all other observable determinants of interest rates on loans, belief about discrimination increases the rate of interest charged to members of the discriminated group. Thus, the results presented in Table 2 and 3 provide strong support for the belief-based mechanism of discrimination presented earlier.

Though the empirical strategy does not allow us to establish a causal link, it is important to note that beliefs are a significant correlate even when we control for region and time fixed effects, a black dummy, as well as a host of other individual level characteristics, suggesting that well established beliefs about discrimination might indeed be an important factor affecting participation and returns in activities involving interlinkages. Furthermore, the fact

that the black dummy is insignificant in columns (5) and (6) of Table 2 and switches signs in Table 3, suggests that indeed beliefs rather than some unobservable characteristic correlated with race could be a driving force behind differences in self-employment.³¹ This is in line with the finding of Fairlie (2002), who shows that controlling for Armed Forces Qualification Test (AFQT) test scores does not significantly reduce the black-white gap concerning self-employment rates, contrary to Neal and Johnson (1996), who find that premarket skills measured by the AFQT account for most of the black-white wage gap. Therefore, discrimination could explain part of the observed differences in participation rates and returns to self-employment.

C. Additional stylized evidence and applications of the theoretical framework

In this subsection, we present further evidence in the form of recent findings in the empirical and behavioral literature that our theoretical framework can reconcile. We then go on to highlight how the presented framework can also be useful for analyzing issues such as the phenomenon of racial tipping points in American neighborhoods.

Alesina, Lotti and Mistrulli (2013) find that banks in Italy charge self-employed women more than self-employed men for credit. They find that characteristics such as riskiness, type of business, or differential bank choice cannot explain their result. They also find that the effect is not restricted to any particular geographical region and taste based indicators of discrimination cannot explain the observed pattern. As women businesses need to establish interlinkages, beliefs of banks that potential productive *male* links might discriminate against women, might result in banks discriminating against women too. Consistent with our theoretical model the authors find that banks discriminate more against women in sectors where men dominate, and can be interpreted as beliefs being higher about the likelihood of being matched with a discriminatory male link.

The mechanism put forth is also a plausible explanation for features highlighted in data for

³¹Observe that columns (3)-(5) in Table 1 are comparable to the regressions presented in Table 3, with the difference being Table 3 includes proxies for beliefs about and taste for discrimination. Whereas in Table 1 being black increases the probability of a loan application being rejected or the interest rate charged, once we control for the proxies for discrimination being black in fact *reduces* the probability of a loan application being rejected or the interest rate charged.

the market for self-employment in India and Sweden. For instance, why the Schedule Castes (SCs) and Schedule tribes (STs), the socially most disadvantaged groups in India are relatively more underrepresented in urban rather than rural areas in terms of non-farm enterprise ownership, even though discrimination is higher in rural areas (Iyer, Khanna and Varshney 2013). Why in Sweden, one of the countries where women's labor force participation rate is very high and only 0.4% of the male population strongly agree that men make better business executives than women, has among the lowest level of self-employment for women in the EU.³² The fact that beliefs about discrimination are higher in urban rather than rural areas in India, and remain high in Sweden concerning women, could be an important explanatory factor.³³

Daskalova (2013) documents in a lab experiment that people who do not discriminate when making decisions individually, discriminate while making joint decisions due to beliefs about what their co-decision maker will do. Albrecht et al. (2013) find that in the lab individuals are conservative in updating their beliefs, which points to another channel through which beliefs regarding discrimination might become sticky over time and be an important determinant of outcomes for the discriminated group.

Our model is also applicable to a range of markets with strategic complementarities. The dominance of particular ethnic groups in certain professions (Greif 1989, 1993; Banerjee and Munshi 2004) might be explained through our mechanism as ethnic enclaves can help secure complementary support from other individuals and overcome coordination failures.³⁴

Card, Mas and Rothstein (2008) assume that when black people move into a neighborhood, white neighbors with a distaste for blacks will change neighborhoods. Anticipating a decrease in housing prices, people without a distaste for black neighbors will also sell their property

³²The wave of 2005-2007 of the World Values Survey exhibits that 43% of the Swedish population mention "Discrimination against women and girls" as one of the two most pressing problems facing the country. Moreover, Swedish males have the lowest bias against women across all 39 countries in the sample, while beliefs about discrimination are the second highest.

³³Observe that coordination failures in urban markets are more likely as they are anonymous, so even if taste for discrimination is higher in the rural than urban settings, it could well be the case that the coordination failures in urban areas outweighs the taste for discrimination effect in rural areas, leading to the outcome observed in the data.

³⁴This benefit, however, has to be weighed against the restriction on occupational choice that might arise due to ethnic enclaves being effective gate keepers to certain professions.

and move. We show that the presence of neighbors with a distaste for black neighbors is not required to trigger the segregating dynamics; the belief is sufficient, hence providing an alternative explanation for the phenomenon of racial tipping points in the United States.

IV. Policy considerations

The belief-driven gridlock put forth by the model, in which discrimination can persist in equilibrium and leaves everybody worse off, provides opportunities for affirmative action to move the economy to the “good” equilibrium as a focal point in the coordination game.³⁵ The analysis is restricted to the long run equilibrium where no taste for discrimination remains, but discrimination persists due to beliefs.

Provision of financial subsidies to the B -types with sufficiently high abilities to become entrepreneurs, but who are being discriminated upon, is a potential remedy. With the subsidy they could afford to pay the higher amount, such that beliefs about discrimination would be compensated and their offers would be accepted with certainty. This measure would overcome the problem that beliefs are prohibiting both, principals from accepting and individuals from applying. On the downside, this provides a solution only as long the subsidy is in place, as this solution does not change beliefs. Moreover, the welfare effect would be negative, as the additional value creation attributed to self-employment sums up to less than the subsidy.³⁶

Another method of achieving equality among equal A and the B -types would be to discriminate against the discriminator. By imposing a fine F on principals who reject a B -type offering the same amount as an equal A -type that has been accepted in the same period, one could target equal treatment of A and B -types.³⁷ This equal treatment might come at a high cost, though. If one principal interacts with various individuals in a given period, there exists the possibility that principals begin discriminating against the A -type as well in order

³⁵In the Online Appendix we show that on an average both principals earn lower profits by discriminating.

³⁶Observe that if it was not the case, the individuals themselves would pay extra to compensate the belief about discrimination.

³⁷This solution assumes that the authorities could estimate ability through information on observables such as education, years of experience, age, etc.

to avoid the fine when rejecting the B -type. Imagine a principal receiving the same offer $\hat{\sigma}$ by two individuals with identical ability \hat{a} , but of different types A and B , in the same period. Now if he accepts the A -type and rejects the B -type, he will receive $\hat{\sigma} + 1 + r - F$, assuming that $-p$ accepts the A -type offer as well. This would only be rational if $\hat{\sigma} - F \geq 1 + r$, because otherwise he would be better off rejecting the A -type, as well. Therefore, discrimination could spillover to the A -type.

By imposing lenders to give an equivalent share of credits at similar conditions to the B -type, as observed over past periods to the A -type, lenders would be forced to accept offers by the B -type. This share would have to be benchmarked by total lending in the past conditioned on economic indicators, in order to avoid discrimination against the A -type. This measure by itself would not be sufficient, though, as individuals of the B -type would continue not to apply and distributors would continue to reject out of fear of discrimination. This intervention would have to be communicated publicly, such that it would serve as a signal and would spillover to the beliefs of the B -type and the distributors. To see this in terms of our model, imagine the government announcing publicly and credibly the implementation of this measure. Now there would be no reason for the distributor or the individual of the B -type to assign $\varphi > 0$. The great advantage of this intervention would be that intervening in one market would be enough to correct beliefs in other markets. Once the measure were to be removed, beliefs about discrimination would have vanished and no further discrimination would take place (assuming no taste for discrimination). Of course the functioning of this intervention hinges on the assumption that an individual only requires two principals. In an economy with n principals the government would have to intervene in $n - 1$ markets.

A further possibility to overcome the coordination failure would be the creation of an institution acting as coordination device providing the service of linking pre-screened non-discriminatory lenders and distributors to able B -types wanting to become entrepreneurs. As this could even be a profitable exercise such institutions might automatically arise and be provided by the market itself.

In the above we saw that schemes, such as subsidies or equal treatment regulations, might only address the problem myopically or, even worse, have undesirable consequences (like

discrimination of A -types in equilibrium).

V. Conclusion

In this paper we show that even once taste for discrimination and statistical discrimination were to cede to exist in society, discrimination can persist due to remaining beliefs making discrimination the best-response, a much weaker condition than traditionally assumed in the literature.

The theoretical mechanism put forth is relevant for markets characterized by the need to establish productive relations or interlinkages with other agents in society in order for the production process to be carried out. It is shown that in such markets the presence of beliefs regarding the existence of taste discriminators, even when no agents with taste for discrimination exist in society, can result in agents exhibiting discriminatory behavior in equilibrium. Discrimination arises as a rational response to the belief that other agents might discriminate, which would impose losses due to the complementarity in the production process. The model shows lower participation and payoff to the discriminated group in markets characterized by the presence of interlinkages.

Empirical evidence in support of the theoretical framework is provided by analyzing the market for self-employment, a market characterized by the need to establish productive relations to be able to operate and be successful. The outcomes predicted by the model, namely lower participation rates, income, and success in establishing interlinkages for the self-employed from the discriminated group, as well as the cost of establishing interlinkages being higher, are confirmed in the data. Using the General Social Survey 1972-2012 of the US we create proxies for taste and beliefs regarding discrimination. We validate that the downward time trend of our proxies of taste for discrimination do not necessarily reflect a social desirability bias, as the proxies are strongly correlated with the time trend of racially-motivated hate crimes against blacks. A simple logit model reveals that beliefs about discrimination are a significant negative correlate of self-employment for blacks, even after controlling for individual level characteristics, as well as a race dummy, and region and year fixed effects. Furthermore, we show that belief about discrimination is a significant correlate of having a

loan application rejected, fearing rejection and therefore not applying, as well interest rates charged.

The nature of discriminatory coordination failures does not allow market forces to overcome discrimination and may require alternative policy tools. The various mechanisms through which discrimination manifests its dynamic linkages in terms of cross market and intergenerational effects, and the tendency to persist through cumulative and belief-based channels, need to be understood and explored in order to develop policies aimed at eradicating discrimination and achieving equal treatment and opportunities.

APPENDIX

A1. Proofs

PROOF:

Proposition 1

- 1) First observe that only B-type individuals in the ability range $a^* \leq a < a_h$ offer a Nash bargaining solution satisfying $1 + r \leq \sigma^N(a) < 1 + r + b$, and hence can potentially face discrimination. The fact that there exists no B-type in the range $a^* \leq a < a_h$ that prefers to offer the Nash bargaining solution while attempting to enter activities characterized by interlinkages implies:

$$(A1) \quad (1 - \varphi_T)^2(\lambda a - 2\sigma^N(a)) + (1 - (1 - \varphi_T^h)^2)(a - \delta) - a < 0,$$

where the left hand side (LHS) is the expected net payoff from offering the Nash bargaining solution minus the payoff from entering the activity involving no interlinkages. The LHS is strictly increasing in a , which implies that if it is not satisfied for a_h then it is not satisfied for all $a \leq a_h$. This implies that all B-types with a such that $\lambda a - 2(1+r+b) \geq a$ (or all $a_m \leq a \leq a_h$) offer a share equal to $(1 + r + b)$, while being accepted by the principals and successfully enter activities characterized by interlinkages. All B-types with $a^* \leq a < a_m$ will be unable to offer a share to compensate the taste of discrimi-

nators, and hence enter activities involving *no* interlinkages. Moreover, note as now all individuals of the *B*-type with $a \geq a_h$ offer $\sigma^N(a) \geq (1 + r + b)$, and all *B*-types with $a_m \leq a \leq a_h$ offer $(1 + r + b)$, this implies that from period T onwards there will be no offers by a *B*-type made within the range of $(1 + r)$ to $(1 + r + b)$. Therefore, beliefs will remain frozen at the current level implying the above equilibrium will persist for ever.

- 2) Let us denote by a_r as the lowest *B*-type in the range $a^* \leq a < a_h$ at T who prefers offering the Nash bargaining solution and attempts to enter the activity involving interlinkages. As the expected payoff from offering the Nash bargaining solution is strictly increasing in a , it implies that all individuals with $a \geq a_r$ offer the Nash bargaining solution in period T . This means that all *B*-types in the ability range $a_r \leq a \leq a_h$ offer the Nash bargaining solution and are accepted as no more principals with taste for discrimination exist. Assume the total number of cases subject to potential discrimination are n_{pot} and as no taste discriminators exist, the actual cases of discrimination are zero. This implies that the point estimates in the next period $T + 1$ for meeting a discriminator is given by $\varphi_{T+1} = \frac{\alpha_0^l + \sum_{t=1}^T k_t}{\alpha_0^l + \beta_0^l + \sum_{t=1}^T n_{tb} + n_{pot}}$. Therefore, $\varphi_{T+1} < \varphi_T$, implying the lowest type who applies in $T + 2$ is such that $a < a_r$, or generalizing $\varphi_{T+t} < \varphi_T$ for all $t > 0$, or $\frac{d\varphi_t}{dt} < 0$ for all $t > T$. Hence, at some point $\varphi_T \rightarrow 0$, implying all *B*-types with $a \geq a^*$ apply and enter activities characterized by interlinkages, wherefore discrimination does not persist in society. The number of periods for which discrimination will persist is as a function of $\varphi_T = f(\pi_0, \omega)$ and the *B*-type with the lowest a preferring the Nash solution to wage employment in T .

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