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Gender differences in bargaining outcomes: A field experiment on discrimination

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ABSTRACT

Relying on a commonly used fixed-offer bargaining script we examine gender differences in bargaining outcomes in a highly competitive and frequently used market: the taxi market in Lima, Peru. Our bargaining script secures that only the seller can change prices and terminate negotiations, thus we are able to examine differences in the seller's entire path of negotiation and in the reservation price at which they are willing to trade. We find that male and female passengers who use the same bargaining script are not treated equally. Men face higher initial prices, final prices, and rejection rates. These differences are consistent with male drivers being more reluctant to give-in to demanding negotiations by male passengers, and with male passengers being perceived as having high valuations. To identify whether taste-based or statistical discrimination drives the inferior treatment of men we conduct an experiment where passengers send a signal on valuation before negotiating. The signal eliminates gender differences and the response is shown only to be consistent with statistical discrimination. Thus in the limiting case of a highly competitive market with experienced traders, we do not find evidence of taste-based discrimination, the differential observed is however consistent with statistical discrimination.

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1. Introduction

Evidence suggests that men and women achieve different outcomes when resources are allocated through bargaining. Despite ever improving identification strategies, it continues to be unclear what gives rise to these differences, when we should expect them to occur, or even whether one gender generally will be disadvantaged.

Considering the many factors that influence taste based (Becker, 1975) and statistical discrimination (Phelps, 1972; Arrow, 1973), it is perhaps not surprising that it is difficult to come up with definitive answers to any of these questions. The characteristics of the item and the market in which it is being negotiated are likely to influence gender differences in bargaining outcomes. Rather than aiming to provide universal answers, this paper asks what type of differences one should expect in the limiting case of a highly competitive market where experienced men and women use the same bargaining script. To identify gender differences in the seller's negotiation path and reservation values for trade, we rely on a commonly used fixed-offer bargaining script.[1] That is buyers in our study always respond to the seller's price by stating a fixed maximum-acceptable offer, thus securing that only sellers can change the price and end the negotiation. Using this simple and easy to implement bargaining script, we determine whether the seller's path of negotiation differs for men and women, and whether potential differences result from taste-based or statistical discrimination.

Specifically we study negotiations for taxi fares in Lima, Peru, using only busy and heavily trafficked routes during weekday morning hours. There are a number of reasons why we selected this particular market. First, the channels through which differential outcomes may arise are relatively limited. The market is characterized by free entry and is very competitive. Taxis are widely used and serve as a primary mode of transportation for both genders, resulting in men and women having experience negotiating for taxi rides. Thus there is limited room for taste-based discrimination and for statistical discrimination

[1] Existing bargaining studies either rely on free-form negotiations or on some sort of concession script where buyers either split the difference between the seller's and buyer's price, or follow a fixed concession path (see e.g., List, 2004; Ayres and Siegelman, 1995). A consequence of these approaches is that through interactions with the buyer, final prices may ultimately reflect differences in the seller's initial prices, hence final prices need not reflect the reservation price at which a seller is willing to trade.

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on the grounds of experience. Second, the taxi market is attractive because while the cost of a ride is small enough that trades can be executed in our study, it is nonetheless an economically relevant market, as taxi rides account for a sizeable share of household expenditures.[2] Third, the market is well suited for experimentation and for using a fixed-offer bargaining script. The full fare of a ride is determined through very short face-to-face negotiations, and naturally-occurring negotiations in the market reveal that both men and women rely on a fixed-offer bargaining script. In fact, of those who engage in multi-round bargaining, half of them (men and women) repeatedly state the same fixed-offer.

An interesting characteristic of our bargaining script is that for sufficiently low fixed-offers it will be viewed as demanding. Recent research suggests that a demanding negotiation may reduce the seller's willingness to trade, and it has been argued that such a response may vary by gender. Hence while competition may reduce the role of taste-based discrimination, the demanding fixed-offer bargaining script may give rise to a different type of taste-based discrimination than typically examined.[3] What is less clear from the existing literature is whether men or women will be at a greater disadvantage when using a demanding bargaining script. On one hand, it has been shown that assertive and demanding negotiations for jobs result in a negative backlash against women. On the other hand, it has been argued that men perceive negotiations by males as competitive, and this has been used to explain recent evidence that male-to-male negotiations are more likely to fail than male–female negotiations.[4] As all taxi drivers in the market are male, our study will help determine whether in a competitive market there is evidence that professional males differ in their treatment of males and females who engage in demanding bargaining.

Statistical discrimination may however also play a role in the market. Similar market experiences imply that it most likely will result from passengers differing in their value distributions. In classifying the type of behavior that would be consistent with statistical discrimination, we note that the taxi market in Lima is characterized by sequential bargaining and repeated matching. A driver who is matched with a potential passenger engages in sequential bargaining, and in the event of an impasse, both the driver and the passenger return to the market in search of another match. Relying on the work by Samuelson (1992) as well as Fudenberg et al. (1987), we expect that heterogeneous agents will engage in haggling. Drivers screen high-valuation passengers by first quoting a high initial fare and then lowering their price as they become increasingly pessimistic in their assessment of the passenger's valuation, eventually reaching a point of agreement or disagreement. Using a simple theoretical example we demonstrate that the driver, when faced with a passenger who is perceived to be a high-valuation buyer, may use both initial prices and rejection rates to pressure the passenger to accept a high price. Specifically passengers drawn from a distribution with higher valuations may be faced with higher initial prices and rejection rates.

Our results reveal first that the market is very competitive. When our trained passengers hail a taxi, we find that two-thirds of the time a second taxi will pull up behind the first taxi to wait for the negotiation to fail, and as evidence of market thickness, the presence of this second taxi does not affect prices at the first taxi. Second, the fixed offers used in the study were both low enough to trigger negotiations and rejections, and high enough to secure agreements. While only 3% of initial prices coincide with the maximum-acceptable-offers, almost a quarter is within one sol of being acceptable, and a third of the negotiations ultimately end with the driver accepting the passenger's offer. Third, despite using identical bargaining scripts, drivers do not treat male and female passengers the same. In sharp contrast to previous studies, the bargaining outcomes for women are superior to those for men. Women are quoted lower initial prices, and conditional on maximum-acceptable offer, they are less likely to be rejected by the driver. That is final prices are higher for men than they are for women. The observed gender differences are consistent with drivers perceiving men to be high-valuation passengers and engaging in statistical discrimination. However, these differences are also consistent with drivers having a relative preference for female passengers and engaging in taste-based discrimination. Admittedly the type of taste-based discrimination needed to explain the results is the opposite of that needed to explain previously observed gender differences. Nonetheless, as with any taste-based model, it is not difficult to provide examples of preferences that are consistent with the differential treatment. In particular the observed difference is consistent with the finding that a greater competitive drive for men reduces the likelihood that male-to-male negotiations succeed. That is the demanding fixed-offer bargaining script may be perceived as more offensive when used by males.

To identify the source of the gender gap, we conduct a second experiment where passengers, prior to negotiating, send a signal on their valuation. In this second study we take advantage of the fact that it is common for a second taxi to queue up behind an initially hailed taxi to wait for the first negotiation to fail. In the instances where a taxi is waiting behind the first taxi, it is therefore possible to send a signal to the second taxi. As in the first study, passengers in this second signaling study were instructed to first hail a taxi and ask for the price to a destination. They were then to visibly reject the first taxi and proceed to negotiate with the second queued taxi, using the fixed-offer bargaining script of our first study. The rejection of the first taxi was intended as a signal of the passenger's low valuation. As rejection is more costly for a high-valuation passenger, this manipulation helps identify the source of the differential treatment. Specifically, if the initial gender differences resulted from statistical discrimination of what is perceived to be a high-valuation male, then the rejection of the first taxi is predicted to reduce the gender difference at the second taxi. By contrast standard taste-based discrimination would predict that the gender gap remains constant. The data from the signaling experiment reveal that the initial prices at the first taxi replicate those of our first study, with men systematically being quoted higher initial prices. However this result changes at the second taxi. We find no gender differences in bargaining outcomes at the second taxi; men and women are quoted the same initial and final price, and they are rejected at the same rate. Whatever the source of the gender differences at the first taxi, these differences are eliminated at the second taxi.

[2] The design of existing studies on gender differences in bargaining rarely results in transactions either because the item is too costly (e.g., negotiations for new cars as in Ayres and Siegelman, 1995) or because the incentive to trade is limited (e.g., in List, 2004, agents bargain over sports cards and receive a payment of $10 for completing the study plus the surplus of potential trades relative to a set reservation price. Evidence of a limited incentive to trade may be seen from final sales prices being three times larger than purchase prices, $104.7 versus $36.2, with only 3% of negotiations resulting in trade).

[3] Evidence of the role of competition is seen in Doleac and Stein (2010). Looking at online ads for iPods they find less buyer interest when the iPod is held by a dark- rather than light-skinned hand, however evidence of differential treatment decreases in more competitive markets. Ayres et al. (2012) extend this work to an auction environment examining sales of baseball cards on eBay. Neither of these studies identifies the source of differential outcomes, nor do they examine bargaining.

[4] Bowles et al. (2007) document negative backlash against women in negotiations for jobs. The social psychology literature suggests that negotiation is more difficult and produces fewer mutually beneficial agreements when parties have a history of competition or have a competitive reputation (see De Dreu, 2010 for a review). Gender differences in competition (e.g., Gneezy et al., 2003; Niederle and Vesterlund, 2007; Gupta et al., 2013; and for reviews Niederle and Vesterlund, 2008, 2011; Croson and Gneezy, 2009) may thus explain the finding that bargaining is more likely to fail in male–male than in male–female bargaining (Eckel and Grossman, 2001; Sutter et al., 2009).

While the presence of a gender gap at the first taxi and the absence of one at the second taxi are consistent with statistical discrimination, it is not explained by a standard model of taste-based discrimination. If taste-based discrimination is the explanation of the initial gender gap, then we should see a gender gap at both the first and the second taxis. Nonetheless to fully examine the possibility of taste-based discrimination we also explore the possibility that only first taxis discriminate based on taste. A closer look at the data reveals that men at the first taxi are given a higher initial price and higher rejection rate than at the second taxi, while the treatment of women does not differ between the two taxis. Thus the initial gender gap is consistent either with statistical discrimination of high-valuation male passengers or with the first (and not the second) taxi engaging in taste-based discrimination against males.

This more precise characterization of the source of differential treatment allows us to derive opposing comparative statics for how each of these two models predict that the gender gap responds to changes in market conditions. Testing these we find that behavior only is consistent with statistical discrimination of male and female passengers. Our study suggests that the market becomes 'gender blind' at the second taxi because the statistical inferences on men and women are the same.

The paper contributes to the existing literature by examining gender differences in the limiting case of a competitive market where equally experienced agents engage in demanding fixed-offer negotiations. We find that in this competitive market there is no evidence that a potential penalty for a demanding negotiation varies by gender. While the observed differential treatment cannot be explained by taste-based discrimination, it is consistent with sophisticated statistical discrimination. Note that in contrast to past studies the identification of the source of differential treatment is secured within the market of interest, hence we are able to address the concern that taste-based discrimination may be implicit and therefore sensitive to the stress and time pressure of the market in which it arises.[5] Another advantage of our study is that the ultimate identification of the source of differential treatment is secured off of opposing comparative static predictions.[6]

We begin the paper by characterizing the market of interest. We then present the experimental design and the behavior expected in our study. Our results from the first experiment are presented and followed by a discussion of the possible explanations for the observed differences. We then proceed to the signaling experiment, which allows us to determine whether the observed gender differences result from statistical or taste-based discrimination.

2. Why the taxi market in Lima?

There are several reasons why we used the taxi market in Lima, Peru, to conduct our experiment. First, the characteristics of the market correspond well with the limiting case of interest, that is, the market is highly competitive and both male and female passengers have substantial experience.[7] Second, the nature of the negotiation makes it well suited for experimentation and for using a revealing fixed-offer bargaining script. Third, the market plays a central role to households in Lima and the cost of an unsuccessful negotiation is substantial for both passengers and drivers. We justify each of these claims below.

Let us first justify the claim that the market is very competitive and both men and women are experienced. The taxi market in Lima is mostly unregulated and there is no limitation on the number of taxis. Legislation was passed in the early 1990s which allowed any person the right to provide public transportation. Combined with a large reduction in public employment and an influx of reconstituted cars, the number of taxis and drivers increased dramatically. While there are taxis on the streets that have gone through licensing by the government, roughly 50% of the taxis are unlicensed (JICA, 2005).[8] According to the Metropolitan Transportation Commission there are about 200,000 taxis in the city of Lima. By comparison, New York City has 53,000 licensed taxis and a population of 8.3 million people. Thus with a population of 7.7 million, the number of taxis is four times larger in Lima.[9] Taxis account for an astonishing 28% of all motor vehicles on the road and there is approximately one taxi for every 12 working adults in Lima.

Indicators of the fierce competition in the market are that taxi drivers, in hope of a failed initial negotiation, commonly will pull up behind a taxi that is in the process of negotiating with a potential passenger, and that taxi drivers spend about half of their time empty and driving around looking for passengers (JICA, 2005). Another indicator is the low earnings of the taxi drivers. Despite working an average of 13 hours per day, a driver's net daily earnings are between 30 and 50 soles which correspond to the minimum daily wage.[10]

While competition reduces the role for taste-based discrimination, the role of statistical discrimination is reduced by passengers (male and female) being very experienced. Taxis are a common mode of transportation for most segments of the population. People take taxis to work, students take them to school and parents take them to go shopping or to drop off children (JICA, 2005). Taxis are used by a representative sample of the population and are used by both men and women. This is in part a reflection of the fact that many people do not own a car in Lima. According to a national survey (Encuesta Nacional de Hogares, 2009), only 17.8% of households in Metropolitan Lima have an automobile, and many of these households use them for business purposes rather than as a mode of transportation.[11] With taxis providing

[5] Recent studies rely on auxiliary analysis to rule out that differential outcomes arise from taste-based discrimination. E.g., Fershtman and Gneezy (2001) and List (2004) use responses in dictator games to show that discriminating agents are not predisposed to engage in taste-based discrimination. Bertrand et al. (2005) however argue that discrimination may be implicit and sensitive to the cognitive load of the market. This suggests that the taste elicited in say a dictator game may not be reflective of that observed in the market of interest. As other examples of within-market identification Gneezy et al. (2012) show that differential treatment of disabled drivers is eliminated when disabled drivers state that they will look around for other options. See also Goldin and Rouse (2000).

[6] The difficulty associated with determining whether differential treatment arises from taste or from statistical inference on payoff relevant information results from the two models generating the same comparative statics. Hence the residual found in labor market studies when controlling for productivity relevant factors may result from taste-based discrimination, or from an inability to control for all relevant productivity differences. A similar problem arises in audit studies where some but not all productivity characteristics can be manipulated (Heckman, 1998). Manipulation of productivity relevant information is more easily achieved in laboratory studies (see e.g., Castillo and Petrie, 2010).

[7] As noted by Heckman (1998) taste-based discrimination is only eliminated in the long run if the supply of drivers is perfectly elastic at zero price. See also Charles and Guryan (2008, 2011) for a careful examination of the role of taste-based discrimination in markets. While perfect competition does not eliminate taste-based discrimination, the driver's small daily earnings make it less likely that they are able to cater to such tastes.

[8] Estimates on the level of informality in the market vary. According to *El Comercio* of November 6, 2010, the number of illegal taxis in Lima is 32%.

[9] This number is much larger than what a city this size can handle. In 2007, the President of the Peruvian association of drivers (Fechop) estimated the optimal number of taxis should be about 25,000.

[10] There are two types of taxi drivers: those that own their car and those that rent. Approximately half of the authorized drivers own their car. For those that rent, drivers pay a fixed rental fee, between 30 and 60 soles ($10–$20) per day, they pay their own gas and keep the money from fares. The types of cars used for taxis are quite diverse. It is common to see Korean TICOs and Japanese sedans and station wagons some of which have had their steering wheel switched from right to left. Our passengers were instructed not to hail the small and less expensive TICOs.

[11] By comparison 46% of households in New York City own cars (www.streetsblog.org/2011/04/06/new-yorks-car-ownership-rate-is-on-the-rise/).

an average of 20 rides per day the estimated number of rides per day is 3 to 4 million. According to the 2007 Peruvian census, metropolitan Lima has about 1.8 million households. Assuming that a taxi passenger takes two rides per day this corresponds to one member of every household taking a taxi every day.

Since taxis are widely used, and the current conditions of the market have been in place for at least 15 years, it is reasonable to argue that this is a market where both male and female passengers are experienced. Thus the role of experienced-based statistical discrimination is limited relative to previously examined markets. That being said, drivers are also very experienced and it is not unlikely that they engage in statistical discrimination to extract rent from high-valuation passengers.[12]

The second attraction of this market is that the nature of negotiations is such that we have substantial control over both the negotiated item and the manner in which the negotiation is conducted. The negotiated item is well defined and solely involves agreement on a fare to secure transportation from one point to another.[13] Taxis do not have meters, prices are not fixed by route or zone, and the fare is determined entirely by a face-to-face negotiation. As there is no tipping, the negotiated price captures the entire cost of the fare. Furthermore negotiations are very quick and involve limited verbal exchange. Negotiations are conducted entirely through the window of the taxi while the passenger is still standing on the street. The passenger does not get in the taxi until an agreement has been reached. These characteristics make it easy to manipulate and control the negotiation as we can provide a short, natural, and gender-neutral negotiation script. In particular we are able to rely on a revealing fixed-offer bargaining script where passengers insist on a low fixed-offer. This script helps identify the seller's entire path of negotiation, including the price at which a driver is willing to accept a particular passenger. Furthermore the script arises naturally in the market and appears to be gender neutral.[14] To document that this indeed is the case we recorded 113 naturally occurring negotiations in the market.[15] Of these we found that at least 17% of women and 14% of men appear to follow a fixed-offer bargaining strategy. Conditioning on negotiations that lasted two or more rounds, we find that 50% of men and 47% of women used fixed offers.

A third and final advantage of the market is that it plays a central role to households in Lima. Despite each negotiated fare being relatively small, the stakes involved in the negotiations are large. Transportation is an important component of the consumption basket for households. The Peruvian Institute of Statistics finds that an average household in Lima spends about 8.8% of their monthly budget on transportation services. According to the IMF, the average per capita monthly income in Peru is about 950 soles. Hence a person who spends 5 soles in taxis daily will consume about 16% of their monthly income on taxis alone. This suggests that passengers have a substantial incentive to bargain for the best possible price. The same holds for the taxi driver, as each successful negotiation represents 5 to 7% of their daily income.

In sum, the Lima taxi market is an attractive environment for examining whether professional male taxi drivers, despite the competitive market and the substantial experience of the passengers, differ in their treatment of male and female passengers who rely on a demanding fixed-offer bargaining script.[16] In examining a market where the sources of differential treatment are limited, we are better able to identify the extent to which drivers engage in statistical discrimination to extract revenue from high-valuation passengers.

3. Example

To get a sense of the differences that may arise from statistical discrimination, we examine a simple theoretical example, which captures the main characteristics of the market we examine. The salient feature of the market under study is sequential bargaining and repeated matching. Buyers and sellers meet, negotiate sequentially until they reach an agreement, or return to the market in search of a suitable match. Samuelson (1992) shows that in a market where bargainers are matched randomly it is possible that disagreement occurs even when gains from trade are common knowledge. The reason is that the negotiating parties may reach a point where the return from a new match exceeds that of the existing match.[17] Fudenberg et al. (1987) demonstrate that haggling, when it is possible to bargain with a sequence of agents, occurs only when transaction costs are sufficiently high. Intuitively, when the seller's cost of finding a new buyer is low, the seller prefers negotiating with a new buyer over continued negotiation with a buyer that has revealed a low willingness to pay. While sellers with low switching cost will charge either a low price or a high take-it-or-leave-it price, sellers with high switching cost may engage in haggling. We draw on both of these models to build an example that shows how bargaining and screening may play out in our environment. Using a model of sequential bargaining and random matching, we start with an example of only one population. We then extend the example to two identifiable populations to demonstrate the comparative statics that may be expected from statistical discrimination in our environment.

Consider a market with an infinite number of buyers (denoted B) and sellers (denoted S). At each time, $t=1,2,\ldots$, buyers and sellers are matched randomly. Sellers are matched with a buyer with probability $\theta_S(\theta_S<1)$ and buyers are matched to a seller with probability $\theta_B(\theta_B<1)$. Parameters θ_S and θ_B represent the level of friction in this market and capture the transaction cost of reaching a bargaining impasse. Sellers are assumed to produce the good at a cost of zero. Buyers' valuation of the good is either $\overline{v}$ with probability π or $\underline{v}$ with probability $1-\pi$. Buyers' valuation of the good is private information. For the sake of the example, we assume that $1<\underline{v}<2<\overline{v}<3$ and that prices can only take integer values. The distribution of buyer's values and the cost of production of the seller are common knowledge. Buyers and sellers discount each period according to discount factors δ_S and δ_B with $0<\delta_i<1$ for $i=B,S$. If a seller is matched with a buyer, the seller quotes a price p that the buyer can accept or reject. If the buyer accepts, the buyer earns $v-p$ and the seller earns p. Both agents leave the market and are replaced by identical replicas. If the buyer rejects, the seller and then the buyer have to sequentially decide whether to continue negotiating or return to the pool of unmatched agents. Matches are broken if a matched agent decides to leave the match. If agents remain matched, the seller lists a second price that the buyer can either accept or reject. This process is repeated until they either reach an agreement

[12] Being a taxi driver is the main occupation for 90% of taxi drivers (JICA, 2005).

[13] Minimizing the ambiguity about the negotiated item reduces the likelihood that men and women are expected to achieve different negotiation outcomes (Bowles et al., 2005).

[14] As noted by Goldberg (1996) it is problematic to hold the bargaining script fixed if different classes of buyers do not act the same. There are a number of reasons why this is less of a concern in our study. Not only are both men and women found to use the script, but also more importantly in our study 2 we find that using the same bargaining script the differences observed at the first taxi (study 1) are eliminated at the second taxi in study 2.

[15] Men and women were equally likely to hail our confederate taxi drivers.

[16] Two recent studies also examine behavior in the taxi market. Keniston (2011) examines the market for local auto-rickshaw transportation in Jaipur, India, to identify the welfare implications of bargaining relative to giving passengers the option of a fixed price. Balafoutas et al. (2011) instead examine the taxi market in Greece to study fraud.

[17] The lowest valuation of a buyer is higher than the highest cost of a seller.

or the match is broken. If they remain matched, but never reach an agreement, both agents receive a payoff of zero.

In this model agents cannot learn about the agents they have not interacted with and the environment remains stable. Samuelson (1992) characterizes two types of equilibria which may arise depending on the value of π.[18] There is an equilibrium in which sellers list a price of 1. In this equilibrium all buyers accept the price of 1, but reject a price of 2. There is another equilibrium in which sellers make a take-it-or-leave-it offer of 2 that only buyers with value $\overline{v}$ accept. Sellers enforce screening by abandoning negotiations after observing a rejection. Relying on the insights of Fudenberg et al. (1987), it is also possible to construct an equilibrium where haggling occurs. For instance, there is a haggling equilibrium in which sellers state a price of 2 as soon they are matched with a new buyer. Sellers then randomize between switching to a price of 1 and abandoning the negotiation. This equilibrium requires that sellers are indifferent between listing a price of 1 and leaving the negotiation. This is possible if the price of 2 is accepted by buyers with value $\overline{v}$ with probability $p=\frac{1-\delta_S}{(2-\delta_S)\cdot\pi}$ (see Appendix A for derivation). For a buyer with value $\overline{v}$ to be indifferent between accepting a price of 2 and waiting for prices to drop to 1, the seller and buyer must remain matched and the seller must drop prices to 1 with probability $q=\frac{\overline{v}-2-\delta_B\cdot V_B(\overline{v})}{(\overline{v}-1-V_B(\overline{v}))\cdot\delta_B}$, where $V_B(\overline{v})$ is the equilibrium payoff of a buyer with value $\overline{v}$.[19]

The equilibrium with haggling requires that the portion of high-valuation buyers is sufficiently large $\pi>\frac{1-\delta_S}{2-\delta_S}$ and the take-it-or-leave-it equilibrium requires an even larger portion of high-valuation buyers in the market $\pi>\frac{1-\delta_S}{(2-\delta_S)\cdot\theta_S}$. The result is intuitive. Sellers may engage in haggling as a way to screen buyers when the likelihood of finding a high-value buyer is sufficiently high, but they may find it profitable to completely screen out low-valuation buyers if the fraction of high-valuation buyers is even higher.

Next we consider the case where there are two different and identifiable groups of buyers, Group 1 and Group 2. Since the haggling equilibrium requires the seller to be indifferent between offering a price of 1 and stopping the negotiation, both the price and the rate of rejection can be used to statistically discriminate. The seller may reject buyers of one group more often in an attempt to extract larger prices from them. For instance, suppose that members of Group 1 have valuations that take values $\overline{v}_1$ and $\underline{v}$ and that members of Group 2 have valuations that take values $\overline{v}_2$ and $\underline{v}$ only. Suppose further that $1<\underline{v}<2<\overline{v}_2<3<\overline{v}_1<4$ and the proportion of high types in each group is high enough for a haggling equilibrium to exist for each group independently. It is clear that, regardless of the proportion of buyers belonging to Group 1 and Group 2, if sellers are randomly matched to members of these groups there will be an equilibrium of the game where sellers start negotiation with Group 1 at price 3 and start negotiations with Group 2 at price 2. Moreover, since a mixing equilibrium requires that $\overline{v}_1-3=(\overline{v}_1-1)\cdot\delta_S\cdot q_1+V_B(\overline{v}_1)\cdot(1-q_1)$ and $\overline{v}_2-2=(\overline{v}_2-1)\cdot\delta_S\cdot q_2+V_B(\overline{v}_2)\cdot(1-q_2)$, where q_1 and q_2 are the probabilities that prices drop to 1 for Group 1 and Group 2, respectively, it follows that it is possible that in equilibrium $q_1<q_2$. Thus the high-valuation Group 1 may face higher prices and a lower probability that the negotiation continues and prices drop in the next period (i.e., they face higher rejection rates).

Finally, note that the model also allows for differential treatment when the distribution of values across populations is identical but the members of Group 1 and Group 2 differ in their discount factors or cost of switching to a new match. Members for whom delay is more costly are more likely to be rejected and less likely to receive a discount. Differential treatment will be possible even if sellers are trying to extract the same set of prices from both groups. Thus conditional on receiving the same prices members of the different groups may face different rejection rates.[20]

In sum, haggling is likely to occur as sellers use prices and rejection rates to extract higher prices from high-value buyers. High-value buyers may face higher initial offers and rejection rates. Moreover, differences in rejection rates may persist even when buyers face the same sequence of price offers.

4. Experimental design

The protocol of our experiment is as follows. Six men and six women are trained to be 'taxi passengers.' They negotiate for a predetermined taxi fare to travel from one destination to another. Passengers are instructed to negotiate for and travel along a number of different routes. Each route consists of three locations, that is, they travel from destination A to B, then from B to C and then return from C to A. Passengers travel in the reverse direction as well.

At each location they hail a taxi at random, approach the passenger window and ask: "How much would it cost to go to X?".[21] After the taxi driver quotes a price, the 'passenger' follows a fixed-offer bargaining script by stating an experimenter determined price $p_{\max}$. We will refer to $p_{\max}$ as the "maximum-acceptable offer." The specific response to the taxi driver's price is nothing other than $p_{\max}$. There is no other dialogue. The passenger repeats this response after each price from the taxi driver and continues until either the taxi driver accepts the price or leaves in disagreement. Thus only the driver can change the price and terminate the negotiation. If the first price quoted by the taxi driver is $p_{\max}$, then there is no further negotiation. If the driver accepts the passenger's offer, the passenger takes the taxi to the predetermined destination. If the offer is rejected and the taxi leaves in disagreement, the passenger is instructed to step away from the street, take out a cell phone as if they just received a call, and wait for the street to clear of any taxis that might have seen that the passenger's last negotiation ended unsuccessfully. From the passenger's perspective, any subsequent negations can therefore be perceived as fresh. Passengers who, after a period of time, failed to reach the predetermined price for travel to a location were instructed to take a taxi (at a possibly higher price) to the next location.[22] This protocol permits us to obtain observations for all passengers on all routes across the morning.

Our negotiation script limits the responses one may expect to see from passengers in the market. The leftmost panel in Fig. 1 presents the structure of a standard negotiation. Taxi drivers state a price after learning the intended destination. Passengers then decide whether to accept this price, continue negotiations and make a counteroffer or leave the negotiations altogether. After this, taxi drivers decide whether to accept the counteroffer, leave or make a counter-counter-offer. Our design is based on this standard procedure with the modification that only taxi drivers end the negotiation and our passengers are instructed to solely state a maximum-acceptable offer $p_{\max}$. The bargaining structure of our study is represented in the rightmost panel of Fig. 1.

There are several reasons why we selected this very simple bargaining structure. First, the bargaining approach is similar to that used in the market. It is common practice for customers to approach

[18] We assume that high-valuation buyers prefer to wait for a lower price (i.e., $\overline{v}-2<\delta_B\cdot(\overline{v}-1)$). This allows us to construct the haggling equilibrium below.

[19] Of course it is also possible to obtain a haggling equilibrium if some buyers strictly prefer to obtain the good sooner at a price of 2 rather than waiting for a price of 1. In this case neither buyers nor sellers need to randomize (see e.g., Fudenberg et al., 1987).

[20] The equilibrium with haggling can also be extended to allow for heterogeneity of sellers' cost of production.

[21] To secure comparable taxis we instructed passengers to only hail taxis and not to approach taxis that were waiting.

[22] These observations are not included in our data.

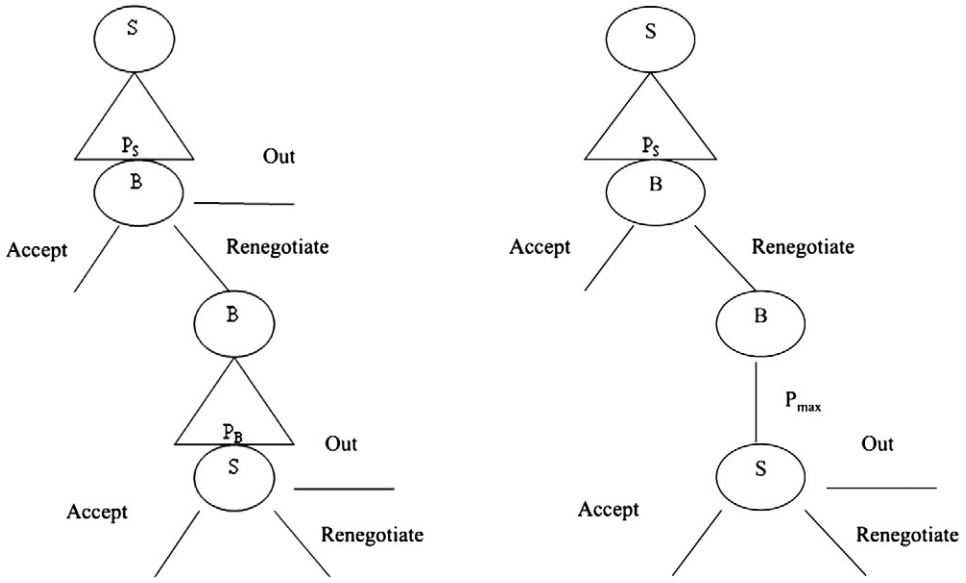

Fig. 1. Structure of bargaining in the taxi market.

the passenger-side window and ask for a price with the expectation that some negotiation will ensue. Second, as noted earlier while there is substantial variation in how passengers respond to the driver's stated price in the market, the strategy of simply responding with a maximum-acceptable offer is commonly used by both men and women. Third, the limited language of the script makes it easier for our passengers to follow the instructions of staying as neutral as possible, avoiding facial expression and intonation.[23]

Finally and most importantly, the script along with passengers completing the transaction allows us to observe the entire path of negotiation. In particular we are able to determine whether the driver's initial price is the same for men and women, whether the response to gender differs over the course of the negotiation and ultimately whether men and women are equally likely to be rejected by the driver. That is our script enables us to elicit reservation prices at which a driver is willing to accept male and female passengers.[24]

To get informative reservation prices and to secure demanding bargaining we wanted to use 'maximum-acceptable offers' which were low enough to trigger bargaining and rejections, yet high enough to be taken seriously by the driver. Consultation with several taxi drivers and taxi companies helped us select 'maximum-acceptable offers' which were meant to capture the lowest price a taxi driver would accept for a particular route.

To secure a competitive environment, we conduct the experiment at central and busy business locations between 8 am and 1 pm, Monday through Friday. Focusing on these hours helps secure that the objective of travel is comparable for men and women and that drivers have similar outside options.[25] We examine negotiations on 30 different routes over a total of 9 days. The distance between the three points on each route varied greatly. The two shortest routes were 1.2 miles and 1.6 miles long and the two longest routes were 3.8 miles and 3.9 miles long. We chose several routes and distances to ensure that the results are robust and not simply a reflection of a particular population of taxi drivers favoring certain routes.

The six men and six women passengers were chosen so that we have 'couples' for whom the primary difference is gender.[26] The two members of a couple are chosen to have similar age, appearance and height. All passengers are trained in the same way and by the same experimenters. All passengers dress alike to avoid attire that might signal personal characteristics. In particular, all participants wear dark pants and a plain, long-sleeve, dark shirt for the entire period of the study. Women do not wear make-up, and men are clean shaven. Neither of these characteristics differs from common attire or appearance in the market. Our trained passengers are paid 15 soles for transportation to the study and another 45 soles per day to conduct the study.

Each passenger carries a small notebook to keep a record of the prices of the negotiation, the time of the negotiation, car characteristics, market conditions etc. In addition they also carry an MP3 player that is used to record negotiations.[27] The recordings of the negotiations allow us to verify the passengers' recorded data and to reconstruct data in case of faulty note taking. The recordings also serve as a monitor that the passenger follows the experimental protocol. We verified the recordings, and all passengers followed the protocol.

5. Results

We begin by broadly characterizing the negotiations we observed in the market. Statistical discrimination suggests that drivers will use prices and rejection rates to screen high-valuation passengers. That is

[23] In longer and more complicated negotiations it is not only difficult to derive a gender-neutral bargaining script, but also to secure that no other information is revealed in the process of the negotiation. To better control for non-verbal cues in longer negotiations researchers have begun to instead rely on pre-recorded and carefully scripted negotiations, see e.g., Bowles et al. (2007).

[24] Importantly the reservation values need not reflect the seller's initial prices as the buyer's response does not in any way depend on the seller's initial response. Note that even a fixed concession script captures the seller's initial response.

[25] Our analysis nonetheless controls for route, time and direction of travel.

[26] Our study 2 helps substantiate this claim. While we find significant and robust gender differences in study 1, a signal on valuations is shown to eliminate all gender differences in study 2.

[27] The MP3 player has an external microphone that is clipped to the passenger's shirt or pocket and looks like the passenger listens to music. As in the U.S., many people in Peru walk around and listen to music on MP3 players.

we expect to see high initial prices which decrease as the driver becomes more pessimistic in the assessment of the passenger's valuation. Ultimately a subset of drivers is expected to reject the passenger because the maximum-acceptable offer falls below the driver's outside option or because the driver reaches a point at which he is indifferent between accepting and rejecting the passenger. Having characterized the general path of negotiation we proceed to investigate whether it is sensitive to the passenger's gender. If drivers perceive one group of passengers as being drawn from a distribution with higher valuations, then we may find that individuals from this group are given higher initial prices, higher final prices, and higher rejection rates.

5.1. Basic results

Our data consists of 1090 negotiations between a male driver and one of our 12 trained passengers. As expected the competition in the market was fierce. Our passengers reported that for 70% of the negotiations a second taxi pulled up behind the first taxi to wait for the first negotiation to fail. Interestingly prices quoted by the driver of the first taxi did not respond to a taxi waiting immediately behind him.[28] This absence of a response is perhaps an indication of both the passenger's transaction cost in moving from one taxi to the next and of the high concentration of taxis. Whether a taxi was waiting behind for a failed negotiation, alternate taxis were readily available in the vicinity of the locations we examined.

We begin by determining whether we succeeded in selecting maximum-acceptable offers which were low enough to trigger negotiations and potentially rejections, yet high enough to be taken seriously. Conditional on the route's maximum-acceptable offer, Table 1 reports the distribution of initial prices quoted by drivers. Note first that consistent with our example in 99.9% of the cases drivers only stated prices in integers.[29] Second, as an indication that prices were aggressively determined the driver's initial prices were never below the maximum-acceptable offer we used on the route, and only rarely (2.8%) did the two prices coincide. Evidence that agreement was within reach is seen from 22.5% of the initial prices being within one sol of being acceptable. Conditional on the maximum-acceptable offer, we see substantial variation in the initial prices passengers received. This heterogeneity is to be expected given that we are considering different routes at each offer, and that the market conditions and the driver's outside option are changing over the course of the day. The mode of the initial price is highlighted for each maximum-acceptable offer, and shows that the gap between the driver's initial price and the passenger's maximum-acceptable offer was most commonly 2 soles (38%). While a gap of 2 soles is the mode for routes with maximum-acceptable offers of 3, 4, and 6 soles, the 5 soles routes appear to have been priced more aggressively with a modal gap of 3 soles. Overall 40% of our negotiations start off with a 3 soles or greater gap between the driver's initial price and the maximum-acceptable offer.

Importantly the maximum-acceptable offers were low enough to trigger rejections. The last row in Table 1 reports the rate at which the passenger and driver failed to reach an agreement during the negotiation. Sixty two percent of the negotiations ended with the driver's final price being higher than the maximum-acceptable offer and the driver rejecting the passenger. The rate of rejection was largest on the 5-soles routes where the initial-price gap was largest.

Table 1
Distribution of initial prices by maximum-acceptable offer.[a]

Initial price	Maximum-acceptable offer				Total
	3	4	5	6	
3	7	0	0	0	7
4	18	9	0	0	27
5	**51**	100	9	0	160
6	20	**212**	31	5	268
7	19	128	51	66	264
8	3	57	**107**	**98**	265
9	1	5	21	20	47
10	0	4	24	20	48
12	0	0	1	1	2
13	0	0	0	1	1
15	0	0	0	1	1
Total	119	515	244	212	1090
Average initial price (SD)	5.3 (1.2)	6.3 (1.0)	7.7 (1.2)	8.0 (1.1)	6.8 (1.4)
Rejection rate	55.5%	63.9%	73.4%	50.5%	62.5%

Note: The highlighted bold entries indicate the modal price for each maximum-acceptable offer.

[a] Included in the 6 soles maximum-acceptable offer routes are also two observations where passengers (both male) incorrectly used a maximum-acceptable price of 7 soles. None of our results are influenced by this inclusion.

In examining the high rate of rejection in our study, it is important to note that rejections are common in this market. For comparison, we observed taxi negotiations at four of the locations and during the hours we examined in our study. The objective was to determine the rejection rates naturally seen in the market. Although we do not have information on prices or the pattern of negotiations, we can observe whether a negotiation ends with the passenger getting in the taxi or moving on to negotiate with a different taxi. Of the 211 initial negotiations we observed, 196 were negotiations when the passenger first entered the market (i.e., negotiating with the first taxi). We found that 28% of these new negotiations and 29% of all negotiations failed.[30] While this rate of failure is smaller than that observed in our study, it nonetheless makes clear that rejections are common in the market.

Our data reveal substantial differences in the length of the negotiation. Table 2 presents the outcome of the negotiations at each round. Here we define a negotiation round to consist of the driver asking for a price, the passenger responding with the maximum-acceptable offer and the driver deciding whether to accept or reject the passenger. In the first negotiation round (row 1) 20% of the passengers were accepted at the maximum-acceptable offer, 28% of passengers were rejected, and 52% negotiated for an additional round. As the duration of the negotiation increases the rate of rejection increases and it becomes less and less likely that the driver enters another round of negotiations.

While our trained passengers experienced substantial variation in the initial price and in the length of the negotiation, changes in driver prices were quite similar over the course of the negotiation. The driver's second price was most likely to be one sol smaller than the first, and discounts of two soles or more were only seen in 15% of the negotiations. Fig. 2 shows the price path for negotiations that lasted 2 or more rounds and those that lasted 3 or more rounds. The graph shows that average prices dropped about one sol from the first to the second round of negotiation and about 40 cents from the second to the third round, as many opt to restate the second-round price.

[28] A dummy indicating that there is a second waiting taxi during the negotiation does not significantly affect the initial offer and second offer. For the initial offer the coefficient on a second taxi dummy is 0.04 (p-value = 0.53), for the second offer it is −0.06 (p-value = 0.34). Both regressions include random effects for time, route, date and passenger. The gender effects shown in our subsequent analysis are not sensitive to the inclusion of a dummy for the second taxi.

[29] An initial price of 5.5 soles is pooled with the 6 soles initial price in Table 1.

[30] 156 of these negotiations were done by single men and single women (84 and 72 respectively). With the rates of failed agreement being 29.8% for single men and 23.6% for single women the difference is not significant (Fisher's exact test $p = 0.47$).

Table 2
Distribution of negotiation outcomes (row percentage in parentheses).

	Acceptances	Rejections	Renegotiations	Total
Round 1	221 (20)[a]	303 (28)	566 (52)	1090
Round 2	136 (24)	271 (48)	159 (28)	566
Round 3	44 (28)	90 (57)	25 (16)	159
Round 4	7 (28)	16 (64)	2 (8)	25

[a] As seen in Table 1, 30 of these round-1 agreements result from the driver proposing an initial price equaling the maximum-acceptable offer.

As indicated by the greater rejection rate on the more aggressively priced 5-soles routes, the outcome of the negotiation is sensitive to the gap between the driver's initial price and the passenger's maximum-acceptable offer. Fig. 3 shows the outcome of the negotiation conditional on the initial price differential. As noted earlier the modal price differential between the initial price and the maximum-acceptable offer was 2 soles. The probability of reaching an agreement decreases substantially with the gap in initial prices. When the initial gap in prices is 2 soles or less, 56.5% of negotiations end with the driver accepting the maximum-acceptable offer, however this percentage drops to a mere 8.9% when the initial price gap is 3 soles or more.

The aggregate data show that the selected maximum-acceptable offers were low enough to trigger negotiations and rejections, yet high enough to result in transactions. As expected the driver initially asks for a high initial price, then lowers the price and ultimately rejects the passenger when there are no gains from trade.

5.2. Gender differences

Next we examine whether the path of negotiations differs by gender. Recall that our experimental design aimed to minimize differences between men and women. The market is one where men and women are equally experienced; passengers were traveling on identical routes; they were dressed alike; they used the same gender-neutral bargaining script; and the driver's outside option of rejecting a passenger was independent of gender.

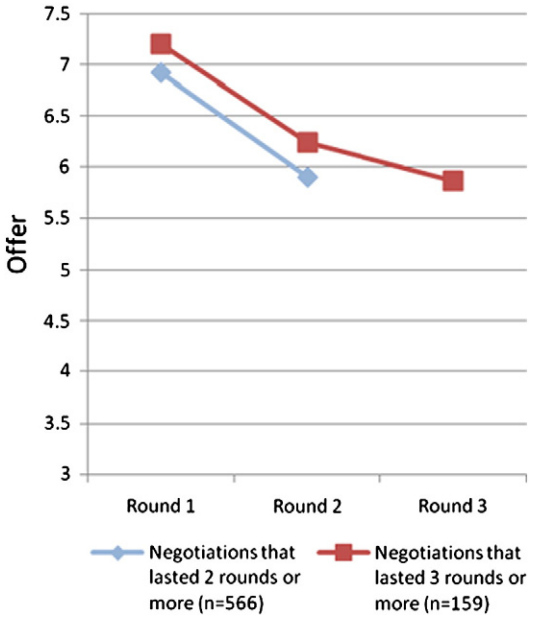

Fig. 2. Price path for negotiations.

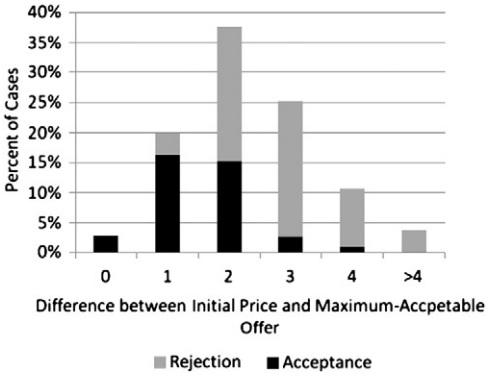

Fig. 3. Bargaining outcome conditional on difference between, initial price and maximum-acceptable offer.

We begin by examining whether the driver's initial prices varied by gender. In sharp contrast to previous studies, we find that men systematically are quoted higher prices than women including random effects for passenger, route, direction of travel, time of day, and day of the week. Table 3 column (1) shows that initial prices given to men were 0.22 soles higher than those for women.[31] With an average initial price for women of 6.76 soles this corresponds to a significant gender gap of 3.3%.

The gender gap in prices continues over the course of the negotiation. Table 3 column (2) reports the results for the driver's final acceptable price, that is the final price the driver stated as being acceptable to him (either the last price stated by the driver before he rejected the passenger or the passenger's maximum-acceptable offer in the event that the driver accepted the offer). As seen in column (2) the driver's final acceptable price for male passengers is on average 0.32 soles higher than for female passengers. With an average final price to women of 5.72 this corresponds to a gender gap of 5.6%.

In assessing the final price one should keep in mind that some of the included negotiations failed while others succeeded. To evaluate the gender gap in prices over the course of the negotiation, it is helpful to compare prices conditional on the negotiation reaching a particular negotiation round. Table 4 reports the gender gap in the first, second and third prices the driver stated. The difference of 0.22 soles for the first price is precisely that reported in Table 3 column (1). We see that the gender gap in prices remains for the second round of negotiations with men receiving prices which are 0.24 soles greater than those received by women. Perhaps as a result of screening the gender gap in prices is much reduced for the third round of the negotiation.[32]

Next we examine whether there are gender differences in the likelihood by which a negotiation ends in a rejection. We find that the rate at which negotiations fail is 68.5% for men and 55.3% for women. Conditioning on the maximum-acceptable offer we report the rejection rates by gender in Fig. 4. Independent of the maximum-acceptable offer, negotiations with female passengers are more likely to succeed. A substantial gender gap in rejection rates is seen for all but the 5-soles routes. The most likely explanation for the smaller gender gap on the 5-soles routes is that these routes were more aggressively priced and hence neither men nor women were likely to be accepted on these routes.

Table 5 reports the corresponding OLS regression when we include random effects for the individual passenger, routes, direction

[31] The results throughout the paper are qualitatively and quantitatively similar if we instead include fixed effect for the route, direction of travel, time of day, day of the week, and cluster on the individual passenger.

[32] Selection makes comparisons of the coefficients difficult. If we instead look at the 566 negotiations that lasted two rounds or more the gender gap on the first offer is 0.26 and 0.24 on the second offer. Of those who negotiate for 3 rounds or more 53% are women.

Table 3
OLS regressions on initial and last acceptable price.

Variables	(1)	(2)
	Initial price	Final acceptable price
Male	0.22	0.32
	(0.02)	(0.01)
Constant	6.22	5.31
	(0.00)	(0.00)
Observations	1090	1090

p-Values in parentheses. Date, time, route and passenger random effects.

Table 4
OLS regressions on prices across rounds by gender.[a]

Variables	(1)	(2)	(3)
	Initial price	Second price	Third price
Male	0.22	0.24	0.06
	(0.02)	(0.08)	(0.73)
Constant	6.22	5.46	5.56
	(0.00)	(0.00)	(0.00)
Observations	1090	566	159

p-Values in parentheses. Date, time, route and passenger random effects.

[a] Because men are rejected more frequently than women, the women in our study are spending more time riding taxis which in turn implies that a larger fraction of our negotiations are done by men. Using routes as the unit of observation, the average proportion of observations produced by men is 55.7% (SD 17.4, median 55).

of traffic, day of the week and hour of the day. The overall rejection rate for men is 11 percentage points greater than for women.

For simplicity we opt to present our results using linear regression analysis, however the results continue to hold when using other methods (e.g., conditional logit and count models). The results on prices and rejections are also robust to controls for the quality of the taxi and for whether another taxi is waiting behind for the negotiation to fail.[33] As a further test of robustness we find that the results are not driven by a particular couple of trained passengers. Recall that the experiment was designed such that the six men and women in our study could be placed into six pairs of a comparable male and female. Our results are robust to controlling for each of these couples as well as to us randomly dropping any one couple from the analysis.[34]

In summary we find that women are given a significant, substantial, and robust advantage over men. Not only do women face lower initial prices, but also they maintain this price advantage as the negotiation progresses. Despite making the same offer for a ride the driver is ultimately more likely to accept the female than the male passenger. Next we discuss what might give rise to these differences.

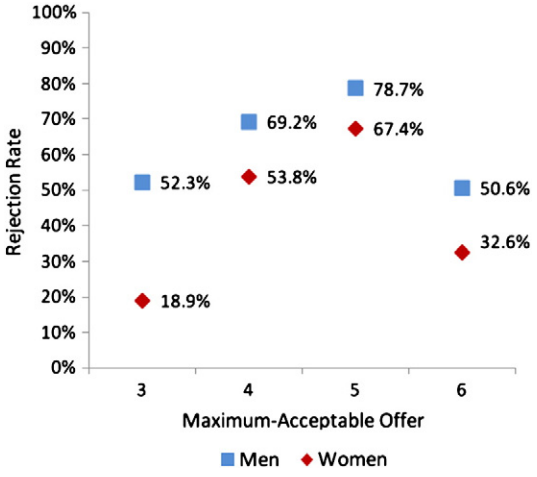

Fig. 4. Rejection rate by maximum-acceptable offer (using matching methods).

6. Explaining the gender difference in bargaining outcomes

As suggested by our analysis in Section 3 we find that drivers do not treat the two types of passengers the same. Consistent with drivers perceiving men to be high-valuation passengers, males are quoted higher initial prices and are ultimately rejected more frequently than females.[35] Finding that behavior is consistent with statistical discrimination however does not enable us to infer that this is what drives the differential treatment in our study.[36] The results may just as well be explained by taste-based discrimination. The higher initial prices and higher rejection rates for males are also consistent with drivers ranking the transportation of female passengers above that of males, be it because they benefit from having female passengers or because they find it costly to have male passengers.

In arguing that taste-based discrimination may explain the advantage given to women, it is interesting to note that the preference differential needed to explain our results is the opposite of that seen in the previous studies where women are placed at a disadvantage relative to men. Nonetheless it is not difficult to provide explanations for why drivers may have a relative preference for female passengers. It may be that women are perceived as being in greater need of a ride and that the driver out of altruism, empathy, or chivalry is more inclined to offer a ride to a female passenger. Or it may be that the driver prefers the company of women and therefore is inclined to accept their low offers. Alternatively the distaste for male passengers may result from the demanding negotiation by male passengers being viewed as more offensive, and thus causing the driver not to give into the male demand for lower prices.

Table 5
OLS regressions on rejection rate by gender.

Variables	Rejection rate
Male	0.11
	(0.03)
Constant	0.51
	(0.00)
Observations	1090

p-Values in parentheses. Date, time, route and passenger random effects.

[33] When controlling for a taxi waiting behind, the coefficients on the gender gap for initial price and rejection do not change. Controlling for the quality of the taxi (old, new or normal) also does not change the coefficients on the gender gap for initial price and rejection.

[34] The gender gap in initial price remains at 0.22 (p-value = 0.00) if we add dummies for each couple, and the gap in rejection rates is estimated at 0.12 (p-value = 0.00). Similar estimates are found if we drop one couple at a time from the analysis.

[35] To investigate negotiations by taxi riders we conducted a field study with the help of a taxi driver over a period of 2 and a half weeks. Similar to the study with taxi riders, the driver followed a script in which offers and counteroffers were gender neutral. The bargaining script was designed to extract information about passengers. Consistent with men having higher valuations we find that, across the 284 negotiations the average discount requested by men was 0.15 soles (p-value = 0.046) lower than those requested by women.

[36] Note that we cannot rule out the possibility that the higher rejection of men is caused by drivers viewing a low offer from a perceived high-valuation passenger as being unfair. Central to this argument however is, that the differential response is due to the passenger's perceived valuation.

We use our study 2 to directly test the role of taste-based discrimination, however our study-1 data provides no evidence that drivers are willing to sacrifice earnings to either secure a ride with a female passenger or prevent one from a male passenger. For example, if the driver benefits from having a female passenger then the benefit should be increasing with the length of the requested ride. However for routes that were longer than the median route in our study we find, if anything, that the gender gap is smaller on longer routes.[37] Similar evidence is seen when we look at the time the driver spent transporting passengers. If drivers enjoy the company of women, then they can extend it by selecting a slightly longer route. Regression analysis shows no significant difference in the duration of the trip.[38]

While our study-1 data do not provide evidence that it is likely that taste-based discrimination is the main source of the observed gender differences, as in previous studies identification is complicated by the fact that both models are consistent with the observed comparative static. To better evaluate the source of the differential treatment, we therefore use an additional experimental study which helps separate the two hypotheses.

7. Taste-based and statistical discrimination: a signaling experiment

To understand the role statistical and taste-based discrimination may play in causing the gender gap in bargaining outcomes, we conducted an experiment where passengers send a signal on their valuation to the driver. This second study takes advantage of the fact that second taxis commonly pull up to wait for the negotiation with the first taxi to fail. In the instances where a second taxi is waiting behind the first taxi, it is therefore possible for the passenger to send a signal to the second taxi. We first describe the design and predicted comparative statics of this second (signaling) study. We then examine whether the results are consistent with taste-based and/or statistical discrimination.

7.1. Experimental design and predictions

The signaling experiment follows a protocol similar to that in study 1. The main difference is that a passenger interacts with two drivers, instead of one. The procedure is as follows. The passenger hails a taxi at random. When the taxi pulls up, the passenger asks the driver, through the passenger side window, “How much would it cost to go to X?”. The driver states a price, and the passenger shakes his head, steps back from the taxi, and lets the taxi leave. The second taxi, waiting behind the first taxi that the passenger just rejected, pulls up to the passenger. The passenger approaches the taxi and asks “How much would it cost to go to X?”. The bargaining protocol then proceeds in the same manner as in our study 1. The passenger records the details of the negotiation, as well as the driver and vehicle characteristics of the first and second taxis.

The reason the passenger steps back from the first taxi and shakes his head is to show the second taxi that it is the passenger that rejected the first taxi (not the first taxi rejecting the passenger). This is the common manner in which taxis are rejected by passengers. In the event that no second taxi is waiting behind the first taxi, the passenger rejects the first taxi, takes out his cell phone, as if he received a call, and steps away from the street to let the traffic clear. Once any traffic that might have seen the previous negotiation clears, the passenger starts the process again.

Twelve passengers (6 men and 6 women) participated in a total of 488 negotiations for the signaling experiment. The routes, time of day, and maximum-acceptable offers were similar to those used in the first study. To secure that we have comparable observations across the first experiment and the signaling experiment, a subset of the observations were collected by having passengers alternate between the instructions for the signaling study and study 1. This secures that we have observations for the same individuals under both protocols and with the same market conditions.

What changes in initial prices and rejection rates do we anticipate at the second taxi? If the signal at the first taxi causes a significantly large decrease in the second driver's assessment of the passenger's valuation then we should see lower initial prices at the second taxi. What about the rejection rate? As noted earlier, the rejection rate is determined by the drivers' outside option, the passenger's perceived type and the passenger's maximum-acceptable offer. A driver should only wait for a passenger's bargaining impasse with the first taxi if he expects to reach an agreement with the passenger. This implies that the waiting taxi on average should have a lower outside option than the first taxi. Whether this results in a lower rejection rate at the second taxi depends on the extent to which indifferent drivers alter their rate of rejection.[39]

7.2. Results

For the portion of the study where passengers alternate between the study-1 and study-2 protocols, the data from the study-1 protocol confirm that men and women do not receive the same treatment. Male passengers are quoted higher initial prices and they are more likely to be rejected by the driver. Interestingly these gender differences disappear when the passenger rejects the first taxi and proceeds to the second taxi. Looking solely at the study-2 data, we see in Table 6 column (1) that the first taxi quotes men initial prices which are 0.30 soles greater than those given to women. With a mean initial price for women of 6.66 soles this corresponds to a gender gap in initial prices of 4.5%. As seen in column (2), this gender gap in initial prices disappears at the second taxi. The coefficient on male is essentially zero and it is not significant.

The gender gap in rejection rates is also eliminated at the second taxi. In the initial study-1 data we found that the rejection rate for men was 68.5% while that of women was 55.5%. At the second taxi we instead find a rejection rate of 61.5% for men and 59.7% for women, thus the rate of rejection does not differ by gender at the second taxi ($p = 0.69$).[40] Table 6 column (3) shows that this result is robust to including random effects for date, time, route and individual passenger.

[37] As routes with higher maximum-acceptable offers tend to be longer one can also see this pattern in Fig. 4 where the gender gap in rejection is not larger for rides with higher offers. Controlling for date, time and passenger random effects, a regression of rejection rate generates coefficients of 0.18 (p-value 0.002) on male, 0.05 (0.29) on a dummy indicating whether the trip was above median length, and −0.09 (0.104) on a male and length interaction term.

[38] The average duration of a trip for females was 12.08 min (SD 6.34 min) and 12.14 min (SD 5.41 min) for males, this difference is not significant (p-value > 0.8). Another reason to prefer female passengers may be that male passengers are perceived as more dangerous, or that the driver thinks that it is more likely that a male passenger will leave without paying the fare. There are a number of reasons why this is not a likely explanation for our results. First, the study was conducted during regular business hours, on very busy and public routes, and all of our passengers were well dressed and groomed. Second, if the passenger was viewed as dangerous the driver would have been better off not stopping to initially engage in the negotiation. Third, it is unlikely that a passenger who is planning to skip out on paying the fare would engage in negotiations in the first place. Finally, and most importantly the absence of a gender gap in study 2 demonstrates that a potential ‘concern’ for male passengers is eliminated at the second taxi.

[39] The rate of rejection is predicted to decrease at the second taxi if all drivers (first and second) accept passengers they are indifferent towards accepting.

[40] The more comparable rejection rates may be seen when passengers alternate between the two designs. For the study-1 part of the alternating protocols the rejection rate for men is 75.4 and the rejection rate for women is 59.4. For the study-2 part of the alternating protocols the rejection rate for men is 62.4 and the rejection rate for women is 58.0.

Table 6
OLS regressions on initial price and rejection rate (study 2).

Variables	(1)	(2)	(3)
	Initial price Taxi 1	Initial price Taxi 2	Rejection rate Taxi 2
Male	0.30	0.01	0.02
	(0.00)	(0.94)	(0.61)
Constant	6.52	6.56	0.59
	(0.00)	(0.00)	(0.00)
Observations	488	488	488

p-Values in parentheses. Date, time, route and passenger random effects.

Table 7
OLS regressions on change in initial price from taxi 1 to taxi 2 and rejection rate between studies 1 & 2.

Variables	(1)	(2)
	Initial price	Rejection rate
	Study 2	Alternating btw studies 1 & 2
Taxi 2	0.05	0.02
	(0.51)	(0.73)
Male	0.30	0.17
	(0.00)	(0.01)
Male × taxi 2	−0.30	−0.12
	(0.02)	(0.13)
Constant	6.52	0.54
	(0.00)	(0.00)
Observations	976	547

p-Values in parentheses. Date, time, route and passenger random effects.

Whatever the source of the gender differences at the first taxi, these differences are eliminated at the second taxi. This change in behavior sheds light on what may explain the initial gender gap. While the response is consistent with statistical discrimination, it makes it questionable that the study-1 gender gap resulted from taste-based discrimination. Certainly the results are not consistent with both first and second taxi drivers favoring female passengers. It is however consistent with a model where there is selection and only the first taxi engages in taste-based discrimination. While we find no evidence that the observable characteristics of first and second taxis differ, elimination of the explanation that only first taxis engage in taste-based discrimination calls for further analysis.[41] Specifically we characterize the nature of taste-based discrimination needed to explain our data. Given this characterization we then derive comparative static predictions from the taste-based and statistical discrimination models. Fortunately the two models give rise to opposing comparative static predictions which we can use to identify the source of the initial difference.

Under the assumption that taste-based discrimination by the first taxi explains our data, we first determine whether the differential response to gender at the first and second taxis is consistent with the first taxi having a taste for women or a distaste for men. Table 7 column (1) reports on the study-2 data and shows that initial prices at the first taxi are 0.30 soles higher for men than for women, and that the initial price to men at the second taxi decreases by precisely this amount, resulting in there being no gender gap in initial prices at the second taxi.[42] Thus moving from the first to the second taxi decreases the initial price to men, but does not affect the initial price to women. Because we do not observe rejection rates at the first taxi it is not possible to determine how it differs from that of the second taxi. However we can use our alternating protocol design to find comparable rejection rates for study 1 and study 2. Looking at the alternating protocol data Table 7 column (2) shows that men in the study-1 design face a rejection rate which is 17 percentage points higher than that for women, however this rejection rate decreases when negotiating with the second taxi in study 2. The rejection rate for men is 12 percentage points lower at the second taxi than it was at a comparable first taxi. The net result is that the rejection rates for women are the same at the first and second taxis, and that the gender gap in rejections is absent at the second taxi.[43] Looking at the second taxi as treating men and women the same, the differential treatment at the first taxi is seen not to result from superior treatment of women, but rather from inferior treatment of men. This demonstrates that if taste-based discrimination by the first taxi is driving the differential treatment, then it is caused by the first taxi discriminating against men.[44]

Of course the differential response to men between the first and second taxis is also consistent with statistical discrimination. If men are perceived to have higher valuations, then a signal to the contrary will cause the second taxi to have a lower assessment of the male passenger's valuation of the ride, potentially causing a decrease in the initial price and in the rate of rejection.[45] To determine whether statistical discrimination or taste-based discrimination against men by the first taxi best explains the data, we exploit the fact that the two explanations do not predict the same changes in the gender gap in response to changes in the market.

Not surprisingly the density and characteristics of the passengers change over the course of the morning. The market is most active in the early morning hours when passengers are traveling for work and school.[46] The population of male and female passengers is more homogeneous during this period, as they are both rushing to be at a certain place at a certain time and it is likely that high-valuation men and women both are present.[47] Later in the day the market

[41] The observable characteristics of the first and second taxis are very similar. The average age of the first taxi driver as assessed by our passengers is 38.3 years and that of the second is 39.6. Thirty-three percent of the time the first taxi is a sedan (40% for the second taxi), and 91% of the time the first taxi is either classified as an average aged or new car (88% of the time for the second taxi). Finally, 93% of the time the first taxi is classified as clean in appearance (94% for the second taxi).

[42] Testing the hypothesis that there is no gender effect (i.e., the sum of the coefficients on men and men × study 2 equals zero) reveals a *p*-value of 0.99.

[43] Testing the hypothesis that there is no gender effect (i.e., the sum of the coefficients on men and men × study 2 equals zero) reveals a *p*-value of 0.53.

[44] Alternatively it may be argued that in moving from the first to second taxi both men and women are perceived to have lower valuations, however the relative preference for women is eliminated once she rejects the first taxi (see Pope and Sydnor, 2011, for a discussion of these counteracting effects). While Table 7 does not allow us to rule out this knife-edge case, where updates on statistical and taste-based discrimination precisely cancel for females, the results in Tables 8 and 9 are not consistent with a persistent preference for females at the first taxi.

[45] The discrete price changes imply that we only will be able to capture sufficiently large changes in the seller's assessment of the buyer's valuation. If women initially were perceived to have low valuations, then we may not be capturing the slight updates that result from them rejecting the first taxi.

[46] According to a transportation survey (JICA, 2005) 80% of trips made during peak morning hours (7–9 am) are trips to work or school (split roughly equally between the two). As an indication of the high demand at 8 am hour we find that rejection rates are at their highest at that time, they are 68% at 8 am and 61% the rest of the morning. Furthermore, JICA (2005) reports that the proportion of taxis without a passenger is the lowest in the morning (26% 7–10 am, 39% from 11 am to 2 pm).

[47] To get a sense of the market we had pictures taken of passengers in our observational study. These pictures were ranked by income by 16 taxi drivers. Consistent with the argument above, male and female passengers traveling between 8 and 9 am were perceived to have higher incomes than those traveling at other times of the day. The scores were based on 1–10 Likert scales that have been standardized by rater (16 raters) and then averaged across raters to get a measure for each picture. Throughout the day men and women are equally likely to use taxis. The labor force participation rates of men and women in the markets under study are similar and high. For all the districts included in the study, the percent of the population that is economically active is 61% for men and 44% for women. If we restrict the sample to people aged 20–50 years the proportion who is economically active is 84% for men and 72% for women.

Table 8
OLS regressions on initial price over course of the morning (study 1).

Variables	(1)	(2)	(3)	(4)	(5)
	8 am	9 am	10 am	11 am	12 pm
Male	0.11	0.02	0.35	0.21	0.24
	(0.49)	(0.86)	(0.05)	(0.24)	(0.32)
Constant	7.03	6.46	6.06	6.01	6.40
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	221	237	246	268	118

p-Values in parentheses. The period 8–8:59 am is recorded as 8 am.
Date, route and passenger random effects.

Table 9
Gender gap in initial price comparing 8 am to 10–11 am (study 1). Using interactions of 8 am with all fixed effects (date, route).

Variables	(1)	(2)	(3)
	Miraflores	Leaving Miraflores	JICA
8 am	0.61	0.86	0.56
	(0.000)	(0.000)	(0.001)
Male	0.35	0.67	0.33
	(0.051)	(0.005)	(0.069)
Male × 8 am	−0.31	−0.95	−0.21
	(0.149)	(0.002)	(0.361)
Constant	6.83	6.47	6.35
	(0.000)	(0.000)	(0.000)
Observations	412	219	385
Number of routes	11	6	14

Date, route and passenger random effects. Miraflores = all routes that leave from or go to Miraflores. Leaving Miraflores = all routes that leave from Miraflores. JICA = all routes that are classified as being congested by the JICA (2005) report.

slows down and the population becomes more heterogeneous with some passengers traveling to meet certain appointments while others are traveling under less time pressure. These changes in the market help us derive opposing comparative statics for the two models.

Consider first how the cost of taste-based discrimination changes. The cost of engaging in taste-based discrimination against men is greater later in the morning when there are fewer potential passengers, and the cost is smaller earlier in the morning when demand is high and there are more high-valuation female passengers in the market. Thus taste-based discrimination against men (by the first taxi) is predicted to generate a larger gender gap in the morning, than later in the day.

By contrast statistical discrimination predicts a smaller gender gap early in the morning and a larger gender gap later in the day as the male and female passengers become more heterogeneous. When male and female passengers are more similar in their value distributions, we would expect a smaller gender gap, and this gap should be increasing as the population of passengers becomes more heterogeneous over the course of the morning.

Table 8 reports the gender gap in initial prices for every hour of the morning from study 1. As the sample at any given hour is reduced substantially, the gender gap is generally not significant. However it is interesting to note that while there is a large and systematic gender gap in initial prices at 10 am, 11 am and 12 pm, the difference is much smaller at the 8 am and 9 am time slot. The low gender gap during the morning hours is consistent with our prediction from statistical discrimination and inconsistent with the prediction from taste-based discrimination.[48] Consistent with the 8 am time slot being one of high demand we note that initial prices are higher for this time slot.[49]

To determine whether the gender gap is significantly smaller early in the morning, we focus on routes that are used primarily for commuting, both at peak times when there are many high-valuation passengers, and at non-peak times when the market is more diverse. Thus, we look at the change in the gender gap at the peak commuting time (8 am to 9 am) and nonpeak times (10 am to noon). According to the JICA (2005) report on traffic volume in various commuting locations across Lima, traffic peaks during the period of 8–9 am and drop precipitously during the 9–10 am time period.

The results are presented in Table 9. We regress initial price on gender and a dummy for peak time (8 am) and interaction terms of peak time and gender. The interaction term on male and peak time allows us to determine whether the gender gap seen at non-peak hours is significant at peak hours. To test the robustness of our results, we use three different criteria to select commuting routes. The first set is routes that start and end in the business and residential district Miraflores. Many people commute to and from Miraflores to go to work early in the morning and to come to shop later in the morning as businesses open. The second set of commuting routes is based on a stricter definition and only examines routes that originate in Miraflores. During peak hours these routes represent middle-class workers who need transportation to work, and during nonpeak hours the purpose of travel on these routes becomes more diverse when the shops in the area open for business. The final set of routes consists of routes that are determined to be congested and heavily used for commuting by a transportation survey of traffic in Lima in 2005 (JICA, 2005).[50]

As can be seen in Table 9, independent of how we define commuting routes, the gender gap in initial prices is smaller during peak hours (8 am–9 am) compared to nonpeak hours (10 am–12 pm). Restricting the sample to routes that are defined to be commuting routes under various criteria, we get the robust result that there is no gender difference during peak hours when the market is more homogeneous.[51] While the results from the two studies may be seen as evidence that the initial gender gap results from a rather unusual model of taste-based discrimination, a more careful analysis ultimately rules out this possibility. We find that the differential bargaining outcomes observed in the first study only are consistent with statistical discrimination.[52]

8. Conclusion

Substantial research has been done to understand differential bargaining outcomes by gender in markets, particularly the underlying causes of statistical or taste-based discrimination. Recognizing the inability to provide uniform answers to the source of differential outcomes, we ask instead what the source of differential outcomes is likely to be in highly competitive markets with

[48] Pooling the data from study 1 with those from the first taxi in study 2 reveals the same result, with the smallest gender gap occurring between 8 am and 10 am, a large and significant gender gap between 10 am and noon, and finally a slight drop in the gender gap at the noon hour.

[49] The mean initial offer is 7.38 (variance 1.77) at 8 am, 6.56 (variance 1.99) at 9 am, 6.72 (variance 2.12) at 10 am, 6.71 (variance 1.94) at 11 am, and 6.96 (variance 2.42) at 12 pm.

[50] The routes used in this classification have volume of roughly 2500+ cars passing in the area during the 8–9 am period.

[51] Testing the hypothesis that there is no gender effect (i.e., the sum of the coefficients on men and men × peak hour equals zero) reveals a *p*-value of 0.87 for Miraflores routes, 0.28 for Leaving Miraflores routes, and 0.60 for JICA routes.

[52] As further evidence of statistical discrimination, we find that the effect of moving from the first to the second taxi is largest at 8 am and then decreases over the course of the morning.

experienced agents. Relying on a fixed-offer bargaining script for buyers, we secure that the reservation price at which the seller is willing to trade is not inadvertently influenced by the buyer's response to the seller's initial prices, thus we are better able to identify differences in the seller's negotiation path.

Studying the highly competitive taxi market in Lima, Peru, we find that drivers are far from gender blind when presented with trained passengers who use the same bargaining script. In sharp contrast to previous studies, we find that men receive worse bargaining outcomes than those received by women. While these differences are consistent with statistical discrimination, it is not possible to eliminate the possibility that differences result from taste-based discrimination.

To disentangle the statistical and taste-based explanations, we therefore conduct an additional signaling experiment. Passengers in this study begin by rejecting a first taxi to send a signal of low valuation to a second (waiting) taxi which they then negotiate with. We find that men and women are treated the same at the second taxi, with the driver's path of negotiation being gender blind. While the differential response by the first and second taxis is easily reconciled with statistical discrimination that is not the case for taste-based discrimination. If the initial results were due to a taste-based bias, then this bias is not present at the second taxi. Thus the signaling result eliminates the possibility that a bias is expressed by all drivers in the market. The case under which we can reconcile the observed differences with taste-based discrimination is when the following three conditions hold. First, there is selection between drivers who become first and second taxis, second, only those who become first taxis engage in taste-based discrimination, and third, discrimination is driven by distaste for male passengers. That is taste-based discrimination is only consistent with our data if first taxis (and not second taxis) discriminate against men.

The attraction of characterizing the type of taste-based discrimination needed to explain the outcomes is that it enables us to derive opposing comparative statics for the two competing explanations. In doing so we are able to conclude that differential outcomes in this market result from statistical rather than taste-based discrimination. Thus we find that recent laboratory evidence of differential treatment of men and women who engage in demanding negotiations does not carry over to the competitive market examined here. Another advantage of our study is that identification is secured within the market of interest, hence we address the concern that taste-based discrimination may be implicit and therefore is difficult to assess by eliciting preferences.

Our results suggest that our competitive market becomes gender blind when the statistical inference on men and women becomes the same. One interpretation of our finding is that drivers in this market do not have preferences for the gender of the passenger that they are transporting. Another is that the competitive pressure and associated low earnings prevent drivers from expressing any bias they may have against a certain type of passenger. While perfect competition does not eliminate the possibility that agents engage in taste-based discrimination, the very low earnings of this market may make it unlikely that drivers can afford to cater to such biases.[53] Consistent with the standard interpretation of Becker (1975), we do not find evidence that taste-based discrimination occurs in this very competitive market.

Throughout the paper we have made clear that we selected the market for this study precisely because the characteristics were such that the channels for differential outcomes were reduced. While we anticipate that the results of this study will hold for markets with similar characteristics, it should not be a surprise if it fails to hold for markets with different characteristics. Failure to document taste-based discrimination in this market does not imply that it does not arise in others. The competitive pressure, the experienced agents, and the low earnings of the agents who may discriminate are likely to play a central role in markets where biases may be expressed.

Despite the heterogeneous and large number of taxi drivers who participate in this market, we find that on average they behave in a manner which is consistent with the type of sophisticated statistical discrimination predicted by Samuelson (1992) and Fudenberg et al. (1987). While competitive pressure need not eliminate the possibility that taste-based discrimination arises, it does appear that the low incomes that result from such competition make it unlikely that agents cater to such biases.

Appendix A

This appendix provides more detail on the construction of the equilibria included in the theory section. Unmatched buyers and sellers always search for a new match. The actions available to a seller if matched are to offer a price of 1 or 2 and to remain in the match or leave the match to search in the event that the price is rejected. The actions available to a buyer if matched is to accept or reject an offered price and to remain matched or leave the match to search conditional on the seller remaining in the match.

Table A1 reproduces the proposed equilibria in Samuelson (1992). Strategies depend only on whether the agents are matched or not. Samuelson (1992) shows that the *no return* equilibrium exists for all values of π. Denote by V_s the expected equilibrium payoff of a seller. A matched seller will offer a price of 1 if this is better than eventually returning to the pool of unmatched agents and obtaining $\delta_s V_s$. This will be the outcome if players follow the recommended equilibrium strategies since $V_s = \theta_s \cdot 1 + (1-\theta_s)\cdot \delta_s V_s < 1$. Given the strategies, it is also the case that after a rejection, both seller and buyer prefer to remain matched and trade at 1 than going back to the pool of unmatched agents and be matched again with less than certainty. Finally, since we assume that $\overline{v}-2 < \delta_B \cdot (\overline{v}-1)$, it follows that high-value buyers are better off rejecting an offer of 2 trading later at a price of 1.

In the *return* equilibrium, sellers offer a price of 2 and abandon negotiations if the buyer rejects the offer. The equilibrium requires that sellers find it profitable to return to the pool of unmatched agents after a rejection and obtain $\delta_s V_s$ rather than offering a price of 1 and obtaining $\delta_s \cdot 1$. It also requires that offering a price of 2 and obtaining an expected payoff of $\pi \cdot 2 + (1-\pi)\cdot \delta_s V_s$ is better than offering a price of 1 that is accepted by everyone. Since the expected payoff of the seller in this equilibrium is $V_s = \theta_s(\pi \cdot 2 + (1-\pi)\cdot \delta_s V_s) + (1-\theta_s)\cdot \delta_s V_s$, it follows that $V_s > 1$ implies that $\pi \cdot 2 + (1-\pi)\cdot \delta_s V_s > 1$. Given these conditions, this equilibrium is possible if $\pi > \frac{1-\delta_s}{2-\delta_s \cdot \theta_s}$.

In addition to these equilibria we also can construct a *haggling* equilibrium as the one discussed in the theory section. Let p be the probability with which a high-value buyer accepts a price of 2 when offered and let q be the probability with which a seller drops the price to 1 if the price of 2 is rejected. A seller is indifferent between dropping the price to 1 and searching for a new partner if V_s equals 1. p is the probability with which a high-value buyer accepts a price of 2 such that V_s equals 1. However, high-value buyers will be indifferent between accepting and rejecting an offer of 2 if $\overline{v}-2 = \delta_B(\overline{v}-1)\cdot q + V_b(\overline{v})\cdot(1-q)$, where $V_b(\overline{v})$ is the equilibrium payoffs of a buyer of value $\overline{v}$. Note that the above equalities imply that $p = \frac{1-\delta_s}{(2-\delta_s)\cdot\pi}$ and $q = \frac{(\overline{v}-2)-V_b(\overline{v})\cdot\delta_B}{(\overline{v}-1)\cdot\delta_B - V_b(\overline{v})\cdot\delta_B}$.[54] This implies that a *haggling* equilibrium can occur only if $\overline{v} < \frac{2-\delta_B}{1-\delta_B}$ and $\pi > \frac{1-\delta_s}{2-\delta_s}$. The *haggling* equilibrium can occur when a screening (*return*) equilibrium cannot.

[53] See Goldberg (1982), Heckman (1998), and Charles and Guryan (2008).

[54] In equilibrium, $V_B(\overline{v}) = \frac{\theta_B\cdot(\overline{v}-2)}{1-\delta_s+\theta_B\cdot\delta_s}$.

Table A1

Strategies of matched agents in period t:								
	Seller		Buyer with value $\underline{v}$			Buyer of value $\overline{v}$		
		Search if buyer rejects	Response to $p=1$	Response to $p=2$	Search if seller stays	Response to $p=1$	Response to $p=2$	Search if seller stays
No return	$p=1$	No	Accept	Reject	No	Accept	Reject	No
Return	$p=2$	Yes	Accept	Reject	No	Accept	Accept	No
Strategies of unmatched agents in period t: search								

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