

DISCUSSION PAPER SERIES

DP12955

**DETERMINING THE EXTENT OF
STATISTICAL DISCRIMINATION:
EVIDENCE FROM A FIELD EXPERIMENT
IN INDIA**

Asadul Islam, Debayan Pakrashi, Liang Choon
Wang and Yves Zenou

DEVELOPMENT ECONOMICS



DETERMINING THE EXTENT OF STATISTICAL DISCRIMINATION: EVIDENCE FROM A FIELD EXPERIMENT IN INDIA

Asadul Islam, Debayan Pakrashi, Liang Choon Wang and Yves Zenou

Discussion Paper DP12955

Published 28 May 2018

Submitted 28 May 2018

Centre for Economic Policy Research
33 Great Sutton Street, London EC1V 0DX, UK
Tel: +44 (0)20 7183 8801
www.cepr.org

This Discussion Paper is issued under the auspices of the Centre's research programme in **DEVELOPMENT ECONOMICS**. Any opinions expressed here are those of the author(s) and not those of the Centre for Economic Policy Research. Research disseminated by CEPR may include views on policy, but the Centre itself takes no institutional policy positions.

The Centre for Economic Policy Research was established in 1983 as an educational charity, to promote independent analysis and public discussion of open economies and the relations among them. It is pluralist and non-partisan, bringing economic research to bear on the analysis of medium- and long-run policy questions.

These Discussion Papers often represent preliminary or incomplete work, circulated to encourage discussion and comment. Citation and use of such a paper should take account of its provisional character.

Copyright: Asadul Islam, Debayan Pakrashi, Liang Choon Wang and Yves Zenou

DETERMINING THE EXTENT OF STATISTICAL DISCRIMINATION: EVIDENCE FROM A FIELD EXPERIMENT IN INDIA

Abstract

In order to determine the relative size of taste-based and statistical discrimination, we develop a simple model to distinguish these two theories. We then test the model's predictions of caste-based discrimination by conducting a field experiment that elicits patients' rankings of physicians of different castes and years of experience in the healthcare market in India. We also run a survey and conduct lab-in-the-field experiments to measure patients' attitudes towards different caste groups. We find that 47 to 80 percent of patients statistically discriminate physicians. The overwhelming size of statistical discrimination has important implications for the use of Affirmative Action policies in India.

JEL Classification: I15, J15, O12

Keywords: field experiment, caste, discrimination, health

Asadul Islam - asadul.islam@monash.edu
Monash University

Debayan Pakrashi - pakrashi@iitk.ac.in
Indian Institute of Technology

Liang Choon Wang - liang.c.wang@monash.edu
Monash University

Yves Zenou - yves.zenou@monash.edu
Monash University and CEPR

Acknowledgements

We are particularly grateful to Birendra Rai, who provided invaluable suggestions and comments at various stages of this project. We would also like to thank Farzana Afridi, Gaurav Datt, Ashwini Deshpande, Nidhiya Menon, Gautam Rao, conference and seminar participants at the Australia-India Development Economics Workshop in Delhi, the Centre for Development Economics and Sustainability's Conference at Monash, University of Queensland for useful comments and suggestions. We gratefully acknowledge the funding support from the Indian Institute of Technology (IIT) Kanpur, the Monash Business School, and the Australia-India Council at the Department of Foreign Affairs and Trade (DFAT). This project is registered in the AEA's registry for randomized control trials as AEARCTR-0002385

Determining the Extent of Statistical Discrimination:
Evidence from a field experiment in India*

Asadul Islam[†] Debayan Pakrashi[‡] Liang Choon Wang[§]
Yves Zenou[¶]

May 25, 2018

Abstract

In order to determine the relative size of taste-based and statistical discrimination, we develop a simple model to distinguish these two theories. We then test the model's predictions of caste-based discrimination by conducting a field experiment that elicits patients' rankings of physicians of different castes and years of experience in the healthcare market in India. We also run a survey and conduct lab-in-the-field experiments to measure patients' attitudes towards different caste groups. We find that 47 to 80 percent of patients statistically discriminate physicians. The overwhelming size of statistical discrimination has important implications for the use of Affirmative Action policies in India.

JEL: I15, J15, O12

Keywords: Field experiment, castes, statistical discrimination, taste-based discrimination, Affirmative Action, health

*We are particularly grateful to Birendra Rai, who provided invaluable suggestions and comments at various stages of this project. We would also like to thank Farzana Afridi, Gaurav Datt, Ashwini Deshpande, Nidhiya Menon, Gautam Rao, conference and seminar participants at the Australia-India Development Economics Workshop in Delhi, the Centre for Development Economics and Sustainability's Conference at Monash, University of Queensland for useful comments and suggestions. We gratefully acknowledge the funding support from the Indian Institute of Technology (IIT) Kanpur, the Monash Business School, and the Australia-India Council at the Department of Foreign Affairs and Trade (DFAT). This project is registered in the AEA's registry for randomized control trials as AEARCTR-0002385

[†]Monash University, Department of Economics. Email: asadul.islam@monash.edu

[‡]Indian Institute of Technology, Kanpur. Email: pakrashi@iitk.ac.in

[§]Monash University, Department of Economics. Email: liang.c.wang@monash.edu

[¶]Monash University, Department of Economics, and CEPR. Email: yves.zenou@monash.edu

1 Introduction

The economics literature posits two major sources of discrimination: taste-based and statistical. The first is due to the fact that agents dislike some categories of the population while statistical discrimination occurs in an environment of imperfect information where agents form expectations based on limited signals that correlate with some observable characteristics. To empirically differentiate these two theories of discrimination is challenging because differential treatments across groups are often consistent with the predictions of both taste-based and statistical discrimination. Measuring the extent of statistical discrimination, in particular, is crucial as the prevalence of statistical discrimination has important implications for the use of Affirmative Action policies.

The aim of this paper is to provide a novel test that is able to disentangle statistical discrimination from taste-based discrimination. Using a correspondence method that elicits patients' rankings of physicians of different castes and years of experience as well as a survey and lab-in-the-field experiments, our research methodology enables us to provide a lower bound of the extent of caste-based statistical discrimination in India.¹

We develop a simple model where patients from different castes decide which doctor to visit. Doctors have two observable characteristics to the patients: their experience (number of years worked as a doctor) and their caste. Patients have preference for high quality (health) service, which is positively correlated with experience. We first develop this model under taste-based discrimination (Becker, 1957) where there is a fixed cost (distaste) of choosing a doctor belonging to the other caste. When choosing a doctor, there will be a tradeoff between experience (high versus low) and the cost of choosing a doctor from another caste (in-group versus out-group). Within this framework, 4 out of 24 (preference) rankings of doctors are possible.

Within the same utility framework, but without taste-based discrimination, we develop a model of statistical discrimination where the experience of a doctor is a noisy signal of the quality of the doctor (health service). The quality of the doctor and the noise of the signal (experience) follow a normal distribution that depend on the doctor's caste. Each patient infers the expected quality of the doctor from the noisy signal using the available information by caste of the doctor. The choice of a doctor depends on the (perceived) caste-specific group average quality of the doctor, the caste-specific variance of the doctor's quality, the caste-specific variance of the doctor's experience, and the doctor's experience. Within

¹There are relatively few correspondence studies in India testing discrimination against low-caste individuals. Exceptions include Banerjee et al. (2009), Siddique (2011), and Thorat and Attewell (2007) for the labor market.

this framework, 6 out of 24 rankings of doctors are possible. Four of these six rankings overlap with those under taste-based discrimination, implying that, in only two cases, we can differentiate the predictions of the two theories.

To test these theoretical predictions, we conduct a field experiment in 40 locations in Uttar Pradesh (UP) in India using a correspondence method that elicits 3,128 patients' rankings of physicians of different castes and years of experience. We find that 33% of patients have rankings consistent with both taste-based and statistical discrimination of doctors while 47% of patients have rankings only consistent with statistical discrimination of doctors. The remaining 20% of patients behave according to neither theories. To account for this last result, we extend the theoretical model to incorporate the possibility that experience could be negatively correlated with quality. It is indeed possible that, in India, some patients prefer low-experience doctors because they have had lower quality service with high-experience doctors in the past than with low-experience doctors or because they believe that younger doctors are more qualified than older doctors. In this context, we show that, for the taste-based discrimination model, there are now 8 possible rankings while, for the statistical discrimination model, all 24 rankings are possible. Thus, in 16 rankings, we can safely say that only statistical discrimination is at work. Using data from our field experiment to reassess the predictions, we find that 36% (instead of 33%) of patients have rankings consistent with both taste-based and statistical discrimination of doctors, while 64% (instead of 47%) of patients have rankings only consistent with statistical discrimination of doctors.

To further separate the rankings consistent with both theories of discrimination into either taste-based or statistical discrimination, we use two additional instruments and assume that taste is not context specific. First, we administer a survey to the same 3,128 patients immediately after the ranking exercise, asking them about their attitudes towards different caste groups. The survey reveals that patients display strong homophily behaviors since they exhibit more positive attitudes toward their own caste than towards the other caste. We use the relative attitudes toward different castes to classify whether a patient's caste preference in the field experiment is consistent with the patient's caste preference in the survey. For example, if a low-caste person prefers high-caste persons over low-caste ones, then this person cannot taste-based discriminate against a high-caste doctor in the field experiment (assuming taste is not context specific). We show that the percentage of statistical discriminators increases to 70%, with the share of statistical discriminators increasing relatively more for high-caste patients than for low-caste patients.

Second, we select a representative subsample of 482 individuals to participate in a lab-in-the-field experiment and let them play 4 dictator games as an alternative method to

distinguish taste-based and statistical discrimination. If a low-caste (high-caste) person gives more to a high-caste (low-caste) person than to a low-caste (high-caste) person in the lab-in-the-field experiment, after controlling for what this person would give to a person living above (below) the poverty line than to a person living below (above) the poverty line, then this person cannot taste-based discriminate against high-caste (low-caste) doctors in the field experiment. Using this approach to define taste-based discrimination, we find that the percentage of statistical discriminators increases to 80%.

Many papers have examined discrimination using laboratory experiments, field experiments, natural experiments, and non-experimental approaches. In particular, the correspondence method has been the primary approach used in recent studies to investigate discrimination in a variety of settings, including employment (Bertrand and Mullainathan 2004; Banerjee et al., 2009; Giulietti et al., 2018), housing (Ewens et al., 2014), product markets (Gneezy et al., 2012; Doleac and Stein 2013; Zussman, 2013), financial markets (Bayer et al., 2018), education (Hanna and Linden, 2012), and along different dimensions, including race, ethnicity, gender, age, disability, sexual orientation, obesity, caste, and religion.²

However, as noted by Kofi Charles and Guryan (2011) and Neumark (2018), few studies were able to empirically differentiate behaviors consistent with taste-based discrimination and statistical discrimination, and, when they do, it is implicitly done at the aggregate (group) level. We believe that, in this paper, we move the literature forward by proposing a more convincing test that allows us to empirically differentiate predictions of these theories at the individual level.

In particular, we have the following contributions to the literature on discrimination. First, we use correspondence methods to elicit (customer) discriminators' rankings of service providers of different types in *real transactions*. The rankings elicited allow us to categorize responses that are consistent with both economic theories of discrimination and responses that are unique to statistical discrimination at the individual level. The technique of eliciting preference rankings was previously implemented in the laboratory setting to test theories about self-regarding and other-regarding preferences (Levati et al., 2014) and correlated beliefs (Cason et al., 2017). To the best of our knowledge, this is the first time that this technique was implemented in a field setting and employed to examine the sources of discrimination. This allows us to circumvent an important shortcoming of past studies on

²See Altonji and Blank (1999), Kofi Charles and Guryan (2011), Lang and Lehmann (2012), and Neumark (2018), for general overviews, Anderson et al. (2006) and Lane (2016), for tests of discrimination in the laboratory, Baert (2017), for correspondence experiments, and Riach and Rich (2002), Rich (2014), and Bertrand and Duflo (2017), for field experiments.

discrimination where the discriminator’s preference rankings over the choice set was unobserved and enables us to determine an individual’s preference consistent with both theories of discrimination or only with statistical discrimination.

Second, because we use a correspondence method and observe the rankings of different types of individuals by different types of discriminators in the *final decision stage* of a transaction, we circumvent some of the common criticisms of correspondence studies (Guryan and Kofi Charles, 2013) where outcomes examined were often measured at a preliminary stage of a transaction, and characteristics of the decision-making discriminators were usually unobserved or limited. Our setting of caste discrimination and the use of caste-based surnames also minimize a typical concern in most correspondence studies of racial discrimination done in the labor and rental markets, where a fictitious applicant’s race is primarily signaled via the first name of the applicant: less-common names that may be more indicative of a person’s socio-economic background than the person’s race (Fryer and Levitt, 2004). In contrast, a caste-based surname is one of the defining features of a caste group, and the surnames that we use are common surnames that unequivocally reveal the castes of doctors.

Third, our field experiment involves randomly contacting households in each village or town to advertise for an upcoming free-of-charge health check service offered by a mobile clinic and asking the subjects to express their preference over four potential doctors listed on a sign-up sheet. In India, mobile medical units are a common practice in places where medical facilities are non-existent or inadequate, or in areas populated by low-income households (e.g., urban slums). Thus, the main advantage of our field experiment is that it occurred in a “natural” environment since people in these areas have used such services. It is also not unusual for patients to register their interest for an upcoming service and express their preference. We therefore believe that these individuals did not know that they were taking part in a caste discrimination study and they acted the way they normally would.

Finally, by using a survey and extending List’s (2004) incentivized method to collect measures of relative attitudes of discriminators towards different groups of individuals and combining the measures with inferences drawn about preferences in our field experiment, we can identify the minimum share of statistical discriminators and the maximum share of taste-based discriminators. This approach has never been implemented in the discrimination literature and demonstrates that the majority of discriminators in our setting statistically discriminate.

This paper is closely related to past studies in the Indian context, which have shown significant socio-economic differences between low-caste and high-caste individuals.³ Some of

³See, for examples, Bertrand et al. (2010) on educational and labor market outcomes; Banerjee and

these studies specifically examine the impacts of caste-based Affirmative Action (AA) policies in addressing the problem.⁴ For example, Bertrand et al. (2010) find that, although AA policies in college admissions lead to higher earnings and greater job quality for lower-caste individuals, the income gains experienced by lower-caste individuals are smaller than income losses experienced by displaced upper-caste applicants. Similarly, Bagde et al. (2016) find that AA policies in college admissions improve educational outcomes of lower-caste students at the expense of higher-caste students. On the other hand, Frisncho and Krishna (2012) note that, under AA policies in higher education, lower-caste (Dalits) students perform poorly and do not catch up with students in other groups. Those enrolled in more selective majors through AA policies end up earning less than what they would have had they enrolled in a less selective major.

We believe that our results have important implications for the use of caste-based AA policies. Our results provide an empirical justification for the statistical discrimination assumption typically made in the related research on AA. Low-caste individuals in India benefit from AA, particularly in college admissions and job placement. As noticed by Deshpande (2016), there is considerable debate about whether caste is a valid indicator of disadvantages or whether AA policy in India should be defined in terms of class/income or other social markers, such as religion. Our findings that the majority of patients statistically discriminate against doctors, particularly doctors from a low-caste background, highlight the interconnection between caste-based AA policies and statistical discrimination. It also implies that much of the advancement in the literature on race-based AA policies in the United States can be used to examine caste-based AA policies in India.

The rest of the paper unfolds as follows. In Section 2, we develop our benchmark model by differentiating taste-based discrimination (Section 2.1) and statistical discrimination (Section 2.2). In Section 3, we delineate our experiment and the India context. In Section 4, we provide our empirical results, testing the benchmark model. In Section 5, we extend our model to incorporate the possibility of a negative correlation between experience and quality, provide some evidence on this, and, then, examine the model predictions. In Section 6, we refine the definition of (uniquely) statistical discriminators by first using information from a survey (Section 6.1) and then a lab-in-the-field experiment (Section 6.2). In Section 7, we look at heterogenous effects, such as gender while, in Section 8, we perform some robustness

Knight (1985) and Deshpande and Newman (2007) on earnings; and, Munshi and Rosenzweig (2006) on social and economic mobility.

⁴For general overviews on the pros and cons of AA policies, see Holzer and Neumark (2000, 2006) and Arcidiacono and Lovenheim (2016)

checks. Finally, Section 9 concludes and offers discussion and implications of this study.

2 The benchmark model

We outline the two major economic theories of discrimination and the respective theoretical predictions that we test in the field experiment. We explicitly model the theoretical predictions using the examples in our empirical setting, where patients are presented with physicians from two different castes and two different levels of experience.

2.1 Taste-based discrimination

According to Becker’s (1957) theory of taste-based discrimination, prejudiced employers (or workers or consumers) dislike employing (or working with, or purchasing from) people with observable traits (e.g., race, gender, caste, etc.).

Using taste-based discrimination, we examine the choice in terms of doctor of a patient from a caste $c = c_H, c_L$ where c_H corresponds to the high caste and c_L corresponds to the low caste. Contrary to Becker’s model, the employer here is the patient and he/she can be of two different castes. We assume that high-caste patients taste-based discriminate against low-caste doctors and that low-caste patients also taste-based discriminate against high-caste doctors. In this choice, there is another dimension that matters: the experience of the doctor (number of years as a doctor). As in the data, we assume two levels of experience: $e = e_H, e_L$ with $e_H > e_L$.

Observe that the taste-based discrimination is similar to a preference bias for own type or homophily (McPherson et al., 2001; Currarini et al., 2009), so that, for a patient of a given caste, there is a cost of interacting with a doctor from another caste.

2.1.1 Ranking from the perspective of a patient from a low caste c_L

The utility function for a low-caste patient c_L choosing a doctor of caste $c = c_L, c_H$ is given by:

$$U_{c_L}^c(q, e) = q(e) - \mathbf{1}_{\theta_H} \tag{1}$$

where $q'(e) > 0$ (higher experience doctors provide better-quality health service) and $\mathbf{1}_{\theta_H} = \theta_H > 0$ if the doctor is from a high-caste and zero otherwise.

We provide the possible rankings for a low-caste patient c_L given that the doctor can have two level of experiences e_L and e_H and can be of two different castes c_L and c_H . It

should be clear that, for a low-caste patient, the best possibility is a doctor $c_L e_H$, i.e., a doctor from a low caste c_L and with a high experience e_H , and the worst possibility is a doctor $c_H e_L$. Here are the possible rankings for a low-caste patient compatible with (1):

$$c_L e_H \succ c_L e_L \succ c_H e_H \succ c_H e_L$$

$$c_L e_H \succ c_H e_H \succ c_L e_L \succ c_H e_L$$

In the first ranking, we need to give the condition for which $c_L e_L \succ c_H e_H$ (the other inequalities are always true by definition since $e_H > e_L$). The condition is:

$$\theta_H > q(e_H) - q(e_L) \quad (2)$$

For the second ranking, we need to give condition for which $c_H e_H \succ c_L e_L$ (the other inequalities are always true by definition since $e_H > e_L$). The condition is:

$$\theta_H < q(e_H) - q(e_L) \quad (3)$$

2.1.2 Ranking from the perspective of a patient from a high caste c_H

The utility function for a low-caste patient c_H choosing a doctor of caste $c = c_L, c_H$ is given by:

$$U_{c_H}^c(q, e) = q(e) - \mathbf{1}_{\theta_L} \quad (4)$$

where $\mathbf{1}_{\theta_L} = \theta_L > 0$ if the doctor is from a low-caste and zero otherwise.

Let us give the possible rankings for a high-caste patient c_H . It should be clear that, for a high-caste patient, the best possibility is a doctor $c_H e_H$, and the worst possibility is a doctor $c_L e_L$. Here are the possible rankings for a low-caste patient compatible with (1):

$$c_H e_H \succ c_H e_L \succ c_L e_H \succ c_L e_L$$

$$c_H e_H \succ c_L e_H \succ c_H e_L \succ c_L e_L$$

In the first ranking, we need to give the condition for which $c_H e_L \succ c_L e_H$ (the other inequalities are always true by definition since $e_H > e_L$). The condition is:

$$\theta_L > q(e_H) - q(e_L) \quad (5)$$

For the second ranking, we need to give the condition for which $c_L e_H \succ c_H e_L$ (the other inequalities are always true by definition since $e_H > e_L$). The condition is:

$$\theta_L < q(e_H) - q(e_L) \quad (6)$$

As a result, in the taste-based discrimination case, there are 4 possible rankings compatible with (1). See the Online Appendix A.1.1, which summarizes these rankings.

2.2 Statistical discrimination

Phelps (1972) and Arrow (1973) pioneered statistical discrimination theory. The theory posits that, in the absence of direct information about ability, a decision maker would substitute group averages. For instance, labor market discrimination may exist because employers don't know with certainty workers' ability and, therefore, may base their employment decisions on the workers' visible features, such as group identity or race, as long as these features correlate with some desirable but more-difficult-to-measure trait. This type of discrimination can result in self-fulfilling behavior from the disadvantaged groups. For example, Verdier and Zenou (2004) show that, if all agents, including blacks themselves, believe with no reason that blacks are more criminal than whites, blacks can become more criminal than whites because, based on wrong beliefs, employers pay them less, which forces them to reside far away from job centres, which leads blacks to rationally commit more crime than whites.⁵

A statistically discriminating patient in our experiment does not have any prejudice against the low-caste doctor, and she derives utility only from the quality of health care, q , which depends on the doctor's level of experience, e . Because the actual quality of health care to be delivered by a doctor is unobserved to the patient before the transaction takes place, she uses the information about the doctor's caste and experience to form a prediction about the doctor's quality.

Based on Aigner and Cain (1977), let us develop a model of statistical discrimination for our case. The experience e of a doctor *now* provides a signal of a doctor's quality q with an error (noise) ε so that:

$$e = q + \varepsilon$$

where $\varepsilon \sim N(0, \sigma_{\varepsilon,c}^2)$ and $q \sim N(\beta_c, \sigma_{q,c}^2)$. It is assumed that $Cov(q, \varepsilon) = 0$. Thus: $\mathbb{E}(e) = \beta_c$ and $Var(e) = \sigma_{q,c}^2 + \sigma_{\varepsilon,c}^2$. Each patient infers the expected value of the doctor quality q from the noisy signal e (experience) using the available information, including the caste of the doctor. In order to make his/her doctor choice, each individual forms $\mathbb{E}(q | e)$. Since q and e are jointly normally distributed, for each caste $c = c_L, c_W$, we have (DeGroot, 2004):

$$\hat{q}_c := \mathbb{E}(q_c | e_c) = (1 - \gamma_c) \beta_c + \gamma_c e_c \quad (7)$$

where $0 < \gamma_c < 1$ is given by:

$$\gamma_c = \frac{\sigma_{q,c}^2}{\sigma_{q,c}^2 + \sigma_{\varepsilon,c}^2} = \frac{Cov(q_c, e_c)}{Var(e_c)} \quad (8)$$

⁵For a substantive survey on the theory of statistical discrimination, see Fang and Moro (2011).

where $Cov(q_c, e_c) > 0$, (i.e., experience is a signal of quality). In other words, for a given caste, c , a doctor with higher experience is perceived to be providing a higher quality health service. Equation (8) says that $\hat{q}_c := \mathbb{E}(q_c | e_c)$, the conditional distribution of q_c given e_c , follows a normal distribution with mean equal to a weighted average of the signal e_c and the unconditional group mean β_c . If the signal e_c is very noisy, i.e., $\sigma_{\varepsilon, c}^2$, the variance of ε is very high, the expected conditional value of doctor's quality is close to β_c , the population average, regardless of the signal's value. On the other hand, if the signal is very precise, i.e., $\sigma_{\varepsilon, c}^2$ close to zero, then the signal e_c provides an accurate estimate of the doctor's quality. In some sense, γ_c can be interpreted as the "reliability" of the signal since the higher is γ_c , the less noisy and thus the more precise is the signal e_c .

The choice of a doctor from a patient of caste c will depend on these different aspects of the model, in particular, on γ_c , the "reliability" of the signal, the average doctor's experience of the caste c , $\mathbb{E}(e_c) = \beta_c$, and the signal e_c .

Different cases may arise. For example, assume that the unconditional distribution of doctor qualities are the same between the two castes, i.e., $\beta_{c_H} = \beta_{c_L}$ and $\sigma_{q, c_H}^2 = \sigma_{q, c_L}^2$ but the signals patients receive are differently informative, i.e., $\sigma_{\varepsilon, c_L}^2 > \sigma_{\varepsilon, c_H}^2$. This means that $\gamma_{c_H} > \gamma_{c_L}$ so that the signal about a doctor's experience is noisier and less precise for the lower caste c_L than for the higher caste c_H . In that case, doctors from a lower caste with high signals (high experience) are less chosen than same-signal doctors from the higher caste, and the opposite occurs to doctors with low signals.

Let us now study the patient's decision in terms of doctor's choice. Contrary to the taste-based discrimination, we don't need to differentiate a patient from a low caste and a patient from a high caste since there is no direct cost of interacting with someone from a different caste. The only difference that may matter is the fact that low-caste patients may hold different beliefs than high-caste patients.

Consider similar preferences as in (1) or (4) but without taste-based discrimination (i.e., $\theta_H = \theta_L = 0$) and with statistical discrimination. Thus, we take the expectation of $U_c^c(q, e) = q(e_c)$ to obtain, for $c = c_L, c_H$:

$$\mathbb{E}(U_c^c(q, e_c) | e_c) := \mathbb{E}(q_c | e_c) = (1 - \gamma_c) \beta_c + \gamma_c e_c \quad (9)$$

where γ_c is defined in (8), and the subscript c refers to the caste of the doctor. Given this utility function, what kind of ranking can we have? First, we can have the same rankings as in the taste-based discrimination, i.e.,

$$c_L e_H \succ c_L e_L \succ c_H e_H \succ c_H e_L$$

$$c_{LeH} \succ c_{HeH} \succ c_{LeL} \succ c_{HeL}$$

Indeed, for a low-caste or high-caste patient, $c_{LeH} \succ c_{LeL}$ and $c_{HeH} \succ c_{HeL}$ are always true since, for a the same caste, a high-experience doctor gives a higher-expected utility than a low-experience doctor since $\mathbb{E}(U_{c_L}^c(q, e_c) | e_c)$ increases in e_c . What about $c_{LeL} \succ c_{HeH}$? This is true if

$$\beta_{c_H} - \beta_{c_L} < \gamma_{c_H} (\beta_{c_H} - e_H) - \gamma_{c_L} (\beta_{c_L} - e_L)$$

This is clearly possible under statistical discrimination. For example, if $\beta_{c_H} = \beta_{c_L} = \beta$ (the expected experience of a doctor is the same independent of caste), then it suffices that $\gamma_{c_H} < \gamma_{c_L}$ (either the covariance $Cov(q, e)$ is lower or the variance $Var(e)$ is lower for high-caste doctors). The other ranking given by

$$c_{LeH} \succ c_{HeH} \succ c_{LeL} \succ c_{HeL}$$

is also possible. Indeed, for $c_{HeH} \succ c_{LeL}$ to be true, it has to be that:

$$\beta_{c_H} - \beta_{c_L} > \gamma_{c_H} (\beta_{c_H} - e_H) - \gamma_{c_L} (\beta_{c_L} - e_L)$$

Again, this is possible under statistical discrimination.

In fact, under statistical discrimination, it is easily verified that there are exactly six possible rankings with two castes and two experience levels that are compatible with (9). Indeed, all the rankings that have $c_{LeL} \succ c_{LeH}$ or $c_{HeL} \succ c_{HeH}$ are not possible because signals are informative, and doctors with a higher experience should be preferred to doctors with lower experience for the same caste. These six rankings are listed in the Online Appendix A.1.2.

3 Context and experimental design

In this section, we first provide some background on the caste system in India and the policies that have been in place to overcome discrimination against low-caste individuals. Then, we explain the way we implemented our correspondence study.

3.1 Caste discrimination and affirmative action policies in India

The caste system in India played an important role in ancient Hindu tradition. The term *caste* originated from the Iberian word *Casta*, which means “lineage” or “breed.” Most Indians use the terms “Varna” and “Jat” when referring to caste. The caste system divides

Hindus into four main categories (Varna)– Brahmins, Kshatriyas, Vaishyas, and Shudras. At the top of the hierarchy are the Brahmins, who were priests, teachers and intellectuals. The next category is the Kshatriyas, who were rulers and aristocrats of the society. The third category encompasses traders, landlords, farmers, and businessmen. The bottom category is the Shudras, who were peasants and working class of the society. Below these castes are the outcasts who are untouchable to these four castes and who call themselves Dalit. These untouchables worked in degrading jobs, such as cleaning, sewage, etc.

The first three castes had social and economic rights, which the Shudras and the untouchables did not have, and were classified as high caste. The lower classes were listed in three categories- (1) Scheduled Castes (SCs) who were untouchables; (2) Scheduled Tribes (STs)- who did not accept the caste system and preferred to reside in the forests and mountains; and, (3) Other Backward Classes (OBCs), which include Shudras, untouchables who converted from Hinduism to other religions, nomads and tribes who made a living from criminal acts.

For centuries, caste dictated almost every aspect of Hindu religious and social life. Rural communities were long divided on the basis of caste – the upper and lower castes almost always lived in segregated colonies.⁶ Brahmins did not share water wells with them, neither did they accept food nor drink and married only within one’s caste. Traditionally, the system bestowed many privileges on the upper castes while sanctioning repression of the lower castes by privileged groups. In recent decades, the influence of caste has somewhat declined, especially in cities where different castes live side-by-side and inter-caste marriages are becoming more common. Despite the changes though, caste identities remain strong, and surnames are almost always indications to which caste a person belongs. There is also evidence suggesting that the lowest-caste groups continue to face stigmatization, exclusion and rejection (Shah et al., 2006; Navsarjan, 2010).⁷

⁶Although Islam does not recognize any castes, Muslim communities in India apply a comparable caste system of social stratification, and they differ widely in power, privilege, and wealth. Thus, the low-class Muslims in India have faced similar discrimination as low-caste Hindus. The upper-class Muslims dominated government jobs and parliamentary representation. As a result, there have been campaigns to include the Muslim untouchables and lower castes among the groups eligible for affirmative action programs in India under SC and STs provision act. There have also been cases, for example, in the Bihar state of India, reported in which the higher-caste Muslims have opposed the burials of lower-caste Muslims in the same graveyard. In UP, Muslims are divided into 68 castes and sub-castes: 35 of them are OBCs.

⁷Nambissan (2010) notes excessive gap in access to quality education leading to inequalities between SC and others. Thorat and Attewell (2007) find in a correspondence study significant differences in job call-back rates between Hindu upper caste and others (Dalit and Muslims). Siddique (2011) also finds similar results, with Dalit women getting the lowest call-back rates. Shah et al. (2006) document untouchability in rural

After independence of India, discriminating a person based on his or her caste was legally forbidden. Affirmative action (AA) policies (known as the “reservation” policy in India) were launched in 1950 to promote equal opportunity to the SCs and STs in areas of employment, education, and politics (Deshpande, 2012). The Ministry of Education, in 1954, suggested a 20% quota (“reservation”) for SCs and STs in educational institutions. In 1982, 15% and 7.5% of vacancies were specified to be reserved for SC and ST candidates, respectively, in public sector jobs and admission into higher public educational organizations, including medical schools. In addition, in the late 1980s, a commission of inquiry (known as the “Mondal Commission”), recommended a 27% quota reserved for OBCs.⁸ Candidates from SCs, STs, and OBCs have to take entrance examinations for educational institutions, but they compete only among themselves to fill the allocated number of reserved seats, which are not available to candidates from other backgrounds. The admission requirement is also lower for these lower-caste groups. For example, for admission to the undergraduate level in a public medical college, a candidate must pass with minimum of 50% marks. However, for candidates belonging to SC/ST/OBC, the threshold is 40% instead of 50%.

3.2 The field experiment

We conducted a field experiment to test for the presence and sources of caste discrimination in the demand for health care in the Kanpur Nagar district of Uttar Pradesh (UP), India. UP is the most populous state in India with a population of about 225 million. UP has the largest concentration of lower-caste people in India. Caste-based issues and policies have historically dominated the state’s politics. The Kanpur Nagar district has a total population of around 4.6 million people as per the 2011 Census, with 1.6 million people living in rural areas and 3 million people living in urban area (Census, 2011). The sex ratio is 862 females per 1000 males. Figure B.1 in the Online Appendix B shows the location of the Kanpur Nagar district in the state of UP.

Similar to Section 3.1, our experiment considers different castes for both patients and doctors: high-caste individuals are those who belong to the general-category (GC) caste while low-caste persons are those who belong to either a Scheduled Caste (SC), a Scheduled Tribe (ST), or an Other Backward Caste (OBC). The field experiment took place in 40

India using a large survey carried out over 565 villages across 11 states during 2001-2002.

⁸In 1992, the Supreme Court of India put a cap on reservation and ruled that reservations should not exceed 50%. The exact percentages of reservation vary from state to state. In 2017, the new state government in UP declared that caste-based reservations in private medical and dental colleges will cease to exist. However, the quota for lower-caste groups remained at 49% (SC-21%; ST-1% ; and OBC-27%).

areas across the Kanpur Nagar district between August and October of 2017. Figure B.2 in the Online Appendix B shows the locations where the experiment was conducted. The selected locations have demographic characteristics that are representative of the overall demographic characteristics of the state of UP. A total of 3,128 individuals participated in the field experiment.⁹

We implemented the field experiment in four stages. In the first stage, subjects registered interests and expressed preference for different types of doctors presented to them. In the second stage, subjects answered a short survey questionnaire. In the third stage, subjects were assigned to doctors and appointments. In the fourth stage, subjects received services.

In the first stage, we randomly approached households in each locality to advertise for an upcoming, free-of-charge health check service offered by a mobile clinic.¹⁰ Due to safety and ethical concerns, individuals with potential urgent and life-threatening diseases or injuries were advised to seek immediate medical attention at the local hospital, instead of waiting for the upcoming health check.

At the point of registration, we requested subjects to express their preference over four potential doctors listed on a sign-up sheet. The sign-up sheet showed a two-by-two matrix containing the information for four different doctors: (i) a doctor with a high-caste surname and a high number of years of experience (c_{HeH}); (ii) a doctor with a low-caste surname and a high number of years of experience (c_{LeH}); (iii) a doctor with a high-caste surname and a low number of years of experience (c_{HeL}); and (iv) a doctor with a low-caste surname and a low number of years of experience (c_{LeL}).¹¹ The high-caste surname that appears on the sign-up sheet belongs to the general-category (GC) caste. The low-caste surname that appears on the sign-up sheet is either an SC or ST or OBC surname but never both. Similarly, the high number of years of experience is either 12 years or 8 years but never both. The low number of years of experience is always 4 years. We do not disclose the first name of the doctor but only the initial, and we randomize the order in which each type of doctor appears in the matrix.

We instructed subjects to rank these doctors from the most desired (rank 1) to the least desired (rank 4), without the possibility of an equal rank. We explained to the subjects that

⁹Table 1 below shows that the sample characteristics of the 40 areas are on average statistically similar to the demographic characteristics of Uttar Pradesh in the 2011 Census.

¹⁰In India, mobile medical units have been introduced into service to provide primary medical care to people living in remote areas in India where medical facilities are non-existent or inadequate. The mobile units typically offer low-cost services from doctors and paramedics, and also medicine.

¹¹The sign-up sheet also indicated that, in case the subject was not assigned to any of the listed doctors, an alternative doctor would be provided.

they had the highest chance of getting their rank-one doctor, the second highest chance of getting their rank-two doctor, the third highest chance of getting their rank-three doctor, and the lowest chance of getting their rank-four doctor.¹²

Once we elicited subjects' rankings of the four doctors, we invited them to fill out a short survey that asked questions about their demographic and socio-economic information, such as their own caste, poverty status, education level, and so on. The short survey also includes questions about their past experience related to health services, their attitudes toward individuals of different castes, their risk attitudes, etc. By surveying them after the elicitation exercise, we minimized any potential priming effect. The correspondence study effectively concluded by the end of stage two.

In stage three, we informed the subject about the doctor they were assigned to and the location and time of their upcoming health-check appointment. This stage typically occurred on the day after registration. In stage four, the mobile clinic arrived in the village to deliver service. The mobile clinic delivered the service within one week of registration.

Table 1 provides summary statistics of the 3,128 participants in the field experiment. The respondent's caste composition is as follows: 836 GC, 739 SC, 12 ST, and 1541 OBCs, which means that roughly 27 percent of participants are from a high-caste (GC) background and the rest from a low-caste background. The mean age of participants is 38. 80% of the participants are Hindu and 51% of the participants are male. 2,049 (65.5%) participants reside in a rural area. Roughly 34% of participants live below the poverty line and roughly 21% of participants have at least some college education. Low-caste participants are more likely to live in urban areas (36% as opposed to 31%), live below the poverty line (37% as opposed to 31%), and have not attended college before (83% as opposed to 69%). Thus, low-caste participants are more likely to come from a low, socio-economic background. We also see in Table 1 that the observable characteristics of our 3,128 individuals are similar to that of the population in UP where the experiment was conducted.

[Insert Table 1 here]

¹²The high-caste surnames used were: Bajpai, Dixit, Mishra, Pandey. The low-caste surnames used were: Katiyar, Pal, Rajput, Yadav, Kanaujiya, Kureel, Sonkar, and Valmiki.

4 First results

4.1 Evidence of caste discrimination

Figure 1 presents the average ranks for the four doctors, pooling the responses of all patients. On average, high-caste, high-experience (HH) doctors are ranked highest (mean of the rank = 1.77), followed by low-caste, high-experience (LH) doctors (mean = 1.85), high-caste, low-experience (HL) doctors (mean = 3.11), and low-caste, low-experience (LL) doctors (mean = 3.27). The differences in average ranks are all statistically different at the 5% level, as none of the 95% confidence intervals overlap. For two doctors from different castes but with the same years of experience, the high-caste doctor is statistically significantly better ranked than the low-caste doctor.¹³ Figure 1 also shows that, on average, *patients tend to prefer doctors with more years of experience*. Thus, this figure seems to indicate that experience matters more than caste.

[Insert Figure 1 here]

Figure 2 reports the average rank for the four different types of doctors by the caste of patient. In panel A, we see that, for high-caste patients, on average, experience matters relatively more than caste. They prefer a high-caste doctor to a low-caste doctor if the two have the same years of experience, and they also prefer a high-experience doctor to a low-experience doctor if the two are from the same caste. These differences are statistically significant at the 5% level. However, high-caste patients are, on average, willing to trade caste for experience. They prefer a low-caste doctor with high experience (*LH* in the figure) than a high-caste doctor with low experience (*HL*). Similarly, in panel B, for low-caste patients, we also see that the experience of the doctor matters relatively more than caste. Low-caste patients are also willing to trade caste for experience. They prefer a low-caste doctor with high experience (*HH* in the figure) than a high-caste doctor with high experience (*LH*). However, low-caste patients differ from high-caste patients in various ways. The average ranks of two doctors with identical years of experience but from different caste groups are more similar for low-caste patients than are more high-caste patients. On average, low-caste patients are more willing to trade caste for experience than high-caste patients.

[Insert Figure 2 here]

¹³The significant differences also mean that by not offering the possibility of an equal rank is not a concern. Otherwise, the differences would not be statistically significant.

Overall, there is evidence of discrimination against low-caste physicians, especially for those who have low experience, but, at this stage, it is unclear whether the discrimination is the result of taste-based discrimination, statistical discrimination, or both. This is what we will investigate next.

4.2 Rankings consistent with each theory of discrimination when experience is positively correlated with quality

In the benchmark model (Section 2), we show that, for the taste-based discrimination model, there were 4 possibilities of ranking of doctors: 2 from low-caste patients and 2 from high-caste patients (see the Online Appendix A.1.1, which gives these rankings). For the statistical discrimination model, we show that 6 different rankings of doctors were possible independent of the caste of the doctors (see the Online Appendix A.1.2, which gives these rankings). We can distinguish between these two theories when patients rank doctors as follows:

$$c_{HeH} \succ c_{LeH} \succ c_{LeL} \succ c_{HeL} \tag{10}$$

$$c_{LeH} \succ c_{HeH} \succ c_{HeL} \succ c_{LeL} \tag{11}$$

In that case, we know that these patients statistically discriminate doctors. Indeed, the first ranking (10) cannot be compatible with utility (1) (taste-based discrimination) because a high-caste patient cannot have $c_{LeL} \succ c_{HeL}$ since, at the same level of experience, he/she always prefers a high-caste doctor, and a low-caste patient cannot have $c_{HeH} \succ c_{LeH}$ since, at the same level of experience, he/she always prefers a low-caste doctor. Also, the second ranking (11) cannot occur under taste-based discrimination because a high-caste patient cannot have $c_{LeH} \succ c_{HeH}$ since, at the same level of experience, he/she always prefers a high-caste doctor, and a low-caste patient cannot have $c_{HeL} \succ c_{LeL}$ since, at the same level of experience, he/she always prefers a low-caste doctor. These two rankings (10) and (11) can, however, arise under statistical discrimination depending on the beliefs people hold of high- and low-caste doctors. For example, at the same experience level, a low-caste patient can choose $c_{HeH} \succ c_{LeH}$ if $\beta_H > \beta_L$ and/or $\sigma_{\varepsilon,H}^2 < \sigma_{\varepsilon,L}^2$ (noisier signals for low-caste doctors).

We now examine the distribution of the various rankings in our experiments. In Figure 3a, we look at the distribution of rankings by high-caste patients while, in Figure 3b, we focus on that by low-caste patients. In panel A of both figures, we see that, in our experiments, some patients rank doctors in ways that are consistent with both taste-based and statistical discrimination while others are only consistent with statistical discrimination (by ranking

doctors as in (10) and (11)). More importantly, in panel B of Figures 3a and 3b, we see that some patients do not behave according to either the taste-based or statistical discrimination models.

[Insert Figures 3a and 3b here]

In Figure 3c, we quantify these different choices by caste of patients. We see that, on average, 40% of high-caste patients have rankings of doctors consistent with both taste-based and statistical discrimination while 37% have rankings of doctors only consistent with statistical discrimination. For low-caste patients, these numbers are 30% and 50%, respectively. Interestingly, 25% of high-caste patients and 18% of low-caste patients do not have preference according to either the taste-based or statistical discrimination model.

[Insert Figure 3c here]

Figure 3d offers a similar exercise but does not distinguish patients by caste. We find that 32% of patients both taste-based and statistically discriminate doctors, while 47% only statistically discriminate doctors and 20% do not behave according to either the taste-based or statistical discrimination models.

[Insert Figure 3d here]

Because a sizable fraction of patients (20%) do not seem to behave according to our model, we will next extend the benchmark model of Section 2 to encompass the rankings of doctors by these individuals.

5 Experience may be negatively correlated with quality

The 20% of patients whose rankings of doctors that are consistent with neither taste-based nor statistical discrimination chose less-experienced doctors over more-experienced doctors when the two doctors were from the same caste. To encompass the rankings of doctors by these 20% of patients, we will need to relax the assumption that quality increases with years of experience of doctor in the benchmark model. We first provide some evidence that, indeed, some patients prefer less-experienced doctors.

5.1 Do some patients prefer lower-experienced doctors?

It may be possible that some patients prefer lower experience doctors because they believe that they are younger and, therefore, more effective in treating them. Let us check if this is true for the 20% of patients whose rankings of doctors are consistent with neither taste-based nor statistical discrimination. Among these patients, we will compare their ranking when they can choose between two doctors whose experience gap is 4 years (4 versus 8 years) and when this gap is 8 years (4 versus 12 years). If younger doctors with lower experience are preferred to older doctors with more experience, then there should be more of the latter than the former.

Figure 4 shows that the share of patients whose rankings of doctors that are consistent with neither taste-based nor statistical discrimination increases when patients have to choose between doctors with 4 years and 12 years of experience (panel A) and between 4 years and 8 years of experience (panel B). Thus, it seems that the reason for some patients to prefer doctors with fewer years of experience is because they believe they are younger and more effective in treating them.

[Insert Figure 4 here]

5.2 Extending the model

We now extend our model to encompass those rankings in which doctors with fewer years of experience are preferred over those with more years of experience.

5.2.1 Taste-based discrimination

We now assume that there are two-types of patients in each caste $c = c_L, c_H$: those for which $q'(e) > 0$ (as before) and those for which $q'(e) < 0$. A way to justify this last assumption is that, in India, some people may prefer younger than older doctors even if the former have less experience than the latter. They may believe that younger doctors provide better quality service as they have received more up-to-date training than older doctors.¹⁴ Another way to justify this assumption is that some people may have had lower-quality service with high-experience doctors in the past than with low-experience doctors and thus may believe that $q'(e) < 0$.

¹⁴Indeed, discussions with many participants who ranked less-experienced doctors higher within their own caste also indicate that these individuals generally believe younger doctors are better trained and equipped with better know-how, and they are more likely to prescribe more efficacious medicines.

Ranking from the perspective of a patient from a low caste c_L The utility function for a low-caste patient c_L choosing a doctor of caste $c = c_L, c_H$ is still given by (1) but for some patients $q'(e) > 0$ so that their utility is $U_{c_L}^c(q, e)^+ = q^+(e) - \mathbf{1}_{\theta_H}$ while, for other patients, $q'(e) < 0$ so that $U_{c_L}^c(q, e)^- = q^-(e) - \mathbf{1}_{\theta_H}$. In that case, instead of two, there are now four possible rankings for a low-caste patient that are compatible with (1). These rankings are provided in the Online Appendix A.2.1.

Ranking from the perspective of a patient from a high caste c_H The utility function for a high-caste patient c_H choosing a doctor of caste $c = c_L, c_H$ is still given by (4) but for some patients $q'(e) > 0$ so that their utility is $U_{c_H}^c(q, e)^+ = q^+(e) - \mathbf{1}_{\theta_L}$ while, for other patients, $q'(e) < 0$ so that $U_{c_H}^c(q, e)^- = q^-(e) - \mathbf{1}_{\theta_L}$. In that case, instead of two, there are now four possible rankings for a high-caste patient that are compatible with (4). These rankings are provided in the Online Appendix A.2.1.

5.2.2 Statistical discrimination

Assume the same statistical discrimination model as in Section 2.2. Now assume that there are two types of patients in each caste $c = c_L, c_H$: those for which $Cov(q_c, e_c) > 0$ (as before) and those for which $Cov(q_c, e_c) < 0$. As above, some people may have had lower-quality service with high-experience doctors in the past than with low-experience doctors and thus may believe that, for a given c , $Cov(q_c, e_c) < 0$. In that case, it is easily verified that, contrary to Section 2.2, there will not only be 6 possible rankings but 24 rankings, which are listed in the Online Appendix A.2.2. This implies that, now, there will be 16 (and not 2 as above) rankings that are compatible only with statistical discrimination.

5.3 Refining empirical results

We now implement the same exercise as in Figures 3a, 3b, 3c, and 3d but with our new model, which offers more ranking possibilities (8 instead of 4 for rankings compatible with both taste-based and statistical discrimination and 24 instead of 6 for rankings only compatible with statistical discrimination). In Figure 5a, we look at the choices of high-caste patients while, in Figure 5b, we focus on low-caste patients. On the left-hand side of each figure, we have the 4 cases ($\times 2$) of taste-based and statistical discrimination together, and, on the right-hand side, we have the 16 cases of only statistical discrimination.

If we compare panels A and B of both figures, we see that many patients behave according to both theories, but a substantial part of them, behave according to only statistical discrim-

ination. In that case, high-caste patients tend to rank higher high-caste doctors (panel B in Figure 5a) while this is less true for low-caste patients (panel B in Figure 5b). Moreover, compared to Figures 3a and 3b, the picture is very different, meaning that many patients believe that experience is not necessary positively correlated with quality.

[Insert Figures 5a and 5b here]

If we now look at Figure 5c, we see that 55% of high-caste patients (compared to 37% in Figure 3c) statistically discriminate doctors while, for low-caste patients, it is 65% (compared to 50% in Figure 3c). This confirms the fact that low-caste patients statistically discriminate doctors more than high-caste patients.

[Insert Figure 5c]

Finally, Figure 5d provides a more general picture of discrimination. We see that 34% (instead of 32% in Figure 3d) of patients both taste-based and statistically discriminate doctors while 64% (instead of 47%) only statistical discriminate doctors. It seems that the 20% of patients that did not behave according to neither the taste-based nor the statistical discrimination theories in Figure 3d are now behaving only as statistical discriminators. It means that these individuals must believe or have preferences such that experience is negatively correlated to quality.

[Insert Figure 5d]

6 Refining the definition of statistical discriminators

6.1 Survey in the field

We are interested in knowing whether patients whose rankings are shown to be consistent with both theories of taste-based and statistical discrimination in the previous section can be further separated into those that are consistent with only statistical discrimination. To do so, we use information we collected through a survey administered to the 3,128 patients after the ranking exercise.

6.1.1 Description of the survey

In addition to the demographic information reported in Table 1, we asked the patients in our field experiment whether they “strongly disagreed,” “disagreed,” “neither disagreed

nor agreed,” “agreed,” or “strongly agreed” with a set of statements about their attitudes toward different caste groups. Four of these attitude questions are useful for us to identify the relative taste each individual has for high-caste and low-caste persons. These four questions are as follows: (i) “It really upsets me if anyone says anything negative about people from Backward Caste”; (ii) “I have very positive attitudes towards people from Backward Caste”; (iii) “It really upsets me if anyone says anything negative about people from General Caste”; (iv) “I have very positive attitudes towards people from General Caste”. We code “strongly disagree” as 1 point, “disagree” as 2 points, “neither disagree nor agree” as 3 points, “agree” as 4 points, and “strongly agree” as 5 points. We then compute the total points for the first two questions (i) and (ii) (this score is denoted by S_{C_L}), which measures a person’s taste towards low-caste individuals, and the total points for the last two questions, (iii) and (iv), which measures the person’s taste towards high-caste individuals (this score is denoted by S_{C_H}).

Figure 6 reports the mean values of these answers by the caste of patients. The top panel shows that high-caste patients tend to have more positive attitudes towards high-caste than low-caste persons. The bottom panel shows that low-caste patients tend to have more positive attitudes towards low-caste than high-caste persons. Figure 6 also shows that these relatively stronger attitudes toward same caste (homophily) are independent of the rankings of doctors that are consistent with both theories or only with statistical discrimination.

[Insert Figure 6 here]

6.1.2 Refining the results

We now use our survey about the relative attitudes towards low-caste and high-caste individuals to classify whether a patient’s caste preference in the field experiment is consistent with the patient’s caste preference in the survey. If a low-caste person has $S_{C_L} < S_{C_H}$, i.e., he/she has a higher score in the last two questions, meaning that he/she prefers high-caste persons over low-caste ones, then this person cannot taste-based discriminate against a high-caste doctor. If this person’s ranking of doctors in the field experiment is consistent with both theories, we will *now* classify him or her as a statistical discriminator. Similarly, if a high-caste person has $S_{C_H} < S_{C_L}$, then this person cannot taste-based discriminate against a low-caste doctor. If this person’s ranking of doctors in the field experiment is consistent with both theories, we will now classify him or her as a statistical discriminator.

In Figures 7a and 7b, we reclassify individuals as statistical discriminators when their rankings in the field experiment are compatible with both theories and who have more

positive attitudes toward individuals from the other caste than their own. Figure 7a displays the results by caste of patients while Figure 7b displays the results for all patients and correspond, respectively, to Figures 5c and 5d, which perform the same ranking without reclassification.

We see that the share of statistical discriminators relatively increases more for high-caste patients than for low-caste patients. Indeed, for high-caste patients, it increases from 55% (panel A in Figure 5c) to 69% (panel A in Figure 7a) while, for low-caste patients, it increases from 65% (panel B in Figure 5c) to 70% (panel B in Figure 7a). When we combine patients of all castes, we see in Figure 7b that, independent of caste, the share of statistical discriminators increases from 64% to 70%.

[Insert Figures 7a and 7b here]

6.2 Lab-in-the-field experiment

In late October 2017, we invited a random subset of the initial field-experiment subjects in 30 randomly selected villages to participate in a lab-in-the-field experiment. The purpose of the lab-in-the-field experiment was to allow separate identification of taste-based discrimination and statistical discrimination for the sets of rankings that are consistent with the predictions of both theories. We examine whether behaviors of discriminators are consistent with the presence of animosity. In total, 482 subjects participated in the lab-in-the-field experiment.

6.2.1 Description of the experiment

The lab-in-the-field experiment was conducted as follows. Each subject participated in four dictator games. In each dictator game, each subject, who had an endowment of 100 Rupees, decided how much he/she wanted to keep from this endowment (a number between 0 and 100 (inclusive) Rupees), given that what is not kept went to a randomly drawn individual from a particular group of subjects. The four games corresponded to four different groups of subjects: high caste, low caste, above poverty line, and below poverty line. If the subject is a low-caste (high-caste) individual, we reminded the subject that the low-caste partner was from the same low-caste group. The anonymous partner was randomly drawn from our field experiment and the allocation was later given to them.

At the beginning of each game, an envelope with the group identity of an anonymous partner written on the envelope was drawn from a set of four envelopes. The subject was then given the group identity of the anonymous partner and the envelope with 100 Rupees ($10 \times \text{Rs}10$ notes). The experimenter then instructed the subjects to go to a quiet corner

to allocate whatever amount they wished for themselves and put the remaining money in the envelope they wanted to give to the anonymous partner. They were also informed that, once they finished the task, they would drop the envelope in a bag full of similar-looking envelopes that the experimenter placed in a different corner.¹⁵ By letting them drop each of the envelopes in a bag full of similar-looking envelopes away from the scrutiny of the experimenter, we ensured minimal experimenter demand effect.

The third and fourth columns in Table 1 display the characteristics of these 482 subjects and show that they are statistically similar to the original 3,128 subjects who participated in the initial field experiment. More importantly, for the lab-in-the-field sample of 482 individuals, we find the same results obtained in Figures 5c and 5d for the whole sample of 3,128 individuals (see the Online Appendix C for the replication results). Thus, these 482 subjects who participated in the lab-in-the-field experiment behave, on average, exactly as the 3,128 subjects who participated in the field experiment. In particular, 34% of them both taste-based and statistically discriminate doctors while 64% of them only statistically discriminate doctors.

Figure 8 displays the mean amounts of giving in our lab-in-the-field experiment. We note a lot of variation in the giving behavior of individuals, which depends on the caste they belong to and on their behavior in the field. In particular, high-caste individuals tend to give more to low-caste individuals while low-caste individuals tend to give more to low-caste individuals. So, it seems that high-caste individuals taste-based discriminate less than low-caste individuals. Moreover, the patterns of giving behavior are similar for individuals who have rankings of doctors consistent with both theories and individuals who have rankings of doctors only consistent with statistical discrimination.

[Insert Figure 8 here]

6.2.2 Results

We first use List's (2004) method to classify whether a patient's caste preference in the field experiment is consistent with the patient's caste preference in the lab-in-the-field experiment. If a low-caste person gives more to a high-caste person than to a low-caste person in the lab-in-the-field experiment, then this person cannot taste-based discriminate against high-caste doctors. As a result, if this person both taste-based and statistically discriminate in the field, then we will now classify him or her as a statistical discriminator. Similarly, if a high-caste

¹⁵In the inside of each envelope, each subject's unique id is written, so the amount can be linked to their responses in the field experiment.

person gives more to a low-caste person than to a high-caste person in the lab-in-the-field experiment, then this person cannot taste-based discriminate against low-caste doctors. As a result, if this person both taste-based and statistically discriminate in the field, then we will now classify him or her as a statistical discriminator.

We then reclassify all individuals whose behavior was compatible with both taste-based and statistical discrimination in the field experiment and who give more to individuals from the other caste than from their own caste in the lab-in-the-field experiment as statistical discriminators. All other individuals keep the same classification. We replicate Figures 5c and 5d with this new definition. Figures 9a and 9b display the results. The pattern is now different as the percentage of statistical discriminators increases but mainly for high-caste patients. Indeed, for the latter, the percentage of statistical discriminators increases from 52% to 75% while, for low-caste patients, this increase is from 65% to 70%. When we put all patients together, we see in Figure 9b that, independent of caste, the percentage of statistical discriminators increases from 62% to 72%.

[Insert Figures 9a and 9b here]

6.2.3 Refinement of List's (2004) method

We have seen in Figure 8 that both high-caste and low-caste subjects tend to give more to individuals from a low-caste background and to individuals living below the poverty line. Since low-caste individuals are more likely to live below the poverty line,¹⁶ it is plausible that the tendency for all individuals to give more to low-caste individuals reflects preferences to help people in need of financial assistance. Thus, in order to have a more accurate classification of caste preference, it is important to control for the tendency to give more to the poor.

To classify whether a patient's caste preference in the *field experiment* is consistent with the patient's caste preference in the *lab-in-the-field experiment*, we refine List's (2004) method. For that, we estimate the following equation:

$$G_{cH,i} - G_{cL,i} = \alpha_0 + \alpha_1 G_{APL,i} + \alpha_2 G_{BPL,i} + \beta' X_i + \varepsilon_i$$

where $G_{cH,i}$ and $G_{cL,i}$ are the amounts given to the high- and low-caste individuals by individual i , $G_{APL,i}$ and $G_{BPL,i}$ are the amounts given to *APL* (above the poverty line) and

¹⁶In our full sample, low-caste individuals are 33 percent more likely to live below the poverty line than high-caste individuals.

BPL (below the poverty line) individuals, and X_i is a set of characteristics of patient i , which include gender, religion, poverty status, and education.

We then estimate the equation by caste of patient and area to obtain the residuals $\hat{\varepsilon}_i$ to define whether a patient's caste preference in the field experiment is consistent with the patient's caste preference in the lab-in-the-field experiment.

For a high-caste patient, if the residual is below zero, i.e., $\hat{\varepsilon}_i < 0$, then this person cannot taste-based discriminate against high-caste doctors under the assumption that taste is not context specific. This is because the negative residual informs us that this high-caste person gives relatively more to a low-caste person than a high-caste person even after considering the person's tendency to give more to the poor (who are more likely to be low-caste). The excess giving implies that this high-caste patient does not have a distaste for low-caste individuals. Similarly, for a low-caste patient, if the residual is above zero, i.e. $\hat{\varepsilon}_i > 0$, this person cannot taste-based discriminate against high-caste doctors under the assumption that taste is not context specific.

As a result, if each of these persons' ranking of doctors are consistent with both taste-based and statistical discrimination in the field experiment, then this person is now reclassified as a statistical discriminator given the incompatibility of preferences in the two experiments.

Using the results of these estimations,¹⁷ we replicate Figures 9a and 9b. Figures 10a and 10b display the results. We find that the percentage of statistical discriminators slightly decreases from 75% to 72% for high-caste patients while, for low-caste patients, it increases from 70% to 84%. The percentage of statistical discriminators considerably increases for low-caste patients because, after controlling for the greater tendency to give to the poor, they do not give more to low-caste individuals. When we combine all patients, we see in Figure 10b that the percentage of statistical discriminators increases from 72% to 80%.

[Insert Figures 10a and 10b here]

6.3 Summary of results

We now summarize how the share of patients whose rankings of doctors are consistent with the two theories of discrimination changes as we alter the way we classify their behavior according to the various theoretical predictions. The results are summarized in Figure 11.

[Insert Figure 11 here]

¹⁷They are available upon request.

The top left panel in Figure 11 shows that, when we do not allow the experience of doctors to be negatively correlated with their quality of service, 47% of patients exhibit preferences only consistent with statistical discrimination, 33% of patients exhibit preferences that are consistent with both taste-based and statistical discrimination, and 20% of patients exhibit preferences that are consistent with neither theories. The top right panel in Figure 11 shows that, when we allow the experience of doctors to be both positively and negatively correlated with their quality of service, the share of patients exhibiting preferences that are only consistent with statistical discrimination increases to 64%, while the share of patients exhibiting preferences consistent with both theories slightly increases to 36%. The bottom left panel in Figure 11 shows that when we assume taste is not context specific and use caste preferences that patients reveal in attitudinal questions in the survey to redefine taste-based discrimination, the share of patients exhibiting preferences only consistent with statistical discrimination increases to 70%. Finally, the bottom right panel in Figure 11 shows that when we use patients' giving behaviors in the four lab-in-the-field experiments to redefine taste-based discrimination, the share of patients exhibiting preferences only consistent with statistical discrimination increases to 80%. Thus, using our novel methodology, we find that 47% to 80% of patients statistically discriminate physicians on the basis of caste in Uttar Pradesh, India.

7 Gender differences and characteristics of discriminators

7.1 Gender Differences

We also consider whether male patients discriminate against male or female doctors and whether female patients discriminate against male or female doctors. The results are reported in figures D.1-D.4 in the Online Appendix D. Overall, the share of rankings of doctors consistent with both theories and the share of rankings of doctors consistent with statistical discrimination are similar for male and female patients, irrespective of the gender of doctors. Thus, there does not seem to be any gender differences in the pattern of discrimination.

7.2 Characteristics of types of discriminators

In Table 2, we show if the mean characteristics for the various types of discriminators differ by caste. The definitions of statistical discriminators are based on the definition after re-

classifying rankings consistent with both theories into only statistical discrimination using the survey information about relative positive attitudes towards different castes. There are some differences in the mean characteristics of the two types of discriminators. For example, among high-caste discriminators, Hindu, females, and those with at least some college education are more likely to have rankings consistent with both theories than with only statistical discrimination. On the other hand, among low-caste discriminators, those living in urban areas and below poverty line are more likely to have rankings consistent with both theories than with only statistical discrimination.

[Insert Table 2 here]

8 Robustness checks

8.1 Patients may strategically manipulate the rankings of doctors

It is plausible that patients may strategically manipulate the rankings of doctors as in the matching literature,¹⁸ such as for the choice of schools.

Such an issue is not as relevant in our specific context. Our subjects were not making decisions in the setting with which the matching literature is typically concerned. First, our subjects were given a short amount of time to choose from a set of doctors that they never heard or visited before (doctors with fictitious names). The information given about these doctors was also very limited (surnames, experience, and gender). Second, our subjects were making decisions for a one-off experience that was expected to last no more than 15 minutes. Third, subjects were not informed about the exact probability of each doctor being chosen. These features contrast the situations of school choice that the matching literature studies, where parents have rich information about the schools available, the number of slots available relative to the number of applicants, have substantial amount of time to make decisions, and an understanding as to where their child will eventually end up attending the school for many years to come.

8.2 Patients may not care much about the lower-ranked doctors

It is also plausible that some patients may only care about their most-preferred choices (the first two doctors that they rank) and do not care much about their less-preferred choices

¹⁸For overviews of the matching literature, see Roth and Sotomayor (1990) and Sönmez and Ünver (2011).

(the last two doctors that they rank). In other words, they may *randomly* rank these less-preferred doctors. Because the ranking of the last two doctors affect whether someone is a statistical discriminator or if he/she is both a taste-based and a statistical discriminator, we need to verify how these labels are affected when we change the ranking of the last two doctors. For that, we swapped the two bottom-ranked doctors for rankings only consistent with statistical discrimination and turned them into rankings consistent with both theories to assess the sensitivity of our results to this type of randomization.

Figure 12 reports the results for all the four different methodologies we adopt in this paper (the benchmark, the reclassification using the survey method, the reclassification using the List’s method, and the reclassification using the refinement of the List’s method).

Quite naturally, we see that the number of statistical discriminators decrease. For example, if we compare the results for the benchmark case (Figure 5d), we see that the share of statistical discriminators decreases from 63% to 33%. Similar results are obtained for the other cases where the share of statistical discriminators after we swap the last two ranked doctors varies from 49% to 69%. These results give us confidence that, even if the share of statistical discriminators is reduced, there are still many patients who do statistically discriminate doctors.

[Insert Figure 12 here]

9 Conclusion

Although the predictions of the two main discrimination theories are often identical, it is important to distinguish the two sources of discrimination and understand the scope of statistical discrimination in explaining the extent to which minority, historically disadvantaged, or under-represented groups endure discrimination. This paper examines the extent of caste-based statistical discrimination in the health care market in India by conducting a field experiment in Uttar Pradesh that elicits patients’ rankings of physicians of different castes and years of experience. Using information about patients’ rankings of doctors of different castes and years of experience, castes of patients, and measures about patients’ attitudes towards different caste groups collected from survey questions and incentivized lab-in-the-field experiments, our novel methodology allows us to determine the minimum share of statistical discriminators and the maximum share of taste-based discriminators.

We find that, irrespective of caste, at least 47% to 80% of patients statistically discriminate against doctors, especially low-caste doctors. This is a lower bound since, for the other category, we are not able to distinguish taste-based and statistical discriminators. This

means that caste-based statistical discrimination of patients against doctors is sizable in India. More importantly, our novel methodology provides an improved method to empirically distinguish taste-based and statistical discrimination at the individual level, and the method can be applied in many other settings to understand discrimination along different dimensions, such as race, ethnicity, gender, religion, age, etc.

The findings have important implications for the use of Affirmative Action (AA) policies. On the one hand, the finding that patients statistically discriminate against doctors on the basis of caste provides justification for the use of caste-based AA policies to address discrimination. On the other hand, given that the majority of patients are statistical discriminators, our findings highlight that policy makers need to be cautious about how AA policies are implemented. For example, since AA policies in college admissions benefit low-caste students to gain entry into selective majors and occupations, these policies may reinforce the negative perception that low-caste doctors are less qualified and thus backfire since individuals may statistically discriminate even more low-caste doctors on the basis that they are less qualified than high-caste doctors. As a result, there are two countervailing effects of AA policies: it increases the investment in education of low-caste individuals but may reinforce the negative prejudices people have against low-caste doctors. These issues are complex, and we do not know if the large fraction of statistical discriminators in our field experiment are a reaction to the AA policies implemented in India or just reflect the individuals' beliefs in terms of low-caste doctors.

More generally, we believe that our methodology could be used to test the extent of ethnic-based statistical discrimination in other countries than India, including the United States, which will help to draw some conclusions in terms of AA policies in those countries.

References

- [1] Aigner, Dennis J. and Glen G. Cain (1977), “Statistical theories of discrimination in labor markets,” *Industrial and Labor Relations Review* 30, 175-187.
- [2] Anderson, Lisa R., Roland G. Fryer, and Charles A. Holt (2006), “Discrimination: Experimental evidence from psychology and economics,” In: William M. Rodgers (Ed.), *Handbook on the Economics of Discrimination*, Cheltenham, UK: Edward Elgar, pp. 97-115.
- [3] Arcidiacono, Peter and Michael Lovenheim (2016), “Affirmative Action and the quality-fit trade-off,” *Journal of Economic Literature* 54, 3–51.
- [4] Arrow, Kenneth (1973), “The theory of discrimination,” in Orley Ashenfelter and Albert Rees (eds.), *Discrimination in Labor Markets*, Princeton, NJ: Princeton University Press.
- [5] Altonji, Joseph G. and Rebecca M. Blank (1999), “Race and gender in the labor market,” In: Ashenfelter, O. and D. Card (Eds.), *Handbook of Labor Economics, Vol.3*, Amsterdam: North Holland, pp. 3143-3259.
- [6] Bagde, Surendrakumar, Dennis Epple, and Lowell Taylor (2016), “Does Affirmative Action work? Caste, gender, college quality, and academic success in India,” *American Economic Review* 106, 1495-1521.
- [7] Baert, Stijn (2017), “Hiring discrimination: An overview of (almost) all correspondence experiments since 2005,” IZA Discussion Paper No. 10738.
- [8] Banerjee, Abhijit, Marianne Bertrand, Saugato Datta, and Sendhil Mullainathan (2009), “Labor market discrimination in Delhi: Evidence from a field experiment,” *Journal of Comparative Economics* 38, 14–27.
- [9] Bayer, Patrick, Fernando Ferreira, and Stephen L. Ross (2018), “What drives racial and ethnic differences in high-cost mortgages? The role of high-risk lenders,” *Review of Financial Studies* 31, 175–205.
- [10] Becker, Gary (1957), *The Economics of Discrimination*, Chicago: University of Chicago Press.

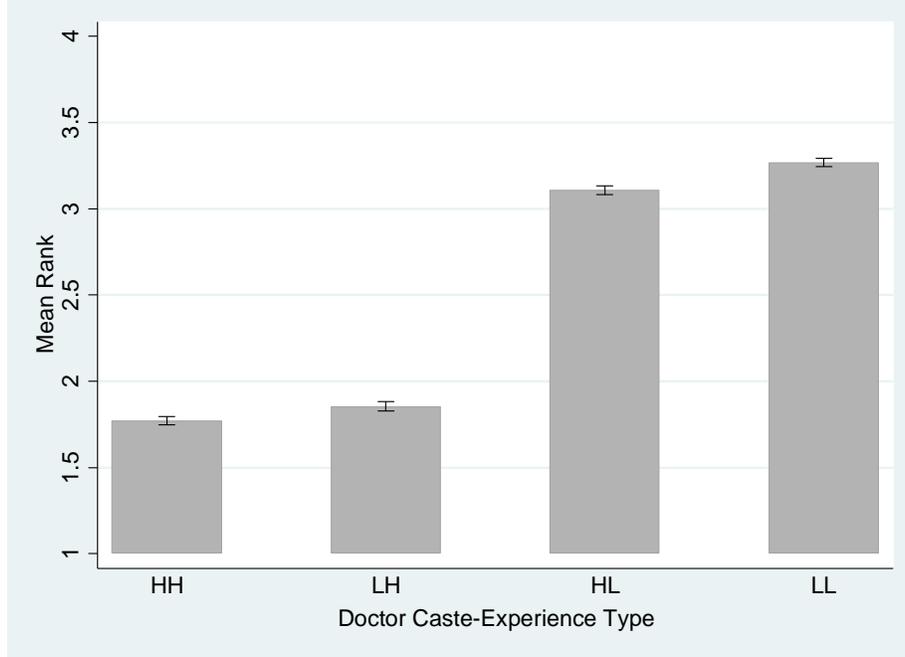
- [11] Bertrand, Marianne and Esther Duflo (2017), “Field experiments on discrimination,” In: Abhijit V. Banerjee and Esther Duflo (Eds.), *Handbook of Field Experiments, Vol. 1*, Amsterdam: Elsevier Science, pp. 309–393.
- [12] Bertrand, Marianne, Rema Hanna, Sendhil Mullainathan (2010), “Affirmative Action in education: Evidence from engineering college admissions in India,” *Journal of Public Economics* 94, 16-29.
- [13] Bertrand, Marianne and Sendhil Mullainathan (2004), “Are Emily and Greg more employable than Lakisha and Jamal? A field experiment on labor market discrimination,” *American Economic Review* 94, 991–1013.
- [14] Cason, Timothy N., Tridib Sharma, and Radovan Vadovic (2017), “Correlated beliefs: Experimental evidence from 2x2 games,” Unpublished manuscript.
- [15] Coate, Stephen, and Glenn C. Loury (1993), “Will affirmative-action policies eliminate negative stereotypes? *American Economic Review* 83, 1220-1240.
- [16] Currarini, Sergio, Matthew O. Jackson, and Paolo Pin (2009), “An economic model of friendship: Homophily, minorities, and segregation,” *Econometrica* 77, 1003-1045.
- [17] DeGroot, Morris H. (2004), *Optimal Statistical Decisions*, New York: Wiley.
- [18] Deshpande, Ashwani (2012), “Social justice through Affirmative Action in India: An assessment,” In: *Capitalism on Trial: Explorations in the Tradition of Thomas Weisskopf*, Northampton, MA: Edward Elgar Publishing.
- [19] Deshpande Ashwini (2016), “Affirmative Action in India,” In: Elaine Kennedy-Dubourdieu (Ed.), *Race and Inequality. World Perspectives on Affirmative Action*, London: Routledge, pp. 63–76.
- [20] Doleac, Jennifer L. and Luke C.D. Stein (2013), “The visible hand: Race and online market outcomes,” *Economic Journal* 123, F469–F492.
- [21] Ewens, Michael, Bryan Tomlin, and Liang Choon Wang (2014), “Statistical discrimination or prejudice? A large sample field experiment,” *Review of Economics and Statistics* 96, 119-134.
- [22] Fang, Hanming and Andrea Moro (2011), “Theories of statistical discrimination and Affirmative Action: A survey,” In: Jess Benhabib, Matthew Jackson and Alberto Bisin

- (Eds.), *Handbook of Social Economics, Vol. 1A*, Amsterdam: North Holland, pp. 133-200.
- [23] Fryer, Roland G., Jr. and Steven D. Levitt (2004), “The causes and consequences of distinctively black names,” *Quarterly Journal of Economics* 119, 767-805.
- [24] Galanter, Marc (1984), *Competing Equalities: Law and the Backward Classes in India*, Oxford University Press, New Delhi.
- [25] Giulietti, Corrado, Mirco Tonin and Michael Vlassopoulos (2018), “Racial discrimination in local public services: A field experiment in the US,” *Journal of the European Economic Association*, forthcoming.
- [26] Gneezy, Uri, John List, and Michael K. Price (2012), “Toward an understanding of why people discriminate: Evidence from a series of natural field experiments,” NBER Working Paper No. 17855.
- [27] Guryan, Jonathan and Kerwin Kofi Charles (2013), “Taste-based or statistical discrimination: The economics of discrimination returns to its roots,” *Economic Journal* 123, F417-F432.
- [28] Hanna, Rema N., and Leigh L. Linden (2012), “Discrimination in grading” *American Economic Journal: Economic Policy* 4 (4), 146-68.
- [29] Hoff, Karla and Priyanka Pandey (2006), “Discrimination, social identity, and durable inequalities,” *American Economic Review* 96, 206-211.
- [30] Holzer, Harry and David Neumark (2000), “Assessing Affirmative Action,” *Journal of Economic Literature* 38, 483-568.
- [31] Holzer, Harry and David Neumark (2006), “Affirmative Action: What do we know?” *Journal of Policy Analysis and Management*, 25(2), 463-490.
- [32] Kofi Charles, Kerwin and Jonathan Guryan (2011), “Studying discrimination: Fundamental challenges and recent progress,” *Annual Review of Economics* 3, 479-511.
- [33] Lane, Tom (2016), “Discrimination in the laboratory: A meta-analysis of economics experiments,” *European Economic Review* 90, 375-402.
- [34] Lang, Kevin and Jee-Yeon K. Lehmann (2012), “Racial discrimination in the labor market: Theory and empirics,” *Journal of Economic Literature* 50, 959-1006.

- [35] Leibbrandt, Andreas, Liang Choon Wang, and Cordelia Foo (2018), “Gender quotas, competitions, and peer review: Experimental evidence on the backlash against women,” *Management Science*, forthcoming.
- [36] Levati, Maria V., Aaron James Nicholas, Birendra Rai (2014), “Testing the single-peakedness of other-regarding preferences,” *European Economic Review* 67, 197-209.
- [37] List, John A. (2004), “The nature and extent of discrimination in the marketplace: Evidence from the field,” *Quarterly Journal of Economics* 119, 49-89.
- [38] McPherson, Miller, Lynn Smith-Lovin, and James M. Cook (2001), “Birds of a feather: Homophily in social networks,” *Annual Review of Sociology* 27, 415-444.
- [39] Nambissan, Geetha (2010) “Exclusion and Discrimination in Schools: Experiences of Dalit Children.”, In: *Blocked by Caste: Economic Discrimination in Modern India*, ed. S. Thorat and K. S. Newman, New York: Oxford University Press, pp. 253-286.
- [40] Navsarjan Trust (2010): “Understanding Untouchability: a comprehensive study of practices and conditions in 1589 villages”, Robert F. Kennedy Centre for Justice and Human Rights and Navsarjan Trust, Ahmedabad.
- [41] Neumark, David (2018), “Experimental research on labor-market discrimination,” *Journal of Economic Literature*, forthcoming.
- [42] Phelps, Edmund S. 1972. “The statistical theory of racism and sexism,” *American Economic Review* 62, 659-661.
- [43] Riach, Peter A., and Judith Rich (2002), “Field experiments of discrimination in the market place,” *Economic Journal* 112, F480-F518.
- [44] Rich, Judith (2014), “What do field experiments of discrimination in markets tell us? A meta analysis of studies conducted since 2000,” IZA Discussion Paper No. 8584.
- [45] Frisancho, Veronica and Kala Krishna (2016), “Affirmative Action in Higher Education in India: Targeting, Catch Up and Mismatch,” *Higher Education* 71(5), 611-649.
- [46] Roth, Alvin E. and Marilda A.O. Sotomayor (1990), *Two-Sided Matching: A Study in Game-Theoretic Modeling and Analysis*, Cambridge: Cambridge University Press.
- [47] Shah, Ghanshyam, Harsh Mandar, Sukhadeo Thorat, Satish Deshpande, Amita Baviskar (2006), “Untouchability in Rural India”, Sage India, New Delhi.

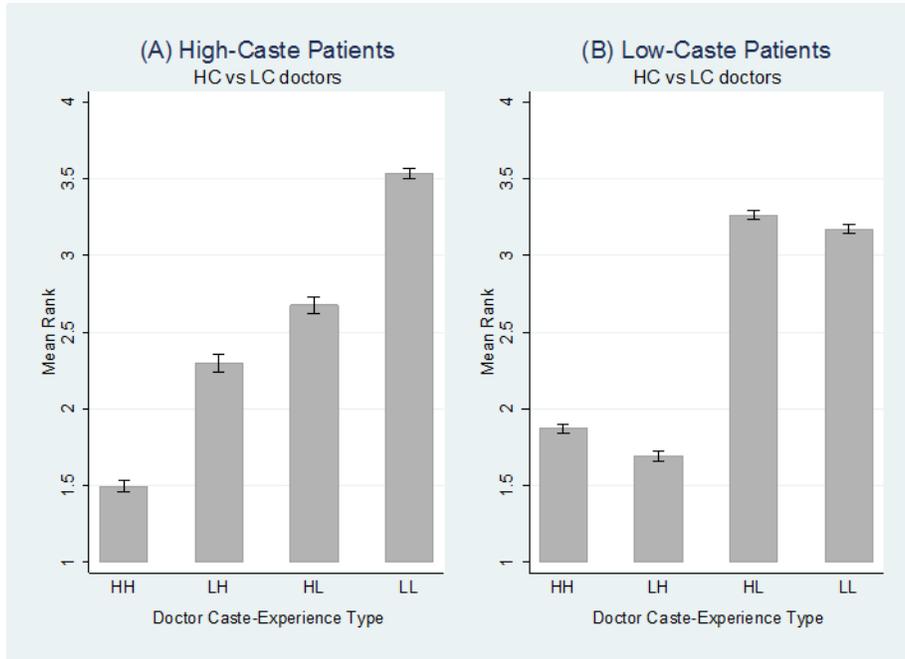
- [48] Siddique, Zahra (2011), “Evidence on caste based discrimination,” *Labour Economics* 18, 146–159.
- [49] Sönmez, Tayfun and M. Utku Ünver (2011), “Matching, allocation, and exchange of discrete resources,” In: J. Benhabib, A. Bisin, and M. Jackson (Eds.), *Handbook of Social Economics*, Amsterdam: Elsevier Science, Chap. 17.
- [50] Thorat, Sukhdeo and Paul Attewell (2007), “Legacy of social exclusion,” *Economic and Political Weekly* Vol. 42, No. 41, October 13-19.
- [51] Verdier, Thierry and Yves Zenou (2004), “Racial beliefs, location, and the causes of crime,” *International Economic Review* 45, 731-759.
- [52] Zussman, Asaf (2013), “Ethnic discrimination: Lessons from the Israeli online market for used cars,” *Economic Journal* 123, F433–F468.

Figure 1: Mean rank by doctor type – Pooling patients of all caste groups



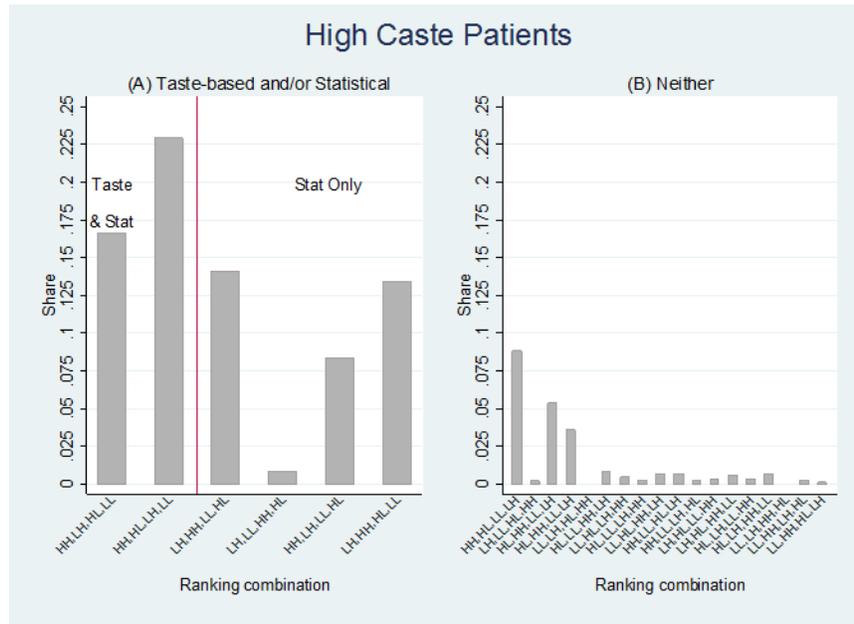
Notes: Higher mean rank means less preferred. Doctor caste-type is denoted by caste and experience. HH = high caste and high experience; LH = low caste and high experience; HL = high caste and low experience; and LL = low caste and low experience

Figure 2: Mean rank by doctor type and caste of patients



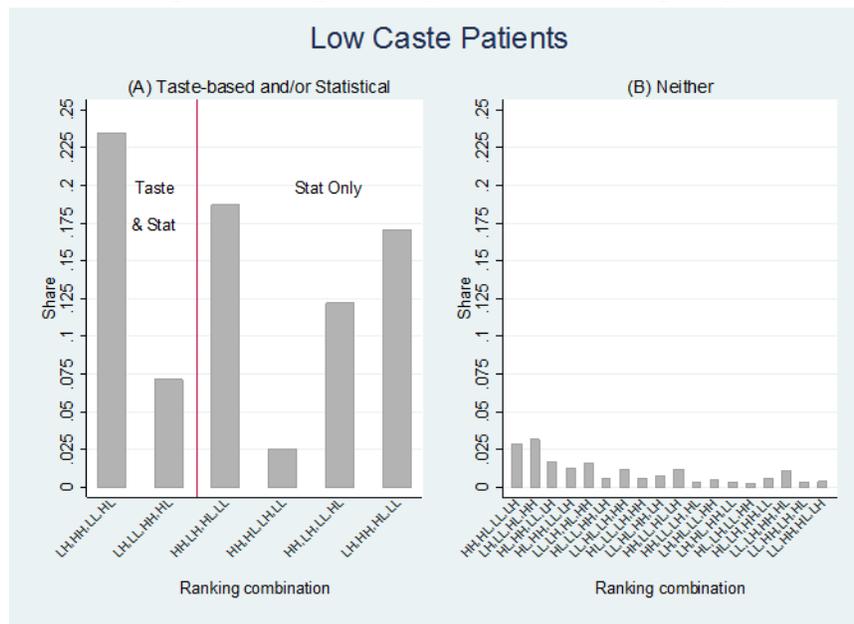
Notes: Higher mean rank means less preferred. Doctor caste-type is denoted by caste and experience. HH = high caste and high experience; LH = low caste and high experience; HL = high caste and low experience; and LL = low caste and low experience.

Figure 3a: Distribution of rankings for high-caste patients
Experience is positively correlated with quality



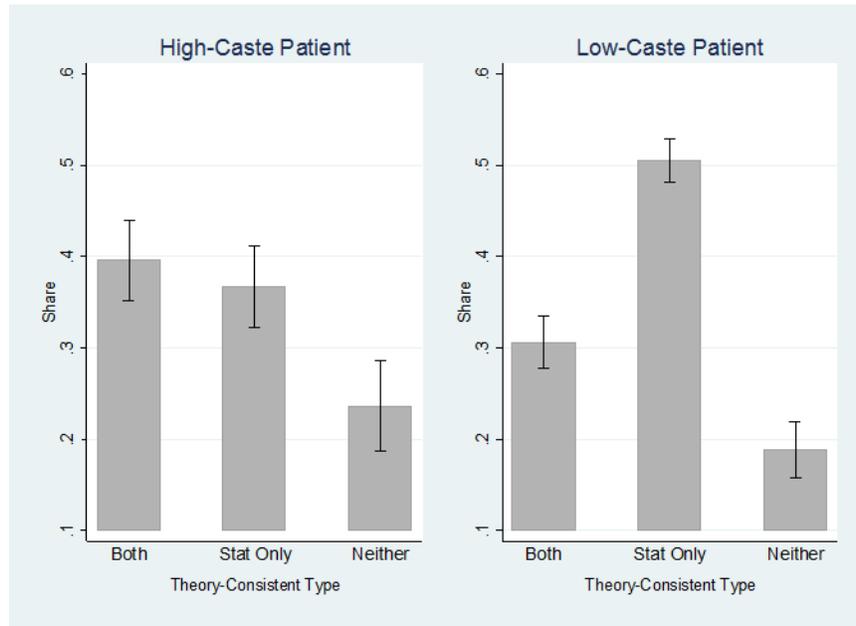
Notes: HH = high caste and high experience; LH = low caste and high experience; HL = high caste and low experience; and LL = low caste and low experience. For example, the ranking order “HH,LH,HL,LL” means that high-caste high-experience doctor is the most preferred, low-caste high-experience doctor is the second most preferred, and so on.

Figure 3b: Distribution of rankings for low-caste patients
Experience is positively correlated with quality



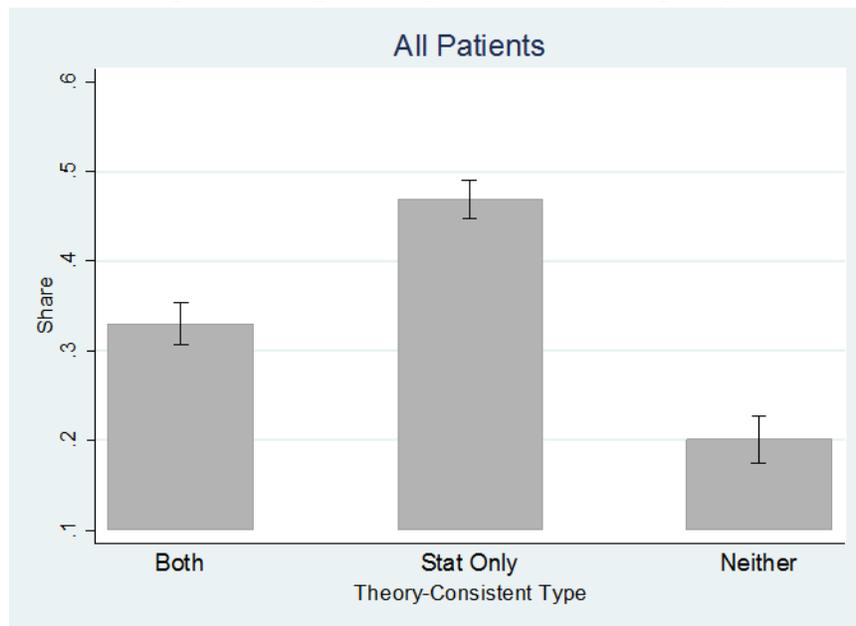
Notes: HH = high caste and high experience; LH = low caste and high experience; HL = high caste and low experience; and LL = low caste and low experience. For example, the ranking order “HH,LH,HL,LL” means that high-caste high-experience doctor is the most preferred, low-caste high-experience doctor is the second most preferred, and so on.

Figure 3c: Distribution of rankings by caste of patients
Experience is positively correlated with quality



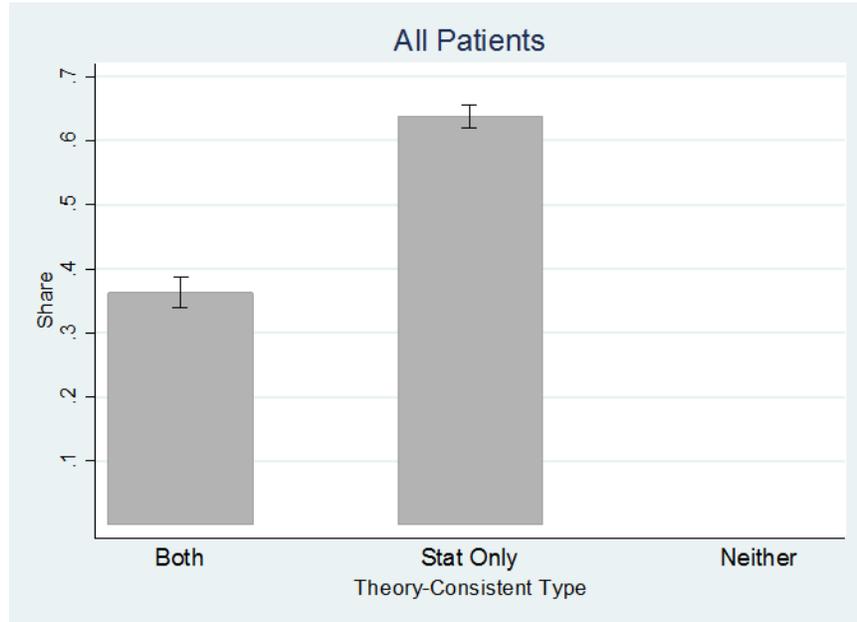
Notes: The taste-based model assumes distaste for out-group doctor (e.g., a low-caste patient has a distaste for high-caste patients, and a high-caste patient has a distaste for low-caste patients). High experience signals better quality of healthcare service.

Figure 3d: Distribution of rankings for all patients
Experience is positively correlated with quality



Notes: The taste-based model assumes distaste for out-group doctor (e.g., a low-caste patient has a distaste for high-caste patients, and a high-caste patient has a distaste for low-caste patients). High experience signals better quality of healthcare service.

Figure 5d: Distribution of rankings for all patients
Experience can be positively or negatively correlated with quality



Notes: The taste-based model assumes distaste for out-group doctor (e.g., a low-caste patient has a distaste for high-caste patients, and a high-caste patient has a distaste for low-caste patients). High experience may signal better or worse quality of healthcare service.

Figure 6: Mean Positive Attitudes Scores towards Different Castes by Caste of Patients and Theory-Consistent Type

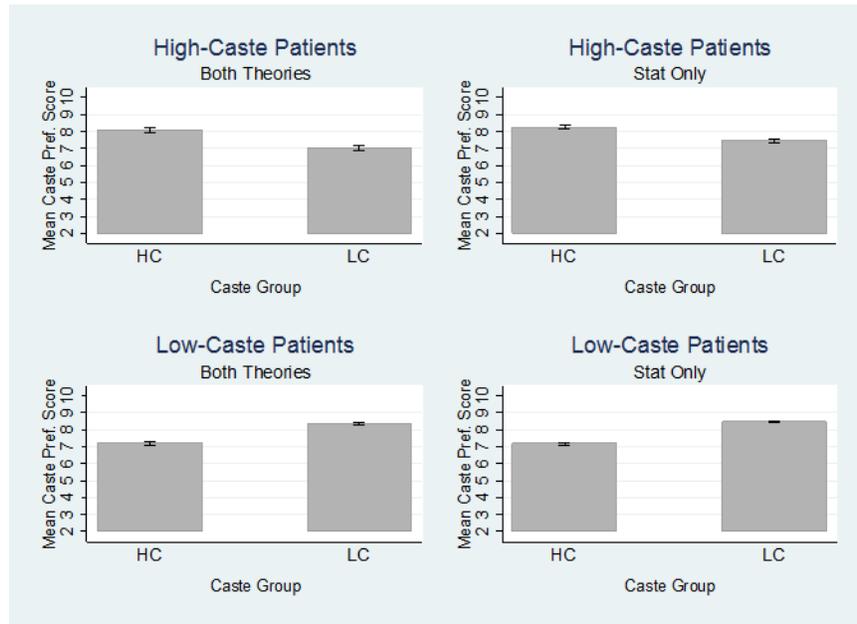


Figure 7a: Distribution of rankings for low- and high-caste patients
 Experience can be positively or negatively correlated with quality
 Patients having more positive attitudes towards out-group are recoded as statistical only

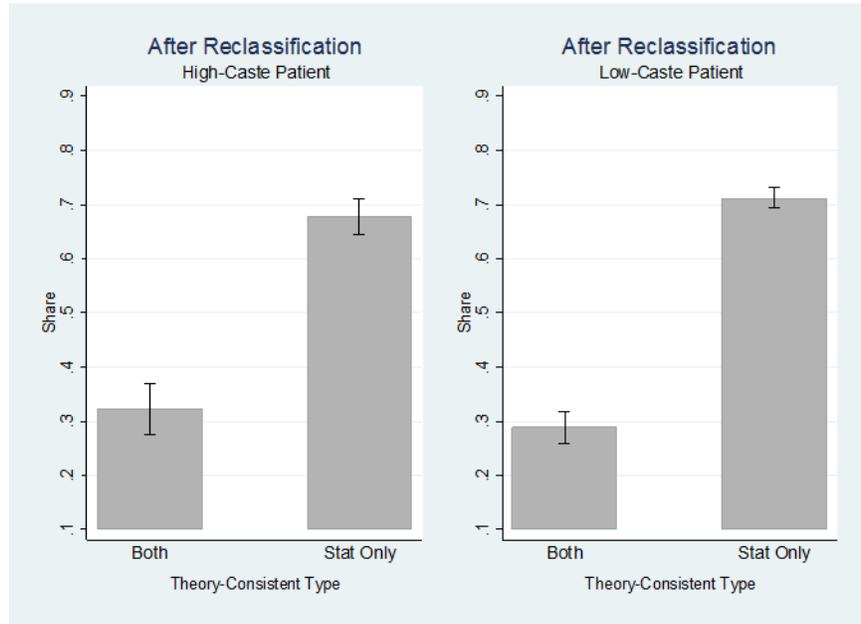


Figure 7b: Distribution of rankings for all patients
 Experience can be positively or negatively correlated with quality
 Patients having more positive attitudes towards out-group are recoded as statistical only

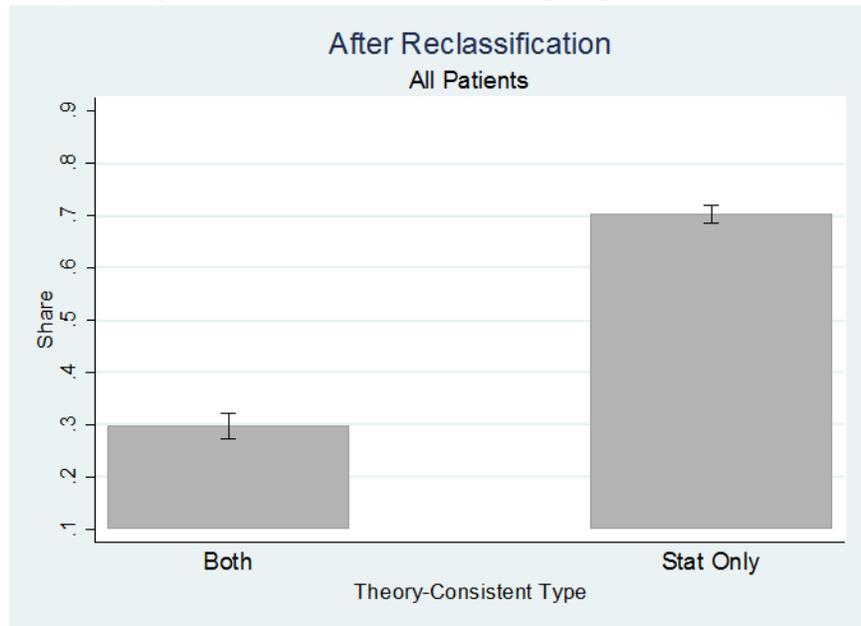


Figure 8: Mean Amount Given to Different Groups by Caste of Patients and Theory-Consistent Type

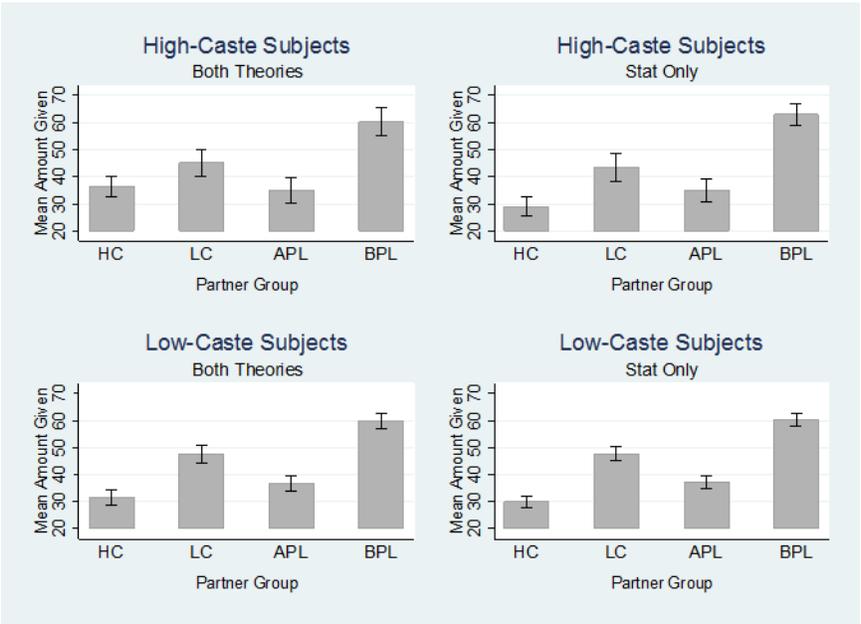


Figure 9a: Distribution of rankings for low- and high-caste patients
 Experience can be positively or negatively correlated with quality
 Patients giving more to out-group are recoded as statistical
 Lab-in-the-field Sample

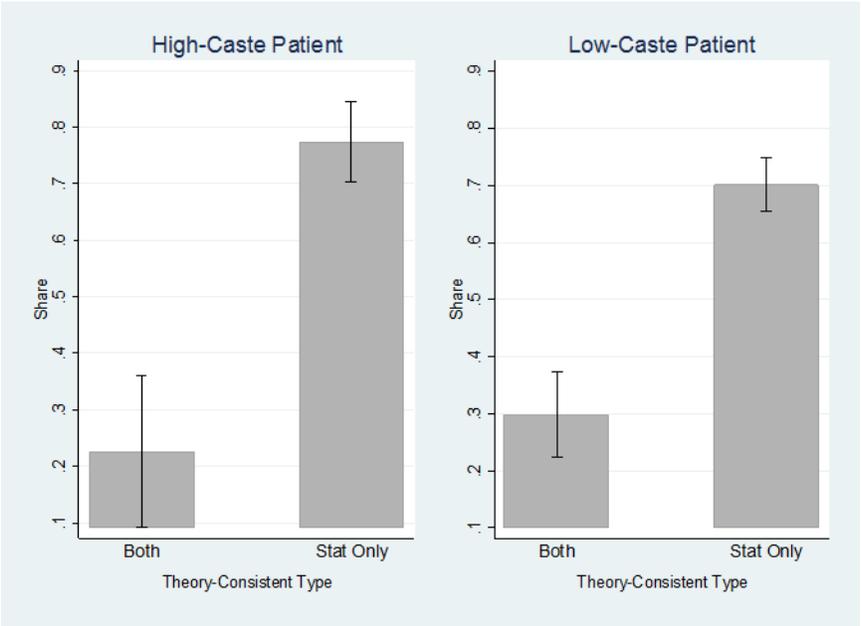


Figure 9b: Distribution of rankings for all patients
 Experience can be positively or negatively correlated with quality
 Patients giving more to out-group are recoded as statistical
 Lab-in-the-field Sample

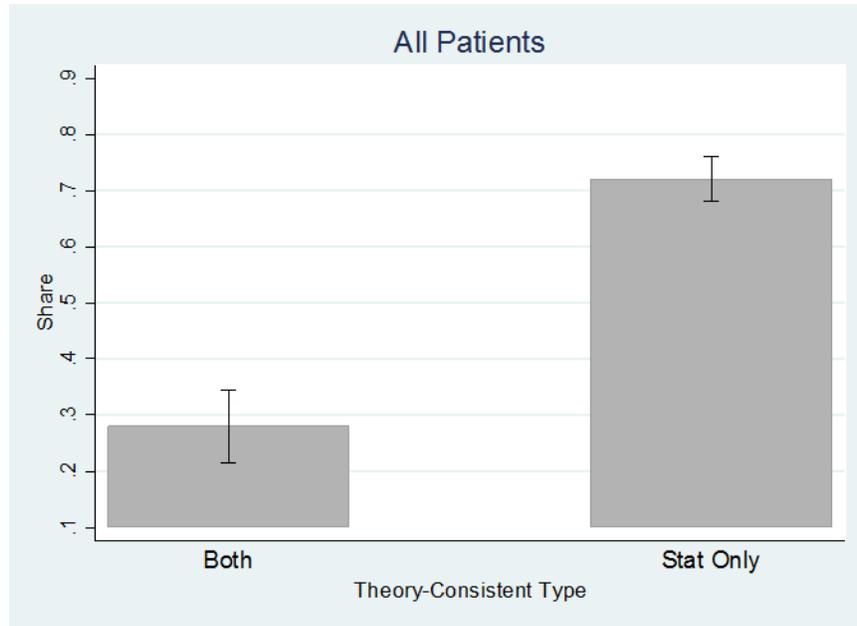


Figure 10a: Distribution of rankings for low- and high-caste patients
 Experience can be positively or negatively correlated with quality
 Patients giving more to out-group conditioning on characteristics are recorded as statistical
 Lab-in-the-field Sample

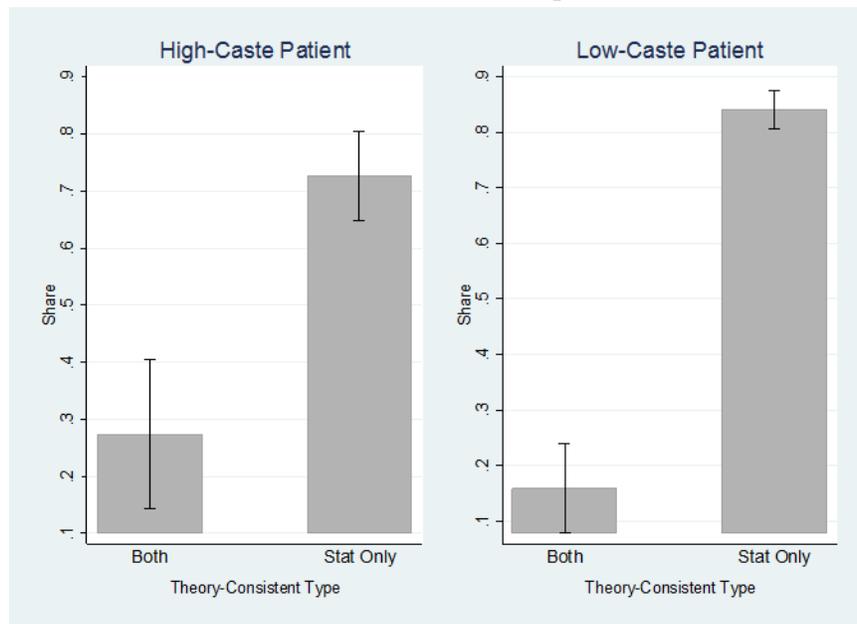


Figure 10b: Experience can be positively or negatively correlated with quality
 Patients giving more to out-group conditioning on characteristics are recorded as statistical
 Lab-in-the-field Sample

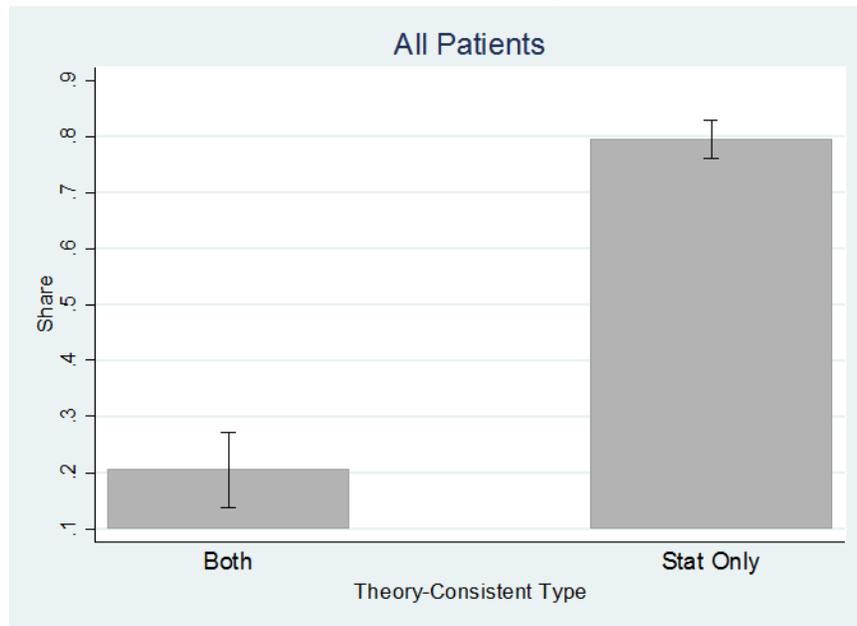


Figure 11: Summary of Main Results

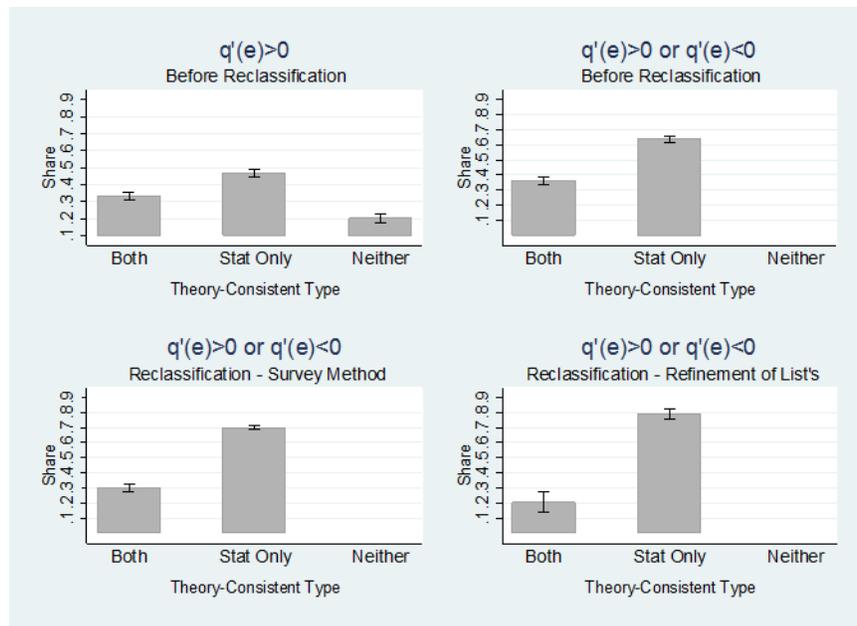


Figure 12: Summary of Main Results

Recode the two bottom ranked doctors as consistent with both theories

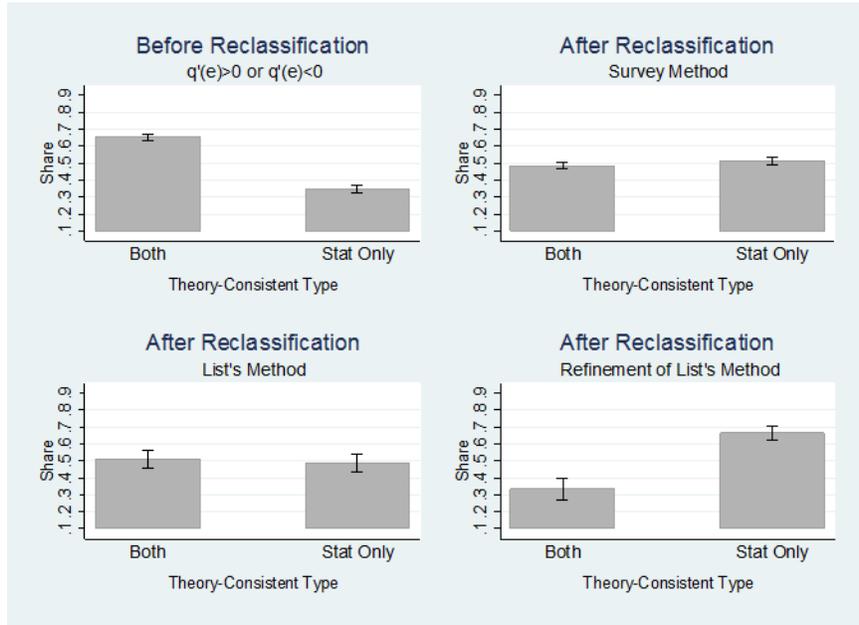


Table 1: Descriptive statistics

	Field Sample (n = 3,128)		Lab-in-the-field Sample (n = 482)		Uttar Pradesh
<i>Patient characteristics</i>	Mean	SD	Mean	SD	Mean
High caste – General category (GC)	0.27	0.44	0.26	0.44	0.27
Low caste –					
Other Backward Classes (OBC)	0.49	0.50	0.50	0.50	0.52
Scheduled Castes (SC)	0.24	0.42	0.24	0.43	0.19
Scheduled Tribes (ST)	0.00	0.06	0.01	0.08	0.01
Age	37.8	14.3	38.5	15.0	38.0
Hindu (or not)	0.80	0.40	0.76	0.43	0.80
Urban resident (or not)	0.34	0.48	0.33	0.47	0.34
Male (or not)	0.51	0.50	0.53	0.50	0.51
High caste – General category (GC)					
Age	38.5	15.0	38.7	15.6	
Hindu (or not)	0.81	0.39	0.75	0.43	
Urban resident (or not)	0.31	0.46	0.37	0.49	
Male (or not)	0.49	0.50	0.58	0.50	
At least college educated (or not)	0.31	0.46	0.26	0.44	
Below poverty line (or not)	0.25	0.43	0.30	0.46	
Low caste – OBC/SC/ST					
Age	37.6	14.0	38.5	14.8	
Hindu (or not)	0.79	0.40	0.77	0.42	
Urban resident (or not)	0.36	0.48	0.32	0.47	
Male (or not)	0.51	0.50	0.51	0.50	
At least college educated (or not)	0.17	0.38	0.16	0.37	
Below poverty line (or not)	0.37	0.48	0.35	0.48	

Notes: The bottom two panels report statistics for high-caste patients and low-caste patients separately.

Table 2: Mean Characteristics of Different Types of Discriminators

	(1) Both theories	(2) Statistical only	(3) Difference (1) - (2)
High caste	0.290 [0.454]	0.258 [0.437]	0.032 (0.018)*
Age	38.071 [13.925]	37.699 [14.400]	0.372 (0.550)
Hindu	0.844 [0.363]	0.779 [0.415]	0.065 (0.015)***
Urban	0.363 [0.481]	0.337 [0.473]	0.026 (0.019)
Male	0.482 [0.500]	0.518 [0.500]	-0.036 (0.020)*
College	0.229 [0.420]	0.200 [0.400]	0.029 (0.016)*
BPL	0.367 [0.482]	0.330 [0.470]	0.038 (0.019)**

Notes: Types of discriminators defined after reclassification using survey information about relative attitudes towards different castes. Standard deviations reported in brackets and standard errors reported in parentheses. *** $p < 0.01$; ** $p < 0.05$; $p < 0.10$.

Online Appendix

A Rankings of doctors

A.1 Rankings of doctors when experience is positively correlated to quality

A.1.1 Taste-based discrimination

Assume $q'(e) > 0$. With taste-based discrimination, there are 4 possible rankings. The possible rankings for a *low-caste patient* compatible with (1) are:

$$c_{LeH} \succ c_{LeL} \succ c_{HeH} \succ c_{HeL}$$

$$c_{LeH} \succ c_{HeH} \succ c_{LeL} \succ c_{HeL}$$

The possible rankings for a *high-caste patient* compatible with (4):

$$c_{HeH} \succ c_{HeL} \succ c_{LeH} \succ c_{LeL}$$

$$c_{HeH} \succ c_{LeH} \succ c_{HeL} \succ c_{LeL}$$

A.1.2 Statistical discrimination

Assume that $Cov(q_c, e_c) > 0$. With statistical discrimination, there are 6 possible rankings and it does not depend on the caste of the patient. These 6 rankings compatible with (9) are given by:

$$c_{HeH} \succ c_{HeL} \succ c_{LeH} \succ c_{LeL}$$

$$c_{HeH} \succ c_{LeH} \succ c_{HeL} \succ c_{LeL}$$

$$c_{HeH} \succ c_{LeH} \succ c_{LeL} \succ c_{HeL}$$

$$c_{LeH} \succ c_{HeH} \succ c_{HeL} \succ c_{LeL}$$

$$c_{LeH} \succ c_{HeH} \succ c_{LeL} \succ c_{HeL}$$

$$c_{LeH} \succ c_{LeL} \succ c_{HeH} \succ c_{HeL}$$

A.2 Rankings of doctors when experience can be positively or negatively correlated to quality

A.2.1 Taste-based discrimination

In that case, there are 8 possible rankings. (i) Consider *low-caste patients* with preferences given by (1). If experience is *positively* correlated to quality, i.e. $q'(e) > 0$, then we have:

$$c_{LeH} \succ c_{LeL} \succ c_{HeH} \succ c_{HeL}$$

$$c_{LeH} \succ c_{HeH} \succ c_{LeL} \succ c_{HeL}$$

(ii) Consider *low-caste patients* with preferences given by (1). If experience is *negatively* correlated to quality, i.e. $q'(e) < 0$, then we have:

$$c_{LeL} \succ c_{LeH} \succ c_{HeL} \succ c_{HeH}$$

$$c_{LeL} \succ c_{HeL} \succ c_{LeH} \succ c_{HeH}$$

(iii) Consider *high-caste patients* with preferences given by (4). If experience is *positively* correlated to quality, i.e. $q'(e) > 0$, then we have:

$$c_{HeH} \succ c_{HeL} \succ c_{LeH} \succ c_{LeL}$$

$$c_{HeH} \succ c_{LeH} \succ c_{HeL} \succ c_{LeL}$$

(iv) Consider *high-caste patients* with preferences given by (4). If experience is *negatively* correlated to quality, i.e. $q'(e) < 0$, then we have:

$$c_{HeL} \succ c_{LeL} \succ c_{HeH} \succ c_{LeH}$$

$$c_{HeL} \succ c_{HeH} \succ c_{LeL} \succ c_{LeH}$$

A.2.2 Statistical discrimination

Assume that some agents are such that $Cov(q_c, e_c) > 0$ and other are such that $Cov(q_c, e_c) < 0$. All of them have preferences given by (9). Then, in that case, all rankings are possible and there are therefore 24 possible rankings, which are given by: (i) When doctors c_{HeH} are ranked first:

$$c_{HeH} \succ c_{HeL} \succ c_{LeH} \succ c_{LeL}$$

$$c_{HeH} \succ c_{HeL} \succ c_{LeL} \succ c_{LeH}$$

$$c_{HeH} \succ c_{LeH} \succ c_{HeL} \succ c_{LeL}$$

$$c_{HeH} \succ c_{LeH} \succ c_{LeL} \succ c_{HeL}$$

$$c_{HeH} \succ c_{LeL} \succ c_{HeL} \succ c_{LeH}$$

$$c_{HeH} \succ c_{LeL} \succ c_{LeH} \succ c_{HeL}$$

(ii) When doctors c_{HeL} are ranked first:

$$c_{HeL} \succ c_{HeH} \succ c_{LeH} \succ c_{LeL}$$

$$c_{HeL} \succ c_{HeH} \succ c_{LeL} \succ c_{LeH}$$

$$c_{HeL} \succ c_{LeH} \succ c_{HeH} \succ c_{LeL}$$

$$c_{HeL} \succ c_{LeH} \succ c_{LeL} \succ c_{HeH}$$

$$c_{HeL} \succ c_{LeL} \succ c_{HeH} \succ c_{LeH}$$

$$c_{HeL} \succ c_{LeL} \succ c_{LeH} \succ c_{HeH}$$

(iii) When doctors c_{LeH} are ranked first:

$$c_{LeH} \succ c_{HeH} \succ c_{HeL} \succ c_{LeL}$$

$$c_{LeH} \succ c_{HeH} \succ c_{LeL} \succ c_{HeL}$$

$$c_{LeH} \succ c_{HeL} \succ c_{HeH} \succ c_{LeL}$$

$$c_{LeH} \succ c_{HeL} \succ c_{LeL} \succ c_{HeH}$$

$$c_{LeH} \succ c_{LeL} \succ c_{HeH} \succ c_{HeL}$$

$$c_{LeH} \succ c_{LeL} \succ c_{HeL} \succ c_{HeH}$$

(iv) When doctors c_{LeL} are ranked first:

$$c_{LeL} \succ c_{HeH} \succ c_{HeL} \succ c_{LeH}$$

$$c_{LeL} \succ c_{HeH} \succ c_{LeH} \succ c_{HeL}$$

$$c_{LeL} \succ c_{HeL} \succ c_{HeH} \succ c_{LeH}$$

$$c_{LeL} \succ c_{HeL} \succ c_{LeH} \succ c_{HeH}$$

$$c_{LeL} \succ c_{LeH} \succ c_{HeH} \succ c_{HeL}$$

$$c_{LeL} \succ c_{LeH} \succ c_{HeL} \succ c_{HeH}$$

B Maps

Figure B.1 shows the location of Kanpur Nagar district in the state of UP while Figure B.2 displays all the locations where the survey was conducted in Kanpur Nagar district. The areas covered in our study comprised rural areas, mainly Ratanpur, Lodhar, Kursauli, Maksudabad, Tikra, Singhpur, Hora, Paigupur, Pachor, Mandhana, Kukradev, Tikkanpurwa, Bairy, Mharajpur, Loharkheda, Pargahi, Guraha, Sandeela, Shadipur, Naurangabad, Baikunthpur, Sakshupurwa, Iswariganj, Hradaypur, Parapratappur, Chandula and Pokharapurwa and urban areas, namely, Naramau, Karsaitpur, Madarpur, Indra Nagar, Kalyanpur Khud, Devi Shai Nagar, Sahab Nagar, Jai Prakash Nagar, Loharanbhatta, Fazalganj, Barasirohi, Mirjapur and Maswanpur.

[Insert Figures B.1 and B.2 here]

C Replication of the experiment only for the 482 lab-in-the-field participants

Figures C.1 and C.2 replicate the results obtained in Figures 5c and 5d for the 482 lab-in-the-field participants. We see that the results are similar.

[Insert Figures C.1 and C.2 here]

D Gender effects

Figure D.1 reports the results for male patients and male doctors, Figure D.2 for male patients and female doctors, Figure D.3 for female patients and male doctors, and Figure D.4 for female patients and female doctors.

[Insert Figures D.1 , D.2, D.3 and D.4 here]

Figure B.1: Location of Kanpur Nagar, Uttar Pradesh on the Map of India



Figure B.2: Locations where the field experiments were conducted

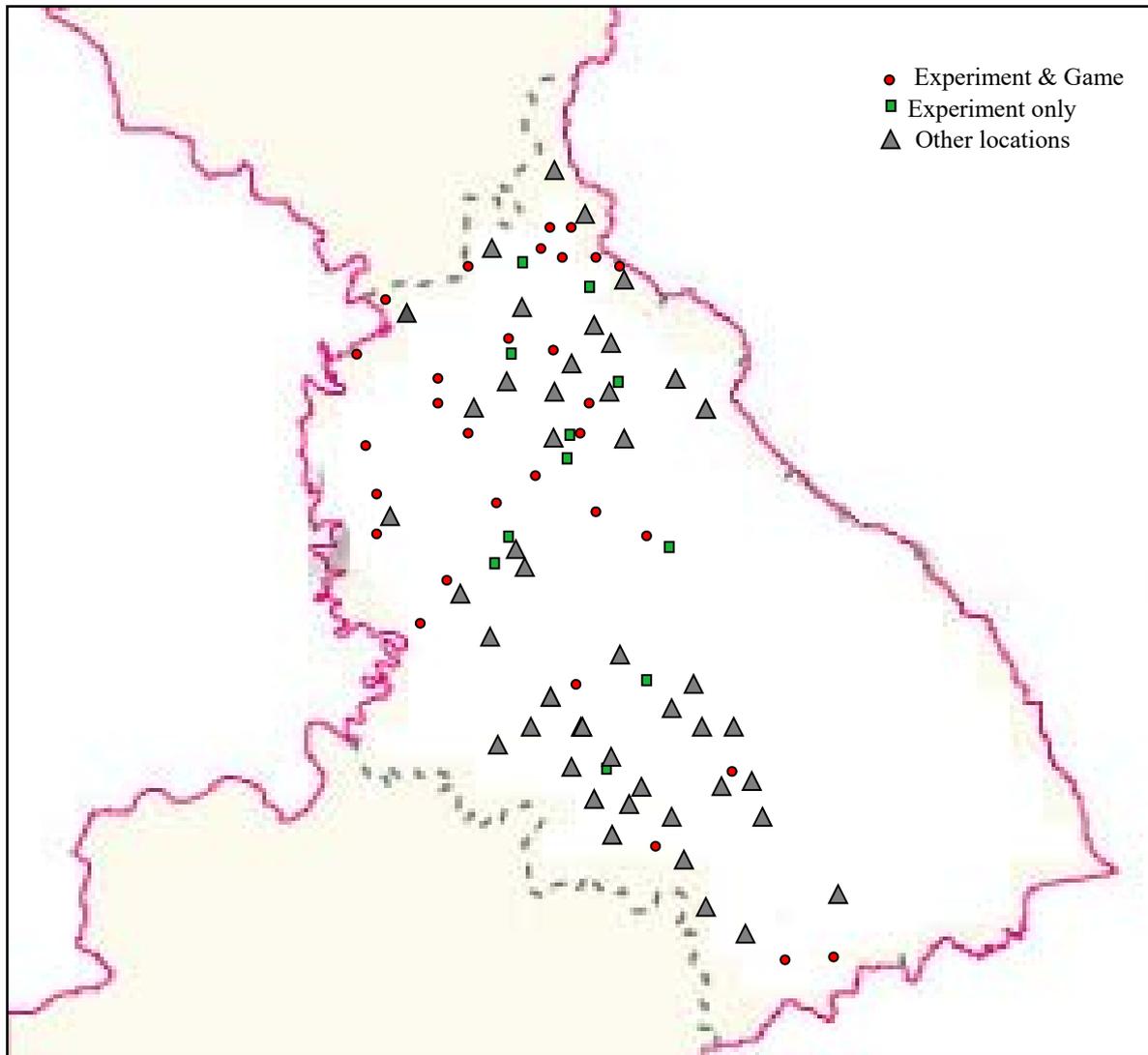


Figure C.1: Distribution of rankings for low- and high-caste patients
Experience can be positively or negatively correlated with quality
Replication of Figure 5c using Lab-in-the-field sample

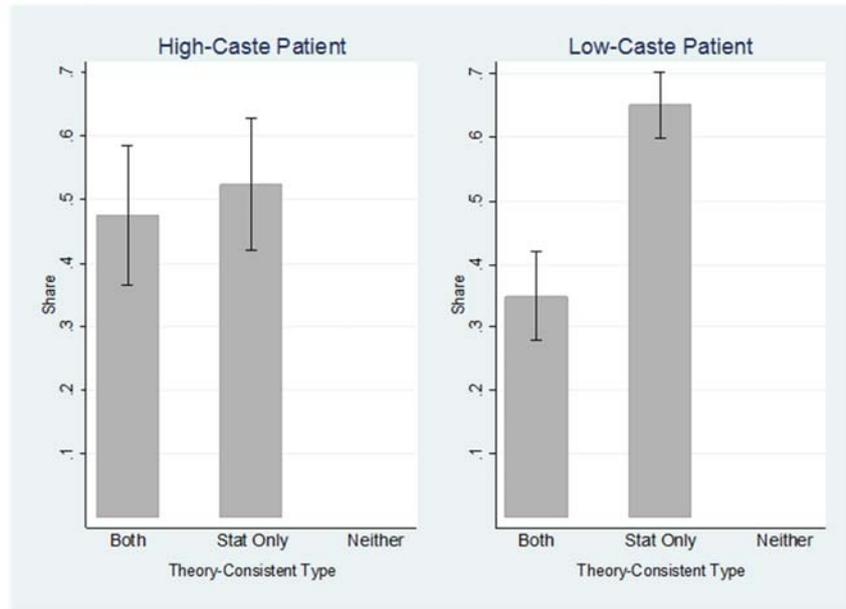


Figure C.2: Distribution of rankings for low- and high-caste patients
Experience can be positively or negatively correlated with quality
Replication of Figure 5d using Lab-in-the-field sample

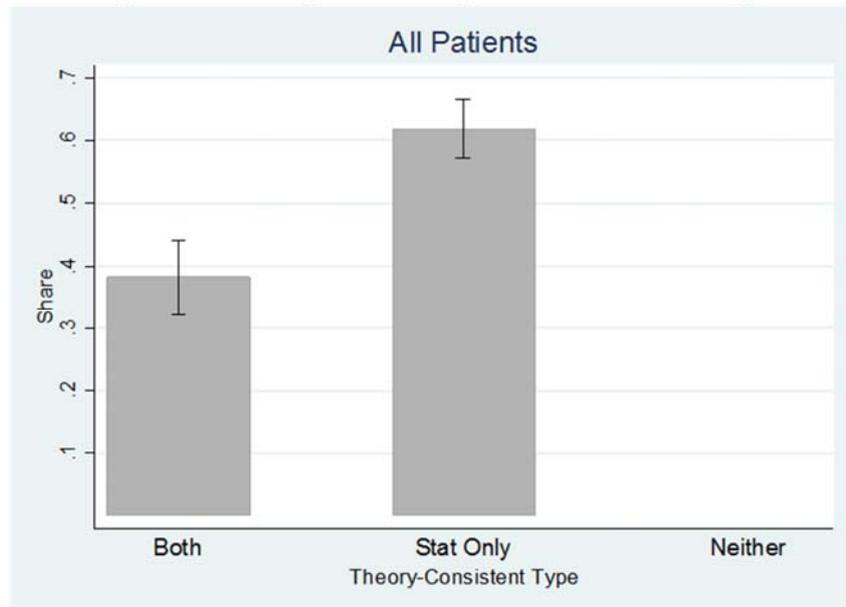


Figure D.1: Male Patients – Male Doctors

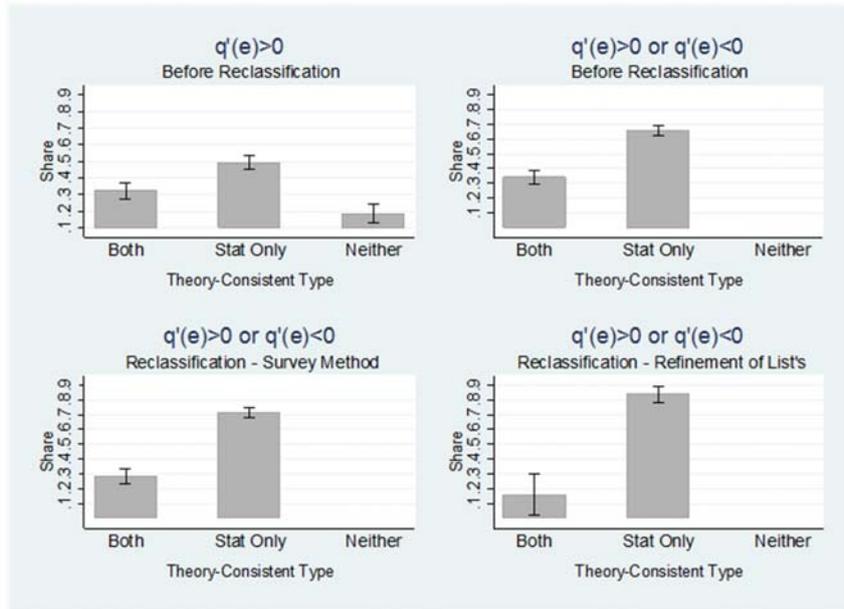


Figure D.2: Male Patients – Female Doctors

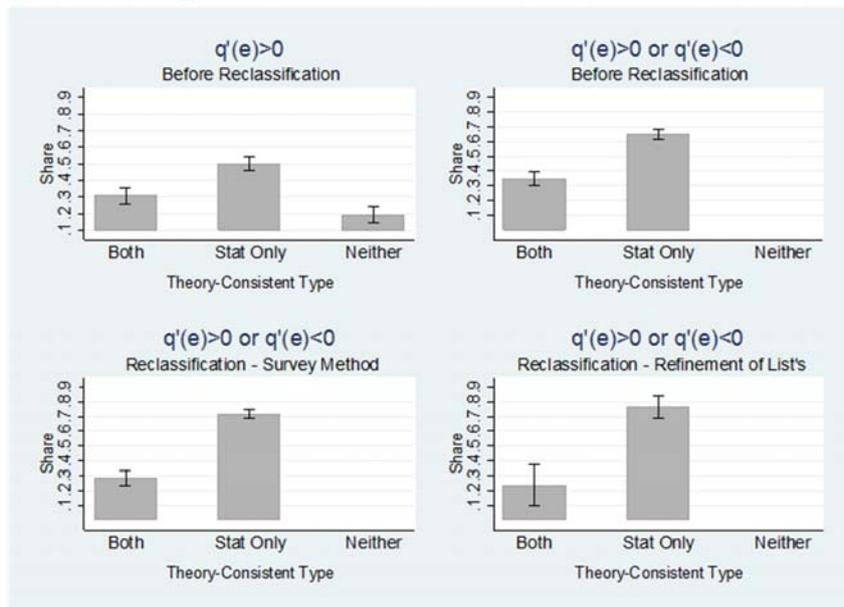


Figure D.3: Female Patients – Male Doctors

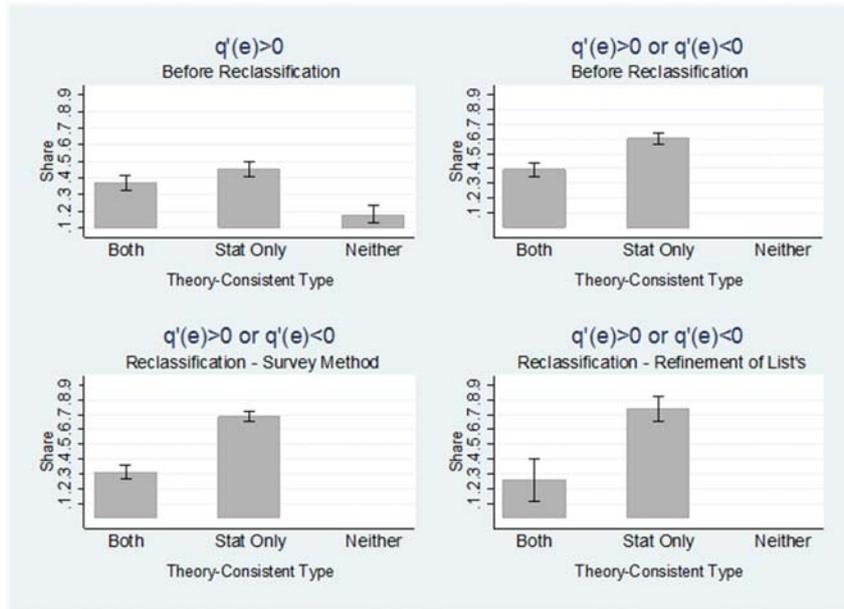


Figure D.4: Female Patients – Female Doctors

