

Does Competition Eliminate Discrimination? Evidence from the Commercial Sex Market in Singapore*

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Abstract

The street sex worker market in Geylang, Singapore is a highly competitive market in which clients can search legally at negligible cost, making it ideal for testing Diamond's hypothesis regarding search and monopoly pricing. As Diamond predicts, price discrimination survives in this market. Despite an excess supply of workers, but consistent with their self-reported attitudes and beliefs, sex workers charge Caucasians (Bangladeshis) more (less), based on perceived willingness to pay, and are more (less) likely to approach and reach an agreement with them. Consistent with taste discrimination, they avoid Indians, charge more and reach an agreement with them less frequently.

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1 Introduction

In the canonical economic model of discrimination, Becker (1957), competition eliminates discrimination by firms. More generally, under competition the law of one price prevails. Comparable workers in similar jobs must be paid the same wage; consumers must pay the same price for a homogeneous good.¹ However, Diamond (1971) shows that even if no participant on either side of the market is large, the law of one price may not hold. With sequential search even a very small search cost creates an equilibrium in which firms set the monopoly price (or offer the monopsony wage as in Black (1995)). This, in turn, implies that customers with a higher willingness to pay will be charged a higher price and that sellers can, within limits described below, indulge discriminatory tastes.

Most tests of the Diamond model have been conducted in laboratory settings.² Despite their obvious value, such experiments inevitably suffer from the concern that their fictitious settings miss important elements of real world markets and that subjects, mostly students, operate in an unnatural setting. Therefore, we use an apparently highly competitive market, the market for street sex workers in Singapore, to test the Diamond model.

During “usual business hours” sex workers are readily available. Potential customers are at no legal risk, and the social risk is small because the sex workers operate in an area regularly frequented by individuals who are on neither side of the sex trade. Thus search costs are very low but nonzero. While clearly there is some heterogeneity among sex workers, we can control for sex worker fixed effects. Moreover, our qualitative interviews suggest that this heterogeneity is relatively unimportant. We would anticipate that, especially within a narrow segment of the sex market, the importance of worker heterogeneity for a brief sexual encounter would be small relative to worker heterogeneity in standard employment relationships. In this sense, the market closely approximates a competitive market with lots of buyers and sellers. At the same time, while sex workers negotiate price freely, they generally do not announce price except to the client with whom they are negotiating and do not interfere with another sex worker’s negotiations with a client. Therefore, the market more closely resembles one in which search is sequential. The market is virtually ideal for asking whether large numbers of buyers and sellers is sufficient to eliminate discrimination in the presence of small search costs and sequential search.

We find that sex workers use ethnicity to price discriminate based on the client’s willingness to pay, which we term statistical discrimination. To a lesser degree, they

¹In the Becker model, this is only true in the long-run. In the short-run, the wage differential reflects the discriminatory preferences of the marginal employer hiring, for example, a black worker. Except for the marginal employer, all employers hiring blacks strictly prefer to hire blacks, and all employers hiring whites strictly prefer to hire whites, and there is complete segregation. We will see that there is relatively little segregation in the market we study.

²Grether, Schwartz, and Wilde (1988) report that monopoly pricing is observed in 32% of cases in settings designed to capture Diamond’s monopoly pricing model. Davis and Holt (1996) find that price rises significantly as search cost increases, but monopoly pricing is consistently absent even when there is search with no posted prices. Using a laboratory experiment, Deck and Wilson (2006) find that online merchandisers charge uninformed buyers more when they can track the potential buyer’s search history, and charge them less when they cannot track customers.

also discriminate against Indians, the primary client group with darker skin tones (taste discrimination). Although most of the negative comments about Indians in our qualitative and quantitative interviews refer to skin color and smell, some of the sex workers justify their dislike of Indians by claiming that they bargain harder, want longer service duration or are more prone to violence. We find no evidence of harder bargaining or of longer service duration and find that Indians have a relatively low demand for forms of sex that the sex workers find more unpleasant. However, we cannot completely rule out the violence explanation.

There is considerable evidence of discriminatory behaviors by firms. Audit and correspondence studies (e.g. Ayres and Siegelman, 1995; Neumark, 1996; Bertrand and Mullainathan, 2004) consistently find differential treatment of men and women and of blacks and whites. However, as Heckman and Siegelman (1993) and Heckman (1998) argue, such studies can reveal discriminatory behaviors but not whether the equilibrium is discriminatory. Unlike the “applicants” in such studies, workers and consumers do not apply to firms randomly. Potential objects of discrimination may know how to avoid transacting with prejudiced individuals or have sufficiently frequent opportunities for transactions to eliminate any impact on transaction prices. In addition, in audit studies it is impossible to ensure that testers differ only with respect to race or sex. Since the number of testers is typically small, it is often difficult, if not impossible, to know whether they also differ on some dimension other than the one intended by the researchers. For example, Castillo et al’s (2013) intriguing study of taxis in Lima, Peru relies on six male and six female testers.³ Similar problems can even arise in correspondence studies. Jacquemet and Yannelis (2012) find considerable within-race variation in callback rates for different names. Kristen was called back at a rate three times that of Laurie, and Ebony at three times that of Lakisha and almost twice that of Laurie.

These concerns have generated interest in studies that can capture discrimination in actual transactions prices by regular participants in markets. There are very interesting studies of on-line markets (Zussman (2013); Doleac and Stein (2013) and Pope and Sydnor (2011)), but these are likely to differ from discrimination in face-to-face encounters with more visual and verbal clues. Thus, List (2004) uses the natural setting of the sportscard trading platform and real market participants to identify the existence and nature of discrimination. In this setting, there is some risk that because the experimenter influences the interactions, he biases the results. It would be preferable, if possible, to observe a large number of naturally occurring transactions.

This is the approach followed by Graddy (1995) who finds price discrimination in favor of Asians and against whites in one wholesaler’s sales of whiting at the Fulton Fish Market in New York. She suggests that, because of the markets in which they resell the whiting, demand for whiting is more elastic among Asians. Our approach is, in many ways, similar to Graddy’s. However, we examine a market with a very large number of sellers. In contrast, only six wholesalers carried whiting at FFM, and the sellers are careful not to announce prices, making it easier for them to avoid

³The authors do allow for random tester effects, but as discussed in Donald and Lang (2007), such techniques are only appropriate when the number of clusters (in this case testers) is large.

competition.⁴

Bayer, Casey, Ferreira, and McMillan (2012) is in some ways the study closest to ours in that it studies a large number of transactions in the housing market. After controlling for a large number of factors, including housing unit, the authors find that black and Hispanic homebuyers pay a premium of roughly three percent. This difference while nontrivial is also modest and occurs in a market in which there is often little face-to-face interaction between buyers and sellers, and, in which there is often a thin market for houses with particular characteristics.

We investigate price discrimination based on ethnicity in a market with a large number of nearly identical sex workers selling homogeneous services to clients who search at negligible cost. We collected data on both sex workers and their recent transactions, recording information only after the transaction so as to avoid interfering. We combine this with rich survey and ethnographic data. In interviews, the sex workers revealed that they price services differently based on the client's ethnicity, which they take as a signal of the client's willingness to pay. They tend to actively approach whites, Japanese, and Koreans, the ethnic groups whom they believe to be wealthier, and inflate the prices quoted to these clients. On the other hand, sex workers express animus towards ethnic groups with darker skin tones. They report that they avoid these clients (such as Indians) or ask for a higher price to compensate for the disutility of working with them. The former hints at statistical price discrimination (Arrow, 1973; Phelps, 1972), while the latter suggests taste-based discrimination.

We build a simple model in which sex workers approach the potential client and offer him a take-it-or-leave-it price. Clients engage in sequential search until they meet a sex worker with an acceptable combination of price and match-specific quality. We show that if a sex worker believes a client has a high willingness to pay, she will be more likely to approach, set a higher price and be more likely to have her price accepted. This is consistent with what we observe for whites and, in the opposite direction, Bangladeshis. On the other hand, if she is driven by distaste, she will be less likely to approach the potential client, set a higher price and be less likely to have her price accepted. This is consistent with what we observe when comparing Indians and Bangladeshis. Thus our qualitative and transactions data are consistent. The sex workers tend to discriminate against whites and in favor of Bangladeshis based on their perceived willingness to pay but against Indians based on animus. These results are robust to including sex worker fixed effects in the analysis of the transactions data. We test and confirm two auxiliary results. Singaporean Indian sex workers, who are presumed to be less likely to have animus towards Indians, are more likely to approach and negotiate successfully with Indian clients although we do not find that their "Indian-client premium" is lower than that of other sex workers. We also show that, as predicted, tastes for one client group affect the prices charged other groups. In particular, sex workers who express animus towards Indians charge lower prices to other ethnic groups.

The remainder of this paper is organized as follows: Section 2 offers a brief institutional review of the commercial sex industry in Singapore. We describe the

⁴See also Weisbuch, Kirman, and Herreiner (2000) for a discussion of price dispersion in the Marseille fish market.

theoretical model in section 3, followed by a description of the survey and data in section 4. Section 5 presents the identification strategy and, key empirical results are thoroughly discussed in 6. Section 7 concludes.

2 The Commercial Sex Industry in Singapore

There is considerable demand for prostitution among locals.⁵ In many professions, women in Singapore have outperformed men, and few are willing to marry below their education and economic status. Around 2005, there were headlines about the existence of 300,000 white-collar workers who could not find wives. At the same time, the roughly 1.2 million foreign workers comprise one third of the Singaporean workforce (Ministry of Manpower, Singapore, 2012). Ten percent of foreign workers are professional, managers, executives or technicians, while 70⁶ percent are low- and semi-skilled workers, including many men in the construction and manufacturing sectors. In addition, in 2011 Singapore attracted 13.2 million tourists (Singapore Tourism Board, 2012), many of whom seek sexual services. Consequently, the client base for prostitution is comprised of many different ethnicities.

Prostitution in Singapore dates to the 1800s when Singapore was a British colony (Warren, 1993). Even before Singapore's independence, Geylang had emerged as a center of prostitution and gang activities. When it came to power in 1959, the People's Action Party (PAP) launched large-scale raids aimed at eliminating vice-related crimes. Instead, prostitution spread to residential areas outside of Geylang, making it harder for government to exercise control. To reverse this negative outcome, the authorities implemented a policy of encouraging the sex trade to move back to Geylang (Ng, 2011). In the late 1990s, Singapore issued special licenses for the operation of "legal" brothels, over 100 of which remain, primarily in Geylang.⁷

There is also an illegal market with three main segments: the even-numbered lanes of Geylang (the low-end), the renowned Orchard Tower Bars (the mid-tier), and nightclubs (the high-end). Sex workers in Geylang and Orchard Tower Bars are mostly full-time with no other source of income. In contrast, many women working in the nightclubs are hired legally by the clubs as dancers, singers or hostesses and make money as sex workers on a part-time basis. The illegal sex workers come primarily from China, Thailand, Vietnam and the Philippines on short-term visitor passes (Agence France Press, 2008). They visit Singapore from time to time seeking lucrative earning opportunities and marriage opportunities with Singaporean men and Western males.

We focus on Geylang, the low end and largest section of the market, but some of our data on sex workers' beliefs and tastes also draw on interviews with sex workers at Orchard Tower and the nightclubs. We have no data on more scattered forms of illegal prostitution such as KTVs (entertainment pubs with activities such

⁵Almost half of the sex clients in Indonesia's Riau region, an island proximate to Singapore, are from Singapore (Williams, Lyons, and Ford, 2012).

⁶The statistics calculated excluding foreign domestic workers. (Ministry of Manpower, Singapore)

⁷This license is not a license for prostitution per se, but a special business license which allows brothel owners to operate the brothel under police authority. (Source: Industry insiders)

as karaoke), massage parlors and social escorts. Sex workers from these venues represent a relatively small portion of the total sex worker population in Singapore.

Before we conducted the survey on which this paper is primarily based, the third author spent over a year doing qualitative research during which he conducted over one hundred interviews with sex workers, pimps and clients. That work guided both the implementation of the survey and our expectations. Our description here is largely based on this qualitative research, but in some places we call attention to differences between the results of the survey and of the qualitative research.

Sex workers in Geylang are located on the even numbered lorong (lanes). Our qualitative interviews and Ng (2011) suggest that each section of a lorong is controlled by one or a few pimps who operate under the umbrella of a gang. Tourist visas enable sex workers to re-enter Singapore frequently. When a sex worker travels to Singapore, the costs are usually borne by the parties who manage her trip and work. In return, she provides the first 60 services for free and pays S\$10/day and 30-40 percent of her subsequent earnings to the pimp. Our survey results are consistent with these numbers for those sex workers who report having a pimp. However, even among those answering the question, roughly half of the sex workers reported not having a pimp. Our qualitative interviews suggest that even sex workers who do not have a pimp have some form of male protection. We expect that the distinction is related to the nature of the “contractual” relation.

Some readers may be concerned that, despite appearances, prices are determined by a consortium of pimps. Neither our extensive qualitative interviews with participants nor our observation of transactions is consistent with this belief regarding price collusion. First, whether the sex worker is employed by a pimp or vice versa, pimps are typically distant from the negotiation since the penalties for pimping are quite severe. Moreover, there are about 200 comparably powerful pimps in the Geylang sex market. It is hardly feasible for a consortium of this size to enforce an implausibly sophisticated pricing strategy.⁸ Indeed Ng (2011) reports that pimps do not cooperate in sharing information about police raids.⁹

From our observations and as described in Ng (2011), pimps and sex workers have a very clear division of tasks, where the former serves as protection and the latter solicits and makes the sale. This is not to say that pimps do not influence pricing. Inexperienced sex workers benefit from the advice of experienced sex workers and pimps about pricing strategies and assessing clients’ willingness to pay. Consistent with this view, the “within sex worker” standard deviation of price is about 0.3 for

⁸An experienced industry insider told us that “Everyone tried to sit down and talk about how to work together, but everyone wanted himself to be the boss and others be the followers. Big argument broke out, followed by small fights. Eventually, because everyone was worried that if there was too many problems, the police would come to know about it and shut them down. Now, everyone has a small area they are in charge of, and there is the unspoken rule in the area which everyone has to abide by. No one works with anyone else and oversteps his or her area.” To his knowledge, no one has broken this rule for the past 5 years.

⁹“I used to pass them information, such as which street police officers are at and if they are coming. But over time, I realize that they do not pass me information they receive. They did not help me. I felt that I judged them wrongly, so I don’t tell them news about the police anymore. If I have information, I’ll keep my girls, and if they ask, I’ll say, ‘Nothing.’ After some time, they stopped asking. Very selfish. Scared of competition? I don’t know. But one has to help one another to be in this line.” (Ng, 2011).

both the log of the initial price offer and for the log of the transacted price. Considerable within sex worker variation in price remains even controlling for detailed service. Even if a pimp could control the prices of the sex workers with whom she is associated, it is difficult to see how her rivals would know if she deviated from a price-fixing agreement. Therefore, pimps are not in a position to control prices nor do they operate in a market environment that would permit it.

Geylang is a favorite destination for less wealthy clients seeking cheap sexual services. Chinese, Thai, Indonesian and Vietnamese sex workers dominate. The plentiful supply of Chinese women makes Geylang the preferred choice for Chinese clients who desire a “girlfriend” experience with the sex worker. It is also a particularly attractive venue for elderly single men who desire companionship. Clients are mostly Singaporean, Bangladeshi, white and Indian. Bangladeshi construction workers, in particular, are frequent visitors to the Geylang red light district, representing a sizable demand for affordable sexual services.

The Geylang market is highly competitive as measured by the number of participants on both sides of the market.¹⁰ Prostitution activities are concentrated in a small zone within which large numbers of nearly homogeneous sex workers solicit on the streets. There is little differentiation in the services offered. Differences in sex workers’ characteristics, such as beauty, may make one more desirable than the other. Nevertheless, our interviews with clients indicate that they are nearly perfect substitutes in the clients’ eyes.¹¹ Levitt and Dubner (2009) make a similar claim in *SuperFreakonomics*. We also note that this tendency is reinforced by the segmentation of the market. More attractive sex workers are likely to be at Orchard Towers. Older sex workers frequent Petain Road, a smaller red light area. We address this issue by controlling for sex worker fixed effects. We do find evidence of considerable variation in pricing among sex workers. After correcting for sampling error, the standard deviation of sex worker effects is about .3 for both initial and transacted price. It could either be that sex workers are less homogeneous than our qualitative interviews suggest or that sex workers use different pricing strategies. We have suggestive evidence for both. Even in the former case, the large number of sex workers in close proximity, usually of the same ethnicity, means that a client with a particular set of preferences will typically have very little distance to travel before coming across a similar sex worker if bargaining fails. Levitt and Dubner (2009)

¹⁰According to police estimates, there are approximately 2,000 street sex workers in Geylang, Desker Road and nearby Petain Road and Keong Saik Road in Singapore on any given night (Chong Chee Kin, 2005). Interviews with pimps suggest a population of about 1,200 sex workers in Geylang during our data collection period, a number somewhat lower than suggested by the police estimate, given the relative size of the red light districts. There are roughly 11,500 linear feet of road in the Geylang red light district. If sex workers are on the street roughly half their working day, as suggested by our estimates, allowing for both sides of the road, this suggests an average of about 40 feet between sex workers on a single side of the road. Of course, the sex workers do not distribute themselves evenly or even randomly. So a novice might take a few minutes to find a group of sex workers but would be likely to find several in close proximity once he does. Newspaper reports by *The Electric New Paper* (2008) and Othman and Yusof (2014) also indicate a large sex worker population in Geylang in recent years

¹¹One pimp told us “Most of the people who go to Geylang go for quick sex, not for lovers. For only 30 to 45 minutes, the looks makes not real difference. If the sex workers’ physical appearance is really different, they will be in Orchard Tower or high-end night clubs, not in Geylang.”

also find systematic difference in sex worker’s price by location, client ethnicity and date, after controlling for service characteristics, but unlike us, find little difference in price among sex workers after controlling for these factors.

At the same time, clients face no legal risk from patronizing sex workers, and the reputational risk is minimal because Geylang is a residential and business district with many famous dining outlets, as well as a popular tourist destination. Time describes Geylang as “an atmospheric quarter on Singapore’s east coast that bristles with great period architecture, leggy street walkers and some of the best local food on the island.” Most importantly, during “normal business hours” (roughly late afternoon until early morning), clients can easily locate a match within 2-5 minutes due to the high density of sex workers on the street. In this sense, clients’ search cost is small.

Because the initial exchange between sex workers and clients takes place on a public street, flirting and negotiation time are relatively short. Based on our survey, almost 40 percent of negotiations are reported as having taken zero minutes, and the median is three minutes. The service rate ranges from S\$27 to S\$250 with a median of S\$60 and mean of S\$70.¹² Over 92 percent of sexual services took place in motels and hotels, with the remainder primarily at the client’s residence. A full-time sex worker will return to her original venue immediately after finishing with a client. Any costs, such as taxi fare and hotel room charges are usually borne by clients.

While clients find sex workers readily, sex workers spend much of their evening soliciting clients. Our data suggest that sex workers may spend around 40 percent of their working time without a client. This naturally raises the question of why prices do not fall, as would be predicted by the competitive model. Our answer is that while the sex workers cannot collude on price, they can collude on prohibiting nonsequential search. There is an informal rule against “snatching clients” which is presumably reinforced by the pimps. A sex worker who broke into an ongoing negotiation or participated in a Bertrand pricing competition would be severely punished. Thus, although in many respects the Geylang market for sex workers appears highly competitive because the number of participants is large and search costs are low, the setting seems to us to fit the Diamond model well. In the next section, we derive a simple model of discrimination with sequential search that allows us to derive predictions that we then take to the data.

3 Theory Model

In this section, we develop an equilibrium sequential search model. The essence of the model is that the sex worker trades off price against the probability that she gets the client. When faced with two clients (at different times) whom she expects to have different willingness to pay, the sex worker will ask a higher price of the one with the higher expected willingness but not sufficiently to reduce the probability of acceptance of her offer to that of the client with the lower willingness to pay since the cost of losing the former is greater. Because she expects more profit from the client with a higher willingness to pay, she is more likely to approach him if she sees

¹²At the time of the survey, a Singapore dollar was worth eighty U.S. cents.

him on the street. This intuition is strong and should hold in most models in which search gives the sex worker some monopoly power. The model developed here is designed simply to show that the result can hold even when willingness to pay is endogenized. In contrast, in a model without monopoly power, clients who value the service more highly will not have higher willingness to pay.

Because there is no widely accepted model of bargaining under asymmetric information, we assume that the uninformed player (the sex worker) sets price and the informed player (the client) either accepts or rejects the offer. The results would not change significantly if it were the client who was uninformed about the sex worker's reservation price, and he made the price offer. We expect that a more realistic model with bargaining and two-sided asymmetric information would give similar results, but in the absence of a formal model of bargaining with this feature, this is a conjecture. However, we remind the reader, that the key result is that clients who value the service more highly are willing to pay more in equilibrium.

3.1 The Basic Model

Customers, c , search for sex workers, i . And sex workers search for customers. Both sex workers and clients are rational agents. When a potential client and sex worker meet, the sex worker must decide whether to approach the client. She offers a price, and the potential client decides whether to accept the offer.

We assume that the client's utility from a successful match with a sex worker is given by

$$u_{ic} = v_c - w_{ic} + \varphi_{ic} \quad (1)$$

where v is the value he places on the service, w is the wage paid to the sex worker and φ is match-specific quality (i.e. how much this customer likes this sex worker). We will assume that v is public knowledge but only the client observes φ . It simplifies analysis to assume that φ_{ic} is entirely idiosyncratic.

3.2 The Client's Problem

The client searches for a sex worker sequentially without recall. We assume that he meets one sex worker each period, but this assumption could easily be relaxed by reinterpreting the discount factor. When the client meets a sex worker, he observes his value of φ from the match and learns her wage demand. We write the cumulative distribution of $\varphi - w$ as G . In equilibrium with identical sex workers, all sex workers will choose the same w so that G will just be the distribution of φ . However, at this stage we allow w to vary since we have not yet established that its distribution is degenerate. In addition, this establishes that the results for clients hold even when sex workers charge different prices.

As is standard in such problems, the client chooses a reservation utility, u^* , to maximize his expected utility from the search process, which is given by

$$U[u^*] = (1 - G[u^* - v])v + \int_{u^*-v}^{\infty} x dG(x) + \delta G[u^* - v]U. \quad (2)$$

The first term is the standard value of the service multiplied by the probability that $\varphi - w$ is sufficiently high that the client accepts the sex worker's offer. The second term is the added surplus from good matches that are accepted. The last term is the discounted value of returning to search multiplied by the probability of this event. Rearranging terms and dropping the arguments of the G function gives:

$$U = \frac{(1 - G)v + \int_{u^*-v}^{\infty} x dG(x)}{1 - \delta G}. \quad (3)$$

Optimality requires that the client be indifferent between accepting his reservation utility and searching again next period so that

$$u^* = \delta U \quad (4)$$

or

$$-u^*(1 - \delta G) + \delta \left((1 - G)v + \int_{u^*-v}^{\infty} x dG(x) \right) = 0. \quad (5)$$

Lemma 1. If the mean value the client places on service increases by one unit, the client's reservation utility increases by less than one unit, that is $\partial u^*/\partial v < 1$.

Proof. By the implicit function theorem

$$\frac{\partial u^*}{\partial v} = \frac{\delta(1 - G)}{(1 - \delta G)} < 1. \quad (6)$$

□

Lemma 2. If each sex worker increases her wage demand by dw , the client's reservation utility decreases by less than dw in absolute value, that is $du^*/dw > -1$.

Proof. v_i and $-w_{ic}$ enter (equation 1) symmetrically. An equal increase in all w_{ic} is identical to an equal and opposite change in v_i . □

Remark 1. If sex workers change their prices by different amounts, du^* must be greater than the additive inverse of the largest price increase. If sex workers have mass, u^* is decreasing in each sex worker's pricing decision.

3.3 The Sex Worker's Problem

Each time the sex worker meets a potential client, she makes him a take-it-or-leave-it offer. If the offer is accepted, she receives w , pays an effort or psychic cost of d , which may include distaste and depend on the client, and returns to work after a delay reflecting the time it takes to provide the service. If the offer is declined, she returns to work after a delay caused by bargaining.¹³ We denote the value of a

¹³It might appear that there is a contradiction between assuming take-it-or-leave-it offers and including a bargaining delay in the model. However, sex workers must first ascertain the services in which the potential client is interested before quoting a price. Therefore even immediately rejected offers take time.

vacancy by π_v . Note that π_v deviates from π both because she will generally face a delay before meeting a new client and because the current client may be more or less desirable than average. Faced with a client, she chooses w to maximize her expected profit which is given by

$$\pi = (1 - F[u^* - v + w])(w - d + \gamma\pi_v) + F[u^* - v + w]\lambda\pi_v \quad (7)$$

where F is the cumulative distribution of φ . We assume that F has the increasing hazard property. Note that $\gamma < \lambda$ since she is out of the market longer providing a service than if the offer is rejected.

The sex worker will choose not to approach the client if

$$\max_w (1 - F[u^* - v + w])(w - d + \gamma\pi_v) + F[u^* - v + w]\lambda\pi_v < \pi_v. \quad (8)$$

The first-order condition for the sex worker's problem is

$$-F'(w - d + (\gamma - \lambda)\pi_v) + (1 - F) = 0 \quad (9)$$

where we have again dropped the argument of the distribution function for ease of presentation.

Lemma 3. An increase in client's reservation utility reduces the wage a sex worker demands by less than the increase, that is

$$0 > \frac{\partial w}{\partial u^*} = -\frac{F' + \frac{(1-F)}{F'}F''}{F''\frac{(1-F)}{F'} + 2F'} = -\frac{\partial w}{\partial v} > -1. \quad (10)$$

Proof. By the implicit function theorem

$$\frac{dw}{du^*} = -\frac{(F'' + F'(w - d + (\gamma - \lambda)\pi_v))}{(F''(w - d + (\gamma - \lambda)\pi_v) + 2F')}.$$

Substituting using (9) proves the first part of the lemma. Proof of the second part is identical. The inequalities follow from the assumption of an increasing hazard function and inspection. \square

Lemma 4. Sex workers will increase their wage demand if the cost of providing the service increases but by less than the increased cost, that is $1 > \partial w/\partial d > 0$.

Proof. By the implicit function theorem

$$\begin{aligned} \frac{\partial w}{\partial d} &= -\frac{F'}{-F''(w - d + (\gamma - \lambda)\pi_v) - 2F'} \\ &= \frac{(F')^2}{F''(1 - F) + 2(F')^2}. \end{aligned}$$

The inequalities follow from the increasing hazard assumption. \square

3.4 Comparative Statics

We are now in a position to prove the main theoretical result of the paper.

Theorem 1. An increase in v

1. Lowers $u^* - v$ and thus increases the acceptance rate
2. Raises w
3. Raises π .

Proof. Lemma 1 establishes part 1 in the absence of a wage increase by sex workers (lemma 3), which induces a decrease in u^* (lemma 2). However, each of these responses reinforces the effect. Therefore to prove parts 1 and 2, we need only show that the system of equations is stable which follows from the fact that $\partial w / \partial u^* > -1$ (lemma 3) and $\partial u^* / \partial w > -1$ (lemma 2). The third part of the theorem follows from the first two parts. \square

Theorem 2. An increase in d for all sex workers raises w , lowers the acceptance rate and lowers π .

Proof. From lemma 4, absent other changes, $\partial w / \partial d > 0$. Since $-1 < \partial u^* / \partial w < 0$ (lemma 2) and $\partial w / \partial u^* < 0$ (lemma 3), additional adjustments reinforce this result, but lemma 2 ensures that the acceptance rate cannot rise. Suppose that π increased. Since the acceptance rate declines, we must have that $dw > dd$. But by (9) and the increasing hazard assumption, this can be an equilibrium only if the acceptance rate is higher, a contradiction. \square

It has been convenient to assume that all sex workers are identical except for an idiosyncratic match-specific component. However, none of the lemmas depend on this assumption. Proof of the theorems would be more complicated, and it does not appear that allowing for such heterogeneity would add much insight. Similarly, although take-it-or-leave-it bargaining gives rise to a simple solution, most models of bargaining under one-sided asymmetric information imply that those who value the item more do worse in bargaining.

If some, but not all, sex workers were prejudiced against a given group, the prejudiced sex workers would raise the price they charge members of that group. As noted in remark 1, this will lower the reservation utility of clients subject to discrimination. By lemma 3, this will, in turn, cause unprejudiced sex workers to also charge higher prices, but not sufficiently to reduce the probability of acceptance and profit to the level that would prevail in the absence of prejudiced sex workers.¹⁴ In essence, clients who face discrimination have a higher willingness to pay and unprejudiced sex workers subject them to discrimination in the same way that they do other clients with a perceived high willingness to pay.

For the most part, we do not pursue this prediction because we have very few transactions between Indians, the group against whom we suspect there is taste discrimination, and sex workers who report not being prejudiced against them. Moreover, unless Indians could tell whether they were bargaining with a prejudiced or

¹⁴This is similar to the result in Black (1995).

unprejudiced sex worker, we would have two-sided imperfect information which creates significant theoretical problems for bargaining models. Nevertheless, we briefly discuss some suggestive evidence based on the behavior of Singaporean Indian sex workers.

3.5 Empirical Predictions

Step 1. Decision to Approach

Sex workers will be more likely to approach ethnicities whom they associate with higher willingness to pay and less likely to approach those for whom they express dislike.

Step 2. Price Setting

Conditional on approaching the client, sex workers will ask a higher price of both ethnicities whom they associate with a higher willingness to pay and for whom they express dislike.

Step 3 Client's reaction to the price offer

Conditional on the sex worker's approaching, members of groups whom sex workers associate with higher willingness to pay will be more likely to accept. Members of groups subject to taste discrimination will be less likely to accept.

Note that the decision to approach and the client's reaction to the price offer are essential to distinguishing discrimination from competitive price-setting. If sex workers charge a compensating differential for services such as anal sex that they find more distasteful, there is no reason for them, as a group, to be more or less likely to approach members of a group with a high demand for such services.

Somewhat more formally, suppose that there are two services. All clients demand service 1, but some would also like service 2. Then in a competitive environment, we can write the supply of sex workers willing to provide service 2 as an increasing function of the premium for providing the service and demand for the service as a decreasing function of this premium, just as in any standard market equilibrium model. Sex workers with a cost of providing (distaste for) the service greater than the premium will not provide it while those with a cost or distaste below the premium will provide it and, except for the marginal sex worker receive producer surplus from doing so.

Strictly speaking, in a competitive market, there is no role for approaching clients and for failed bargaining. But if we can be allowed a little informality, we can imagine that sex workers might approach clients without knowing their demand for service 2. In this case, 'bargaining' would fail when a sex worker with a cost above the market premium approaches a client with a valuation in excess of the market premium. Moreover, if there is a cost to approaching (again a departure from the standard assumptions of the competitive model), sex workers who know they will not agree to provide service 2 will be less likely to approach clients they believe are likely to demand the service. But sex workers with a low cost of providing the service will be more likely to approach them. So the competitive model does not make a prediction about whether overall sex workers will be more likely or less likely to approach clients from groups that are more likely to demand premium services.

Similarly it is unclear for which group bargaining will fail most frequently. To

see this, consider two extreme examples. Suppose that all members of group A but only some members of group B want the premium service. Sex workers who do not want to provide the premium service will never approach members of group A but will sometimes fail to reach an agreement with members of group B. On the other hand, if no members of group B and only some members of group A demand the premium service, and if sex workers with a high cost of providing the service sometimes approach members of group A, they will sometimes fail to reach an agreement with the potential client when they do so.¹⁵

4 Survey and Data

4.1 Survey Design and Data Collection¹⁶

The survey, conducted under the direction of the first author, collected information about the sex worker and her recent business transactions. For each worker we have basic demographic information, attitudinal information regarding clients of different ethnicities and her report regarding the factors that influence her decision to approach a client and the price to ask. In addition, enumerators rated the interviewees on aspects such as beauty, physical figure and English skills as they believed clients would judge them. Rating workers from the client's point of view is a common practice in surveys of sex workers. We also collected information regarding the most recent 4 to 7 transactions (who initiated the contact, initial price, whether agreement was reached, final price, services provided and characteristics of the client such as ethnicity, attractiveness, and quality of dress).

The questionnaire provided a general structure to the interview. The combination of the nature of the subject and frequent language difficulties meant that enumerators found it more effective to use the questionnaire to guide the conversation while maintaining the freedom to change the order of questions and to rephrase questions in order to make sure the sex worker understood what was being asked.

To gain access to the sex workers, we hired one female and three male enumerators, all roughly forty years old, who had prior experience in this market and were friendly with prostitutes and/or pimps.¹⁷ Their personal connections enabled us to conduct phone and personal interviews with sex workers, pimps and regular patrons and thereby acquire much of the institutional background that informs this study and allowed us to develop and refine the survey instrument before taking it into the field.

It is not feasible to fully randomize the sample in this market since, due to the underground nature of the business, we lack complete information on the composition of the target population and its geographic distribution. We compensated for this limited control by visiting different lanes at different times of the night and on

¹⁵Recall that this statement is relative to competitive price-setting. In a search model, some sex workers with a strong aversion to anal sex might demand a very high price and be turned down frequently in a manner analogous to taste discrimination. Even more possibilities arise if we allow for search when the price distribution is not known.

¹⁶See the Appendix for a detailed description of the survey design and data collection.

¹⁷See Appendix A for a detailed description of the enumerators.

different days of the week. The choice of locations at which we sought interviews were random. Sex workers spend a fair amount of their work day waiting for customers in a fixed location, so we had a good chance of finding a sex worker if she was usually located at the spot and time we selected. Nevertheless, there are reasons to be concerned that our sample is not fully random. For example, less popular sex workers have more unemployment during a shift and may be more tempted by the gift voucher we offered, making it is easier to interview them. In addition, some sex workers refused to be interviewed or were forbidden from doing so by their pimps although this latter case could sometimes be addressed through a small gift or invitation to have a drink. In some cases our enumerators could arrange a meeting with a respondent outside of business hours, allowing us to connect with less reachable targets. Our use of insiders, tipping and random visits helps to ensure a moderately randomized sample but cannot completely eliminate nonrandomness.

Despite the inevitable lack of an accurate census, we have gathered a fair amount of information on population composition and its rough geographic distribution based on our conversations with insiders. Our sample closely approximates the estimated population distribution reported to the third author in his qualitative research. Using the averages reported by pimps who have spent more than ten years in the area, the sex worker population at time of survey was 35% Chinese, 24% Thai, 22% Vietnamese, 14% Indonesian and 5% other. This is close to what we find in our sample (34% Chinese, 33% Thai, 21% Vietnamese, 9% Indonesian, 3% Singaporean Indian). If pimps' estimates are accurate, then our sample approximates the population distribution fairly well. None of the differences is significant at the .05 level and a chi-squared test of equality of the distributions is not significant at any conventional level. The enumerators estimate a refusal rate of about 30%.¹⁸

We study only heterosexual transactions where the women are the sellers and the men are the buyers. The enumerators read a letter of consent to gain the sex workers' understanding and consent before starting the interviews. Each interview took about 30-45 minutes. The enumerator was paid S\$15 for each survey, and each interviewee received a gift voucher of S\$10 to compensate for her time. Sometimes the sex workers agreed to take the survey as a favor to our enumerators and did not ask for a monetary reward. In those cases, the enumerators invited them for a simple meal and conducted the interview either during the meal or on a separate occasion.

The first author scrutinized each completed survey carefully to weed out major mistakes, especially in the early stages. Reviewing the survey right after submission allowed us to correct errors immediately before the enumerators forgot the information. Data-entering personnel recorded any unconventional answers following the rules we formulated and made notes on a separate sheet for the changes for each data point.¹⁹ About thirty of the earliest surveys were excluded because of clear

¹⁸It is not possible to have a precise refusal rate because in some settings the objections of a pimp or deployment of anti-vice operation would require the enumerator to withdraw from a location without information on the number of sex workers who would have been selected for the sample.

¹⁹For example, many of the sex workers could not recall the exact amount of their earnings and their clients' ages. Thus, the data entry personnel calculated the average using the range provided and made a note of these changes.

communication failures. About twenty interviews were interrupted by such events as police patrols and had to be discarded because they could not be completed.

Business in the sex market is seasonal. June (Great Singapore Sale), September (Formula One Grand Prix) and December (Holiday season), when Singapore faces a surge of tourists, are the peak months. January and February have both less supply and demand due to the Chinese New Year. The data were deliberately collected during the low season for tourists, from late February to the end of March.²⁰ We were somewhat concerned that prices might rise during the high tourist season. This could increase the proportion of inexperienced sex workers in the market and might also lead some locals to significantly reduce their demand. Nevertheless, there is a significant tourist component in the client base at all times of the year.

4.2 Data Description

The sample consists of 176 street sex workers from Geylang and 814 transactions. Three observations were dropped because client's ethnicity was not recorded. There were 678 transactions where the sex worker made the first offer, 130 transactions where the clients initiated the price and 6 where this was not determined. We focus on the first set of transactions although we use all transactions in some specifications.

Transactions are limited to cases in which there was real interaction between the sex worker and the potential client. They do not include the common event where the sex worker tries to attract a client and is rebuffed with no expression of interest. Consequently our measure of whether the sex worker approached the client corresponds only imperfectly to our theoretical measure. If a potential client was near to a sex worker but neither party approached the other, we are unaware of the event. We only have information on who initiated the interaction if one party approached the other, and there was sufficient engagement that price was discussed. The validity of our approach is predicated on the assumption that the sex worker's tendency to approach a client of a given type is associated with the probability that the sex worker rather than the client initiated the interaction.

4.2.1 Sex Workers' Characteristics

Table 1 reports the characteristics of the sex workers in the full sample. About one-third of the sex workers come from each of China and Thailand. The remainder come from Vietnam and Indonesia except for a small group of Singaporean Indians. As expected, they have low educational attainment. Fully 72 percent have completed no more than primary education, including 21 percent who are illiterate. The average age of the sex workers is 26, with the youngest aged 18 and the oldest aged 39. Two-thirds of the sex workers in the sample are single and only 11 percent are currently married while 23 percent have at least one child. Over half the sample had at least 2 years' experience as a sex worker prior to working in Singapore. The average respondent had been working in Singapore for about 2 years.

Geylang street sex workers report that they work 6-7 days a week, averaging 9 hours on weekdays and 11 hours on weekend days. They on average have only

²⁰We conducted surveys in other sectors and qualitative interviews through August.

about 4 customers per day, suggesting that 40% of their day involves waiting for clients, once we account for time traveling to and from and registering at the hotel and showering afterwards. While there are obvious limits on the ability of unprejudiced sex workers to increase their capacity sufficiently to equalize prices, as they would in the Becker model, the high level of “unemployment” suggests that there is substantial opportunity for unprejudiced sex workers to handle more clients.

Sex workers earn an average of somewhat more than S\$3,200/month from sex, substantially more than they earn at home. About one-third of the sex workers report income from sources other than sex, which we understand to be primarily payments for nonsexual companionship.

Despite our understanding that Geylang sex workers are controlled by pimps, over half of the sex workers who answered the question and one-third of all sex workers said that they did not have a pimp. Interestingly, the sex workers who report having pimps also report less experience in Singapore, in the sense of stochastic dominance. This is true even if we drop the Singaporean Indian sex workers, none of whom reports having a pimp. Of the small number who report the pimp share, the mean is within the 30-40 percent range, which is consistent with the share reported to us in conversations with insiders.

4.2.2 Client Characteristics

Chinese, mostly Singaporean but including some Malaysian Chinese, comprise the largest ethnic group among the clients, followed by Bangladeshis, whites and Indians (see table 2). There are smaller numbers of Malays, Japanese and Koreans, and Middle Easterners and a handful of black Americans. Clients’ ages, as estimated by the sex workers, range from 20 to 60 and average about 37. About 30 percent of customers are tourists and about 20 percent are repeat customers. There is no statistically significant difference in these proportions by sex worker country of origin. On a scale of 1 to 5 where 1 is dress very badly and 5 is dress very well, sex workers tend to think that their clients dress rather poorly (mean equals 2.4) and on a similar scale find their customers unattractive (mean equals 2.0).²¹

4.2.3 Sex Workers’ Views of Clients

The sex workers were asked to rate different ethnicities on a scale of 1 (dislike) to 5 (like very much) with 3 being “like.” They consistently give high ratings to Chinese (4.2) and white (3.9) clients (see the top row of table 3).²² In contrast, the Bangladeshi and Indian clients earn average ratings of 3.1 and 2.1.²³ Although sample sizes are small, this distinction does not appear to be greatly affected by the sex worker’s country of origin except that Singaporean Indian sex workers assign

²¹These means exclude sex workers who claim not to notice dress/attractiveness.

²²Although not shown in the table, Koreans/Japanese receive ratings similar to those of Caucasians while Malaysians fall between Bangladeshis and Indians.

²³For reasons we have been unable to ascertain, the question about Bangladeshis was not asked of a significant minority of the sex workers.

higher ratings to Indians and Bangladeshis.²⁴

To understand the sex workers' preferences, we rely on informal conversation with sex workers and pimps and a nonrandom sample of sex workers from all three illegal market segments whom we asked "Given the same price and equally attractive clients, do you prefer ethnicity X or ethnicity Y and why?" and, for cases where bargaining failed, we inquired about the reason. For the sample used in this paper, of the roughly sixty responses we received as to why they preferred Chinese to white customers,²⁵ twenty cited easier communication; thirteen said they were more likely to come back and four said that there was a chance of becoming a Chinese client's mistress. There were fewer than ten responses suggesting that sex with whites was harder (picky, slower, bigger). While there were a few responses suggesting that whites are more fun or better at sex, the overwhelming majority of sex workers who said they prefer whites and explained why gave an explanation related to willingness to pay. These results are broadly consistent with the results of our qualitative interviews.

In contrast, Indians are less popular among sex workers mainly because of their dark skin tone and lower expected wealth, and to a lesser extent because they are perceived as more demanding/rough and bargain a lot. Surprisingly, since we would expect few sex workers to be able to distinguish between the two, many sex workers compare Bangladeshis favorably to Indians. Feedback from sex workers and pimps suggests that they use skin tone and to a lesser extent their accent to distinguish these two client groups and uniformly describe men with lighter skin tone as Bangladeshi.²⁶ The sex workers often maintained that Indians take longer to service but are unwilling to pay a commensurately higher price and bargain harder. Some interviewees justify their distaste towards Indians by claiming that Indian men have a higher probability of being sexually violent. Thirty percent of the respondents in this group who provided an explanation for preferring some other group to Indians used terms like "smelly" and a somewhat higher proportion complained that they took too long although in a few cases this was explicitly in comparison with Bangladeshis. This is consistent with our qualitative interviews with sex workers who generally assert that they prefer Bangladeshis to Indians because Indians are darker. The following quote is typical. "No like Indian, too dark, no clean." There were also references to bargaining hard and a low willingness to pay although these were less common than the other two reasons. While we cannot preclude the possibility that the sex workers' dislike for Indians is based on a rational assessment

²⁴These discriminatory attitudes appear to be mutual. Interviews with insiders reveal that dark skin sex workers (Singaporean Indians and Indonesians) are less popular, especially among the light skin clients.

²⁵We say "roughly" because this question appears to have caused some language difficulties. A small number of respondents both preferred whites to Chinese and the opposite. Some explained their preference for Chinese by saying that there were more of them and some essentially responded that they like Chinese because they prefer them.

²⁶Indian and Bangladeshi clients in Geylang are mostly construction workers. Among this group, the association between skin tone and nationality appears largely to be empirically valid. This is supported by a small-scale experiment we conducted in which sex workers showed a high degree of accuracy in distinguishing between the two ethnicities. The important point is that we rely on the sex workers' reports of client ethnicity. Provided sex workers identify ethnicity similarly and clients are aware of how they will be treated, our analysis is unaffected.

of the risk of violence or more demanding sex, the qualitative interviews point us towards prejudice. We will see that longer service duration is not supported by the data, further supporting the view that we are observing prejudice rather than real danger. Nevertheless, the implications of our theoretical model do not depend on whether dislike is justified or unjustified, which means that the patterns of pricing, approaching and negotiation outcomes in the data will not allow us to distinguish between the two.

The sex workers reported that ethnicity was an important factor in determining which potential customers to approach and the initial price to set. In addition, the value of previous tips and gifts (for repeat customers) and the client's appearance were also listed as important factors.

Surprisingly to us, table 2 shows little sorting of clients and sex workers by ethnicity with the exception that Singaporean Indians are more likely to have Bangladeshi and Indian clients. We cannot reject at the .1 level that the distribution of white, Chinese, Bangladeshi and Indian clients is independent of whether the sex worker is Chinese, Thai, Vietnamese or Indonesian.

4.2.4 Transaction Characteristics

The average unit price for sex is S\$70 with a lowest rate of S\$27 and highest rate of S\$250.²⁷ The average service duration is around an hour, but this is skewed by a modest number of cases where the service was for all or most of the night. The median is 45 minutes. Most of the transactions take place in either motels (70 percent) or hotels (22 percent). Only about 6 percent of the transactions occur in the client's residence. There is very high awareness of contraception among both clients and sex workers in Singapore. There is only one case in which the sex worker reported that the client had not used a condom.

Table 3 shows some transaction characteristics for the four most common client ethnicities and for all ethnicities together. In row 2, we show the initial price offered by sex workers to their potential clients. Among these groups, Whites face the highest initial price (S\$91) and Bangladeshis the lowest (S\$49) with Chinese (S\$74) and Indian (S\$67) clients falling in between. Row 3 restricts the sample to those transactions where bargaining was successful. Perhaps surprisingly, the mean initial offers are similar.

Note that while the model assumes that sex workers can make take-it-or-leave-it offers, in practice clients can and do sometimes make counter-offers. We know that in 55 percent of the cases in which the sex worker made the first offer, the transaction price equaled her initial offer while in 2 percent of the cases it was higher. Bargaining failed after a very short interval in a further 2 percent of cases.

Row 4 shows the mean contracted price. The ranking of prices is unchanged although whites receive a somewhat larger discount. These differentials are in line with or somewhat larger than those in Levitt and Dubner (2009) who report that in Chicago whites pay \$9 more per sexual service than do black customers, with

²⁷The rate in legal brothels in Geylang is fixed at S\$50 per 20 minutes, half of which goes to brothel owner. It is typical for a legal brothel sex worker to serve 10-20 customers a day, as the average duration for each service is about 20 minutes.

prices for Hispanic customers falling in between.²⁸ There is some difference in the change between initial and contract prices by client ethnicity, but these differences are insignificant when we control for other client characteristics and sex worker fixed effects, which suggests that negotiation strategy does not vary much across client's ethnicities.

Row 5 shows that sex workers make the first move almost three-quarters of the time. However, they are almost always the first mover with whites. Even though both initial prices and transactions prices are higher for Indians than for Bangladeshis, sex workers are much more likely to be the one who approaches a potential client who is Bangladeshi (67 percent) than one who is Indian (43 percent). At the same time, we see in row 6 that while bargaining almost never fails with whites and rarely fails with Chinese potential clients, there are significant failure rates with both Bangladeshis (24 percent) and Indians (26 percent).

These results are largely consistent with our theoretical model and qualitative evidence. Sex workers view whites as willing to pay high prices. They therefore are more likely to approach them, ask for a higher price and are more likely to reach a deal, while the opposite is true of Bangladeshis. The results for Indians compared with Bangladeshis are consistent with our findings of animosity towards Indians. On the other hand, Indians are charged lower prices than are Chinese customers, suggesting that sex workers also believe they have a lower willingness to pay than Chinese or white customers. With respect to the claim by some sex workers that their dislike of Indian clients is objective rather than subjective, we see that contrary to claims that some of them make, Indians do not have high service duration, do not get an unusually large price reduction from the initial offer (suggesting that they do not bargain harder) and do not have an unusually high rate of demand for anal sex, our only proxy for roughness. Their average bargaining time (not shown) is shorter than the average for all other ethnicities except Chinese clients whose three-second shorter average bargaining time relative to Indians is more than entirely explained by shorter bargaining with Chinese sex workers. While we can never completely rule out objective factors, these findings support the clear inference from the qualitative interviews that it is skin tone rather than objective factors that drives many sex workers' dislike of Indians.

²⁸The authors attribute these price differences to price discrimination. They argue that price discrimination is possible because the sex worker's product cannot be resold but do not discuss the role of competition. This is perhaps not surprising given that they estimate that the city of Chicago has 4400 street sex workers each week. In their data, the average sex worker has 7.8 customers per week when working solo and 6.2 when working with a pimp, about one-fourth to one-third the number in our sample. Chicago sex workers are also much more likely to be part-timers, working an average of thirteen hours per week, less than a quarter of the time reported by our sample. Consequently, the number of sex workers on the street at any given time is likely to be lower in Chicago than in Geylang, and while the street sex workers in Chicago are also geographically concentrated, they are far less so than in Geylang. In addition, while the probability of being prosecuted as a client is low in Chicago, the cost is likely to be high. These two make search much more costly in Chicago than in Geylang. Furthermore, Dubner and Levitt do not address why they believe the sex workers are engaged in statistically based price discrimination rather than taste-based discrimination. It is quite possible that this conclusion comes from the accompanying ethnographic research. Otherwise, it is also plausible that the mostly black sex workers prefer black customers to Hispanics whom they, in turn, prefer to whites.

Of course, these differences could reflect other factors. The next rows show characteristics of the transactions that actually took place. Rows 7 and 8 present the proportion of the transactions that occur during the weekend and at night for each ethnic client group. We see that 58% of transactions take place over the weekend (Friday, Saturday, Sunday), while 42% occur on weekdays. Most (85%) transactions occur during the night time. There is no strong difference in transaction day and time across ethnic client groups, except that Chinese clients are more likely than other client groups to patronize sex workers during the day.

Almost all clients request vaginal sex. The real variation is in demand for oral and anal sex and manual manipulation, all of which may command a price premium. Chinese and white clients are most likely to have oral sex. This is somewhat less common among Indians and much less common among Bangladeshis. On the other hand, anal sex is most common with whites and less common with other ethnicities while manual manipulation is more common among Indians and Chinese clients. Median duration of service is highest among whites and lowest among Bangladeshis and Indians²⁹ which may suggest that the higher prices paid by whites and lower prices paid by Bangladeshis reflect a compensating differential for longer service. Except for Indians, the average prices per minute do not vary much by ethnicity.

Duration and sex acts may be discussed after the initial price offer, but are almost always discussed before the final price which explains why the final price is sometimes higher than the initial price. However, we generally do not know duration and rarely know the sex acts that were being negotiated in cases where the bargaining failed. Therefore, although we present some estimates controlling for these variables, we cannot reliably know how sex acts and duration affect initial price. We can, however, look at the relation between these variables and final price, conditional on an agreement being reached. We will see that longer durations and the nature of the sex acts do affect price. However, these effects are small and have only a modest effect on the differentials.

There may still be concerns that the higher prices charged to whites are a compensating differential based on expected duration or sex acts rather than on actual duration or sex acts. This is an advantage of our theoretical model. In a market-clearing model with compensating differentials, there would be no reason for bargaining to fail less frequently with whites or for sex workers to be more likely to approach them. But these predictions fall naturally out of a model with bargaining and sequential search.³⁰

It is not clear whether it should be advantageous to engage in “sweet talk.”³¹ On the one hand, sex workers may prefer clients who tell them they are beautiful. On

²⁹We use medians instead of means to minimize the effect of a small number of very lengthy exchanges, some of which lasted the entire night.

³⁰While we cannot be sure, we believe it would be quite hard to build a model in which the price made sex workers indifferent among customers but in which they were more or less likely to approach those to whom they charged high prices. And, since bargaining in such a model would be a smoke-screen for a competitive price, it would be equally difficult to explain differential failure rates.

³¹Sweet talk captures the flirtation between the sex worker and the client. We control for this factor because the sex workers indicated in the survey that their decisions on price may be influenced by the client’s sweet talk.

the other, such cheap talk may be perceived as an indication of higher willingness to pay. The mean of this categorical variable (from 1 to 5) is highest for whites and lowest for Bangladeshis.

5 Identification

5.1 Estimation Equations

Since our model has the sex worker making a take-it-or-leave-it offer, our principal specification restricts the sample to cases where the sex workers initiate price. Only one out of seven transactions involved the client suggesting the initial price. We do, however, use all transactions as a robustness check.

We estimate the following equations:

$$Move_{ij}^* = \Sigma_j \beta_{1j} E_j + X_j B_1 + \Sigma \delta_{1i} W_i + Z_{ig}^1 \Gamma_1 + \varepsilon_{1ij} \quad (11)$$

$$\ln Price_{ij} = \Sigma_j \beta_{2j} E_j + X_j B_2 + \Sigma \delta_{2i} W_i + Z_{ig}^2 \Gamma_3 + \varepsilon_{2ij} \quad (12)$$

$$Fail_{ij}^* = \Sigma_j \beta_{3j} E_j + X_j B_3 + \Sigma \delta_{3i} W_i + Z_{ig}^3 \Gamma_3 + \varepsilon_{3ij} \quad (13)$$

where i is the sex worker and j is the client.

The dependent variable $Move^*$ is a latent variable capturing the tendency of the sex worker to approach the client. If and only if the latent variable is positive, we observe that the sex worker approached the client rather than vice versa. This is an imperfect proxy for whether the sex worker finds it worthwhile to approach. There are undoubtedly occasions where the client approached first where the sex worker's expected surplus was positive and many occasions on which we do not observe the sex worker's failure to approach because the potential client also chose not to approach. Our principal estimation method for (11) is fixed-effects logit. If price discrimination is driven by perceived willingness to pay, we should see that the ethnicities for whom the initial price is higher are also those that the sex workers are more likely to approach.

The variable $\ln Price$ is the natural logarithm of the initial price offered by the sex worker. Equation (12) is estimated by ordinary least squares with sex worker fixed effects. As a robustness check, we also estimate versions of the equation in which the transaction price is used in lieu of the initial price. Of course, we do not observe the transaction price when the bargaining fails. Consequently, these estimates must be used with caution.

$Fail^*$ is the latent tendency for negotiation to fail. We estimate (13) using fixed-effects logit. However, since these coefficients are difficult to interpret, we also present standard logit estimates that control for sex worker characteristics while clustering on sex worker.³²

The explanatory variables in the equations are E_j , dummy variables for the ethnicity of the client (Chinese men are the base group), X , a set of client characteristics, which includes the client's age, whether he is a regular customer and whether he

³²The sex worker's country of origin, age, years of experience, education, marital status, beauty and English skills.

is a tourist and the ratings the sex worker gives to the client based on his outfit, attractiveness and “sweet talk,” except that this last variable is excluded from the decision to approach, W_i , sex worker fixed effects, and Z , a set of match-specific variables that varies among the equations because of different information available. All of the information about clients comes from the sex workers.

Our theory distinguishes three cases although we recognize that hybrids are possible:

Case 1. Statistical discrimination + No/Weak Taste Discrimination:

$$\beta_1 > 0, \beta_2 > 0, \beta_3 < 0$$

If, for example, as suggested by our qualitative interviews, sex workers believe that whites have a higher willingness to pay than the Chinese and if there is no or only very weak taste-based discrimination, we expect, *ceteris paribus*, the sex workers to more actively approach whites, suggest a price and to be more likely to successfully conclude negotiations with them. Of course, a group like the Bangladeshis whom we anticipate benefit from statistical discrimination based on willingness to pay should have coefficients with the opposite signs.

Case 2. Taste Discrimination + No/Weak Statistical discrimination:

$$\beta_1 < 0, \beta_2 > 0, \beta_3 > 0$$

If, as suggested by our qualitative interviews, sex workers tend to dislike Indians, and, if statistical discrimination based on willingness to pay is of little or no importance, sex workers should be less likely to approach Indians, suggest a higher initial price and be less likely to reach an agreement with them.

Case 3. No Statistical discrimination + No Taste Discrimination:

$$\beta_1 = \beta_2 = \beta_3 = 0$$

This is a trivial case. When there is no discrimination, we clients of all ethnicities should be treated equally.

Finally, we note that other combinations are either inconsistent with our model or are possible only if there are multiple sources of discrimination.

6 Empirical Results

6.1 Price Discrimination

We saw in table 3 that the raw price differences among ethnic groups were consistent with our qualitative data on sex workers’ beliefs. However, these differentials might simply reflect matching of more attractive and therefore higher price sex workers to wealthier clients. Our qualitative interviews do not support this interpretation; clients claim that sex workers are highly substitutable in their eyes. While richer clients favor more beautiful sex workers and can afford them, our interviews suggest that they are (almost) equally happy to buy services from less attractive workers. And those who are willing to pay more for higher class sex workers generally frequent Orchard Towers or the night clubs.

Nevertheless, to determine whether the raw price differences merely reflect sorting, we include sex worker fixed-effects in the price equation. In addition we control for client’s age (as estimated by the sex worker) and its square, and dummy variables for whether the client is a repeat customer, a tourist, rated above the median

in attractiveness, rated above the median in quality of dress, rated above the median in “sweet talk” and indicators for each of these variables being missing.

The first column of table 4 shows the results from this estimation. Relative to the base group (Chinese), the same sex worker suggests an initial price to whites with an 11 percent (10 log points) premium and gives Bangladeshis a 13 percent discount on the initial price offer, thus asking whites for almost 30 percent more than she asks from Bangladeshis. The point estimates suggest that our small sample of black Americans is asked the highest premium (not shown), but this estimate is very imprecise. The initial price asked of Indians is similar to that asked of Chinese prospects.

Although we have not focused on tourists as a group, we would not be surprised if they had higher willingness to pay. We observe that the initial price they face is 15 percent higher than locals (not shown). Being well-dressed and older raise the asking price. The former is presumably an indicator of willingness to pay. The latter could reflect presumed financial status or tastes, but the fact that attractiveness of the client does not affect the initial price points us towards the former. Telling the sex worker she is beautiful (“sweet talk”) also raises the asking price. Finally, regular clients do not seem to be charged a premium or receive a discount relative to other locals. There is considerable residual price variation both between and within sex workers with each accounting for half the residual variance.

Column 2 repeats the exercise but drops all observations with missing data on client characteristics and the corresponding dummy variables. The estimates are broadly similar to those in the first column but generally suggest somewhat larger ethnicity effects. Column 3 adds dummy variables for ten combinations of sex acts. In principle, there are fifteen possible combinations. In practice we observe only ten in our data. The excluded category is “sex acts unknown” which applies to virtually all of the cases where bargaining fails. The sex acts over which the parties were bargaining are reported in only five cases where sex did not take place. Note also that the services the client is requesting may not be known when the sex worker initiates price. There were five transactions in which the final price exceeded the sex worker’s initial offer.

Despite this limitation, we find highly significant effects of the transacted sex acts on the initial price, but the precision of the individual estimates is too weak to allow meaningful interpretation. Moreover, the magnitude of these differences is such that their inclusion does not greatly alter the ethnic differentials.

In the fourth column, we control for where the sexual activity took place and for whether this variable is missing. Similarly, column 5 further controls for duration, including a dummy for when this variable is missing. We view this specification as important because our qualitative interviews revealed that some sex workers believe that Indians require longer service. Nevertheless, the estimate for Indians remains almost unchanged. We continue to find robust evidence of a white premium and a Bangladeshi discount. Moreover, we observe that duration of service is only weakly associated with initial price. The coefficient is small and significant only at the .1 level using a one-tailed test. Some readers may find this puzzling, but it is not necessarily. Sex workers typically spend 40 percent of their time waiting for clients, and there are large fixed costs (travel, showering, and risk) associated with an

additional client. Nevertheless, it is also possible that the initial price offer precedes discussion of sex acts and duration. The next table explores this possibility.

We also experimented with augmenting the specification in column 5 with dummies for day-time and week-end transactions and whether this information was missing. The results are almost identical to those shown in column 5 and are therefore not presented.

Finally, in column 6 we include all encounters regardless of who made the first offer. Again the results are robust to the change of sample because white clients offer higher initial prices and Bangladeshi clients offer lower initial prices, consistent with sex workers' beliefs. The modest drop in the coefficient on Indian reflects their tendency to offer a lower initial price.

In table 5, we examine the relation between the transaction price and ethnicity. We remind the reader that we do not observe this price when bargaining fails. Moreover, our model does not have predictions about the transaction price independent of the initial price since sex workers make take-it-or-leave-it offers. However, this specification helps us address the possibility that ethnic differentials are merely compensating differentials for differences in duration or sex act. Subject to the caveats about the theory and data, we note that bargaining does not eliminate the ethnicity differentials, which supports the rationality of the sex workers' pricing behavior. The white premium and Bangladeshi discount are similar in the corresponding columns of tables 4 and 5. However, the white premium is somewhat higher and the Bangladeshi discount lower. Moreover, including information on sex acts noticeably reduces the Bangladeshi discount while controlling for duration lowers the white premium. Nevertheless, large ethnic price differentials remain.

When we estimate the specification in column 5 using the sample for whom we have a transaction price, there are some interesting differences (not shown). "Sweet talk" is associated with a higher initial price but a lower final price, suggesting that this is an effective negotiating strategy. The effect of service duration on the final price is still small, about .6 percent for an additional ten minutes but is substantially larger than the effect on the initial price (about 0.3 percent), and is now highly significant. If we limit ourselves to known service durations of less than four hours, this rises to 1.3 percent. The coefficients on the sex act dummies remain too imprecise for us to interpret. If we simplify the model to assume that price is additive in sex acts, oral sex and manual manipulation cost significantly more than vaginal sex, while we cannot reject the hypothesis that the price of anal sex is equal to any of the other sex acts. We speculate that price differences reflect the relation between anticipated service duration and sex acts. Vaginal sex is associated with noticeably shorter service durations than are the other sex acts. Finally, we again experimented with augmenting the specification in column 5 with dummies for day-time and week-end transactions and whether this information was missing. The results are almost identical to those shown in column 5.

Before moving on to other outcomes, we examine the relation between initial offers and ethnicity when the client makes the first offer using the specification in column 1. Clients who make the first offer are not necessarily representative of all clients. Nevertheless, it is striking that Bangladeshis make substantially lower and whites substantially higher initial offers relative to Chinese customers. Perhaps even

more significantly, the offers made by Indians are lower than those of Bangladeshis. This is consistent either with Indians have a lower willingness to pay or with the claims of sex workers that Indians bargain harder. We find the latter view less compelling because when we limit the sample to the cases where the transaction was completed and the sex worker made the initial offer, both the initial and final prices for Indians were similar to those charged to Chinese clients (not shown).

Taken together, we view our price results as consistent with the view that whites have a relatively high willingness to pay, while Bangladeshis and Indians have a relatively low willingness to pay, but that in the case of Indians this low willingness to pay is largely offset by the sex workers' antipathy with the consequence that they do not receive low initial price offers comparable to those offered to Bangladeshis.

6.2 Who Approaches Whom?

If our interpretation of prices in the previous subsection is correct, sex workers should be more likely to approach whites and less likely to approach Bangladeshis and Indians than they are Chinese potential clients despite the fact that the prices paid by Indians and Chinese clients are similar.

Table 6 shows the relation between client characteristics and the probability that it was the sex worker who initiated the contact. We remind the reader that this is an imperfect measure of the theoretical variable which is whether the sex worker wishes to engage in negotiation. If the sex worker did not approach the client, and the client found the sex worker unattractive and did not approach her, we do not observe her failure to approach. The theoretical model does not permit the client to make the approach, but it seems that he should be more likely to do so in cases where she was not intending to approach him.

Column 1 shows the results from fixed-effects logit when, as in our main specification, we restrict the sample to interactions in which the sex worker made the first offer. We observe that, as predicted, sex workers are more likely to approach whites (significant at the .05 level using a one-tailed test) and less likely to approach Indians (significant at any conventional level) than they are to approach Chinese clients. The point estimate for Bangladeshis is negative as predicted but falls well short of significance at conventional levels.

Unfortunately, the coefficients from fixed-effects logit are not readily interpretable. Therefore in the second column we replace the sex worker fixed effects with sex worker characteristics³³ and do the estimation using ordinary logit while clustering the standard errors by sex worker.³⁴ The results, shown in column 2, are similar to the fixed-effects results.

Consequently, the marginal effects (shown in square brackets) from the ordinary logit estimates are likely to be a reasonable guide to the magnitude of the ethnicity effects. The point estimates suggest that sex workers are substantially more likely

³³This is figuratively but not literally true since Chamberlain's conditional logit does not involve estimation of fixed effects but rather partials them out.

³⁴Given the small number of clients per sex worker, clustered standard errors should be treated with caution. For some parameters the clustered standard errors are lower than the conventional standard errors while the reverse is true for others. In no case is the interpretation of the ethnicity coefficients affected by this choice.

(21 percentage points) to approach whites, substantially less likely to approach Indians (21 percentage points) and somewhat less likely to approach Bangladeshis (8 percentage points) than they are to approach Chinese clients. Recall that overall, sex workers approach clients in 72 percent of cases.

Columns 3 and 4 repeat the exercise but include transactions in which the client initiated the price. The estimates are considerably less precise when we add these observations, but the magnitude of the estimated effects are similar to those in the main specification for whites (14 percentage points) and Bangladeshis (negative 7 percentage points), and substantially more negative (27 percentage points) for Indians.

6.3 Failed Bargains

So far our results are broadly consistent with the view that, relative to what they offer Chinese clients, sex workers charge a premium to whites and offer a discount to Bangladeshis based their on the sex workers' perception of willingness to pay but dislike Indians and therefore do not offer them a discount even though they, too, generally exhibit a low willingness to pay. Based on this interpretation, we expect that, relative to bargaining with Chinese clients, bargaining is more likely to fail when the client is Indian or Bangladeshi and less likely to fail when the client is white.

Table 7 shows the relation between ethnicity and the probability that the bargaining fails. As in table 6, the sample in the first two columns is restricted to our main sample in which the sex worker made the first offer. Using the fixed-effects logit results shown in the first column, bargaining with both Bangladeshis and Indians is more likely to fail relative to bargaining with Chinese clients. The estimate also suggests that bargaining with whites is less likely to fail, but the coefficient falls just short of statistical significance at the .05 level even using a one-tailed test.

In order to be able to discuss the magnitude of the marginal effect, we again replace the sex worker fixed effects with sex worker characteristics. In contrast with the analysis of the decision to approach the client, the coefficient on white is sharply lower in the second column than in the first, suggesting that we should be cautious about using these estimates to calculate the marginal effect of the client being white on the probability that the bargain fails. Subject to this caveat, we find that bargaining fails with whites 14 percentage points less frequently and with Bangladeshi and Indians 20 and 18 percentage points more frequently than with Chinese customers. We note that these point estimates are very large. Bargaining fails in about 12 percent of cases in the entire sample and only in 4 percent of transactions involving the base group, Chinese customers.

When we extend the sample to transactions in which the bargaining was initiated by the client, we get similar results except that the one-tailed test is now statistically significant at the .05 level for whites. The magnitude of the estimated effect is slightly larger than in column 2 for whites (18 percentage points) and slightly smaller for Bangladeshis (16 percentage points) and Indians (15 percentage points).

6.4 Singaporean Indian Sex Workers

The theoretical model implies that if most sex workers engage in taste discrimination against Indians, sex workers who do not have a distaste for Indians should nevertheless charge a premium and therefore be more likely to approach them and reach an agreement. We use being a Singaporean Indian sex worker (hereafter Indian) as a proxy for not having a distaste for Indians. The sample is small; we have only 11 transactions between Indian sex workers and Indian clients. Therefore, all results should be viewed as suggestive. For this analysis we drop Bangladeshis from the sample and combine the remaining non-Indian ethnicities into a single group. We summarize the results, but do not present them in tabular form.

Indian sex workers charge Indian clients as much as other sex workers do. The coefficient in the initial price equation on the interaction between Indian sex worker and Indian client is actually positive but highly imprecise. However, Indian sex workers are much more likely to approach Indian clients. Using a linear probability model with the other controls, including sex worker effects, the difference is 54 percentage points and significant at the .05 level. Similarly, bargaining is less likely to fail. The difference is 32 percentage points and significant at the .1 level using a two-tailed test.³⁵ Despite their obvious limitations, these results are broadly consistent with the theoretical model.

6.5 Further Evidence: Tastes and Prices

In the standard Becker model, firms that discriminate against blacks earn lower profits until the market reaches an equilibrium in which blacks and whites earn equal wages. By analogy, in our model, sex workers who dislike serving Indians suffer a utility loss while those who like serving whites receive a utility benefit. Unfortunately, we have no direct measure of utility, and, for reasons to be explained shortly, we do not believe we can use revenue as a proxy for utility. We can, however, show that an increase in the cost to a sex worker of serving one type of client will cause her to lower the price she asks of all other clients. Intuitively, because she raises her price for the type of client she dislikes, she is less likely to be hired by that type, which, in turn, lowers her value of time and thus lowers her price for all other clients.

Somewhat more formally, suppose that a sex worker can meet either of two types of clients. When she meets a client, she has expected profit

$$\begin{aligned} \pi = & p(1 - F_1[w_1])(w_1 - d_1 + \gamma\pi_v) + (1 - p)(1 - F_2[w_2]) * \\ & (w_2 - d_2 + \gamma\pi_v) + (1 - p(1 - F_1[w_1]) - (1 - p)(1 - F_2[w_2])) \lambda\pi_v \end{aligned} \quad (14)$$

where, for notational simplicity, we have dropped the types' equilibrium utility and mean value of services and p is the probability that, conditional on meeting a client, the client is of type 1.

Because bargaining and serving a client take different amounts of time, it is somewhat easier to use continuous time rather than assuming discrete time as in

³⁵We confirm the linear probability models with fixed-effects logit for which we use bootstrapped standard errors and calculate the 95 percent confidence interval from the distribution of the bootstrap replications.

our main model of consumer search. Let the arrival rate of clients be Poisson with arrival rate τ . Then

$$\pi_v = \frac{\tau}{\tau + \delta} (p(1 - F_1[w_1])(w_1 - d_1 + (\gamma - \lambda)\pi_v) + (1 - p)(1 - F_2[w_2])(w_2 - d_2 + (\gamma - \lambda)\pi_v) + \lambda\pi_v). \quad (15)$$

Proposition 1. Sex worker utility is decreasing in d_i .

Proof. Solve (15) for π_v and take the derivative with respect to d_1 or d_2 , noting that, by the envelope theorem, $\partial\pi_v/\partial w_i = 0$. \square

Not surprisingly increasing the disutility that a sex worker receives from serving a client reduces her expected utility overall.

Theorem 3. An increase in a sex worker's disutility of serving one type of client, lowers the price she charges the other type of client.

Proof. The first-order condition with respect to w_i is

$$1 - F_i - F'_i(w_i - d_i + (\gamma - \lambda)\pi_v) = 0 \quad (16)$$

where we have again used the fact that $\partial\pi_v/\partial w_i = 0$ at the optimum. Applying the implicit function theorem gives

$$\frac{dw_i}{dd_j} = -\frac{(\lambda - \gamma)\frac{\partial\pi_v}{\partial d_j}}{\frac{\partial^2\pi_v}{\partial w_i^2}} < 0$$

since $\lambda > \gamma$, the denominator is negative by the second-order conditions and $\partial\pi_v/\partial d_j < 0$. \square

It is not clear to us whether there is also a prediction regarding revenues. Sex workers who, for example, particularly dislike Indians will ask them for a higher price, thereby lowering their revenues (since monopolists operate in the range where demand is elastic) but will lower the prices they charge other customers, thereby raising revenues. In addition, sex workers can adjust the time they spend in the market. In the extreme case, if sex workers were target earners, we would expect no effect on revenue.

Therefore, we proceed to test the hypothesis that sex workers who like whites charge higher overall prices and those who dislike Indians charge lower overall prices. Our approach is straightforward. We use the estimated fixed-effects in the first columns of tables 4 (initial price) and 5 (final price) as our dependent variables in an auxiliary regression. The explanatory variables are three dummy variables for marital status, four for educational attainment, 3 for reported beauty, 4 for reported English ability, 4 for country of origin, age and its square, and experience as a sex worker and its square. Finally we include our two key explanatory variables, a dummy variable equal to 1 if the sex worker gave Indians the lowest possible rating (47 percent of the sample) and one equal to 1 if she gave whites the highest rating (55 percent of the sample).

Strongly disliking Indians is associated with an 11 log point reduction in the sex-worker fixed effect for the initial price and a 13 log point reduction in the final-price fixed effect (both significant at the .05 level). Similarly, a sex worker who is strongly positive about whites has a higher initial-price fixed effects of 10 percent (significant only at the .1 level even using a one-tailed test) and a 6 percent higher final-price fixed effect although this last result is not significant at conventional levels.

7 Conclusion

Recall that our prediction was that because sex workers believe whites have a high willingness to pay, sex workers would be more likely to approach potential clients who are white, would chose a higher initial price and would be more likely to reach an agreement. Conversely, because sex workers believe Bangladeshis have a lower willingness to pay, they are less likely to approach, set a lower initial price and are less likely to reach an agreement with Bangladeshi clients. Drawing on rich data collected by the first author on street sex workers in Singapore, we have robust evidence supporting all three predictions.

We also predicted that because there is widespread antagonism towards Indian clients, they would be charged a higher price. Prejudiced sex workers would be less likely to approach and less likely to reach an agreement with Indian potential clients. We find robust evidence that sex workers are less likely to approach Indians and that they are less likely to reach an agreement. We do not confirm the expectation of a higher price relative to Chinese clients; the initial prices demanded of the two ethnicities are similar, perhaps because sex workers also believe that Indian clients have a relatively low willingness to pay, a belief that would be consistent with the low offers made by Indians when they make the first offer. Consistent with our expectations, Indians pay a premium relative to Bangladeshis.

Even though this market is highly competitive in the sense that there are many buyers and sellers and that buyers have very low search costs, price discrimination is not driven from the market. Instead, we find support for Diamond's prediction that in the presence of sequential search, sellers have monopoly power even when search costs are very small. This, in turn, permits price discrimination based on willingness to pay. Strikingly, these modest search costs also allow the survival of taste-based discrimination.

The consistency between the implications for discrimination based on sex workers' self-reported preferences and beliefs and the actual pricing and approaching decisions made by sex workers and the rate at which bargaining is concluded successfully provides strong evidence that discrimination persists even in this highly competitive market with low search costs.

Of course, it might be argued that our setting is not truly competitive for reasons other than sequential search. After all, sex workers are not identical. To some extent we agree. A competitive market is an ideal that, at best, will be only be approximated in real-world settings. The issue is the extent to which this approximation produces relatively accurate predictions. Our view is that there are few labor markets that are likely to approximate the competitive ideal more closely than the

market we study with the exception that nonsequential search may be more applicable elsewhere. The importance of worker heterogeneity is unlikely to be as important for a half-hour sexual encounter as it is for most employment relationships. We view the inability of customers to hold multiple offers or engage sex workers in an auction to be the major threat to the external validity of our results. Of course, this feature also strengthens the value of this setting for testing the Diamond model.

Our results should provide insight in any setting in which a worker (or customer) is likely to lose an offer if he does not accept it within some prescribed time and in which firms have the ability to make different offers to different workers. There is considerable evidence for the latter. Hall and Krueger (2012) report that only 32 percent of workers knew the exact pay offer they would receive when they first interviewed for a job and that 37 percent bargained over wages and that only about one-quarter both knew the offer exactly and did not bargain, suggesting that there is considerable opportunity for firms to tailor job offers to individuals. Note also that only about 40 percent of workers bargained after receiving the offer.

Sequential search is an essential element of the Mortensen-Pissarides model, a workhorse of modern macroeconomics. This does not, of course, mean that sequential search is the norm or even widespread. It does, however, suggest that many economists think that it is a reasonable approximation to the way parts of the labor market work. In the extreme, sequential search can be supported by “exploding offers” of the types discussed by Roth and Xing (1994), but even in our own market for new economics PhD, it is not unusual for job candidates to be faced with a single offer that will disappear within a modest time period of a week or two. Most unemployed workers have never received a job offer. A May 1976 Current Population Survey found that only about 10 percent of the unemployed had received an offer that they had rejected (Clark and Summers, 1979), and a survey by the consulting firm Personified in 2010, found that only 17 percent of unemployed workers had received an offer (une, 2010). This suggests that relatively few unemployed workers hold multiple offers simultaneously. Even in settings where search is apparently nonsequential (e.g. students in MBA programs), employers may attempt to mimic sequential search by paying a bonus that declines with the time that the job seeker holds the offer.

Our findings may be applicable to other settings where there is sequential search. Historically in the United States, salesmen offered prices on mattresses and used cars that were good “only if you buy it now.” Our experience in markets without posted prices is that an offer often explodes after you leave the shop or stall. While leaving or pretending to leave may bring the salesperson running with a lower offer (a possibility admittedly missing from our simple bargaining model), returning after having walked away sometimes results in a higher offer than was proffered on the previous visit. Armstrong and Zhou (2011) discuss a variety of similar tactics involving “buy-now discounts.”

Lastly, we have heard concerns that our sample is neither fully random nor representative. We have worked hard to mitigate these concerns; our sample composition approximates insiders’ estimates of the population composition. But regardless of whether our sample is representative of sex workers in Geylang, we have strong evidence that some sex workers discriminate on the basis of ethnicity and neverthe-

less continue to transact with those ethnicities to whom they charge higher prices. Thus we do not observe the full segregation of the market that prevails in Becker's short-run equilibrium. Consequently we conclude that discrimination can survive in equilibrium when clients search sequentially at even a modest cost, and therefore that our findings support more recent search-theoretic models of the labor market rather than those using the traditional competitive market assumption.

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Table 1: Sex Worker's Characteristics

Variable	Mean
Age(Sex Worker)	26.3
Experience	2.9
Experience in Singapore	1.7
Total Monthly Income(S\$)	4371
Monthly Income from Sex	3246
Days/Week Worked	6.3
Hours Worked (Weekday)	9.0
Hours Worked (Weekend)	11.0
Customers/Day	3.9
	Col %
Country	
China	33.5
Thailand	33.0
Vietnam	21.0
Indonesia	9.1
SgpIndian	3.4
Education	
Illiterate	21.1
Primary	50.9
Secondary	20.6
High School	5.7
College	1.7
MaritalStatus	
Single/Relationship	67.6
Married	11.4
Divorced	19.3
Widow	1.7
Beauty(1=lowest; 5=highest)	
2	17.6
3	33.5
4	45.5
5	3.4
Urban	35.6
Has Child	22.7
Has Pimp	47.9
N	176

* Total Monthly Income includes both sex income and non-sex income from clients

Table 2: Client's Characteristics by Sex Worker's Country of Origin

	Sex Worker's Country of Origin					Total
	China	Thailand	Vietnam	Indonesia	SingIndian ^a	
Ethnicity						
Chinese	39.9	34.7	33.8	42.2	10.7	36.4
Caucasian	15.7	9.4	16.2	13.3	3.6	13.1
Bangladeshi	17.4	23.4	17.6	21.7	39.3	20.6
Indian	9.6	12.1	4.9	9.6	39.3	10.6
Malay	10.2	6.4	7.0	2.4	3.6	7.4
Middle Eastern	3.4	3.8	10.6	1.2	0.0	4.4
JapaneseKorean	3.4	9.4	9.2	8.4	0.0	6.8
Black(American)	0.3	0.8	0.7	1.2	3.6	0.7
Tourist						
Tourist	26.6	32.3	30.7	25.3	42.9	29.5
Repeat Clients	20.5	13.9	22.5	21.7	17.9	18.8
Age	37.2	36.5	36.9	40.7	37.0	37.3
Dress ^b	2.3	2.2	2.8	2.5	2.3	2.4
Looks	2.0	1.8	2.4	2.1	2.0	2.0

^a SingIndian are the Singaporean Indian sex workers, who typically have dark skin tone

^b For both Dress and Looks, 1=worst and 5=best

Table 3: Transaction Characteristics by Client's Ethnicity

	Chinese	White	Bangladeshi	Indian	All
Mean Rating(1=dislike, 5=like most)	4.16	3.93	3.15	2.08	
Initial Price (S\$)	73.80	91.22	49.04	67.14	71.28
Initial Price (Bargain Successful)	73.88	91.13	47.45	64.62	72.13
Transaction Price	68.07	81.34	43.74	57.69	65.78
Sex Worker Approaching First	72.8	91.8	67.3	42.9	71.9
Bargain Fails	4.2	1.0	24.0	25.7	11.8
Transaction Day (Weekend=1)	58.5	60.6	54.3	64.3	58.2
Transaction Time (Night=1)	70.2	92.2	96.2	91.8	84.7
Oral Sex	76.1	89.6	33.0	62.0	67.2
Anal Sex	4.9	45.8	1.9	8.0	15.0
Duration of Service	60	85	35	40	45
Sweet Talk(1=least, 5=most)	2.08	2.69	1.58	1.85	2.08

¹ Top line based on up to 174 observations. Remaining rows based on up to 677 transactions in which the sex worker was the first to suggest a price.

Table 4: Log Initial Price by Client Ethnicity

	(1)	(2)	(3)	(4)	(5)	(6)
Ethnicity (Base=Chinese)						
White	0.103** (0.043)	0.127** (0.052)	0.102** (0.044)	0.100** (0.044)	0.096** (0.044)	0.143*** (0.040)
Bangladesh	-0.144*** (0.033)	-0.186*** (0.040)	-0.116*** (0.034)	-0.108*** (0.034)	-0.110*** (0.034)	-0.135*** (0.033)
Indian	0.019 (0.034)	0.015 (0.040)	0.021 (0.034)	0.030 (0.034)	0.035 (0.034)	-0.035 (0.034)
Sex Worker Makes 1st Offer Sample	Yes	Yes	Yes	Yes	Yes	No
Dummies for missing	Yes	No	Yes	Yes	Yes	Yes
Sex Acts	No	No	Yes	Yes	Yes	No
Sex Venue	No	No	No	Yes	Yes	No
Service Duration	No	No	No	No	Yes	No
N	676	548	676	676	676	810
R ² Within	0.522	0.521	0.552	0.564	0.569	0.457
R ² Between	0.072	0.280	0.017	0.020	0.008	0.279
R ² Overall	0.221	0.301	0.190	0.201	0.185	0.278

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

¹ Columns (1)-(5) show results with sex worker fixed effects using the subsample where sex workers initiate prices. Column (6) uses the full sample

² All regressions include sex worker fixed effects and control for client's ethnicity (estimates for Malay, Middle Eastern, East Asian, and black American clients are not shown because the number of observations is small), client's perceived age and age squared, dummies for repeat customer, tourist, client's dress rating above median, client's attractiveness above median, client's "sweet talk" above median. All estimates except column (2) also control for indicators for the above variables being missing.

³ Sex act dummies: 10 combinations of sex acts plus "not reported."

Table 5: Log Final Price by Client Ethnicity

	(1)	(2)	(3)	(4)	(5)	(6)
Ethnicity (Base=Chinese)						
White	0.145*** (0.043)	0.182*** (0.056)	0.142*** (0.044)	0.142*** (0.044)	0.128*** (0.044)	0.181*** (0.037)
Bangladesh	-0.125*** (0.035)	-0.172*** (0.045)	-0.081** (0.036)	-0.076** (0.036)	-0.075** (0.036)	-0.132*** (0.032)
Indian	0.014 (0.037)	0.008 (0.045)	0.029 (0.037)	0.039 (0.037)	0.032 (0.037)	0.008 (0.034)
Sex Worker Makes 1st Offer Sample	Yes	Yes	Yes	Yes	Yes	No
Dummies for missing	Yes	No	Yes	Yes	Yes	Yes
Sex Acts	No	No	Yes	Yes	Yes	No
Sex Venue	No	No	No	Yes	Yes	No
Service Duration	No	No	No	No	Yes	No
N	596	469	596	596	596	709
R ² Within	0.506	0.496	0.540	0.551	0.561	0.481
R ² Between	0.025	0.282	0.000	0.000	0.000	0.269
R ² Overall	0.157	0.265	0.121	0.130	0.128	0.239

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

¹ Table 5 repeats the regressions exercises as described in Table 4 and use log final price as dependent variable.

Table 6: Did Sex Worker Approach Client? By Client Ethnicity

	(1) Fixed Effect Logit	(2) Logit	(3) Fixed Effect Logit	(4) Logit
Ethnicity (Base=Chinese)				
White	1.515* (0.842)	1.244 (0.772) [0.208]	0.574 (0.632)	0.769 (0.662) [0.138]
Bangladesh	-0.484 (0.481)	-0.447 (0.404) [-0.075]	-0.423 (0.420)	-0.364 (0.390) [-0.065]
Indian	-1.434*** (0.469)	-1.271*** (0.373) [-0.213]	-1.621*** (0.412)	-1.499*** (0.365) [-0.268]
Sex Worker Makers	Yes	Yes	No	No
1st Offer Sample				
Sex Worker Characteristics	No	Yes	No	Yes
N	483	586	595	650
Likelihood	-154.849	-294.156	-202.402	-345.006

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

¹ All regressions include sex worker fixed effects and control for client's ethnicity (estimates for Malay, Middle Eastern, East Asian, and black American clients are not shown because there are fewer such observations and are not the interest of this analysis), client's perceived age and age squared, dummies for repeat customer, tourist, client's dress rating above median, client' attractive rating above median, as well as for indicators of above variables being missing.

² Sex worker characteristics: quadratic in age, quadratic in experience, four country of origin dummies, marital status, education, beauty and English skills dummies.

³ Fixed effects logit drops sex workers who always or never approached clients. Their transactions and other cases where success/failure are perfectly predicted are excluded from N.

⁴ Standard errors in parentheses, clustered on sex worker in columns 2 and 4. Marginal effects in brackets.

Table 7: Bargaining Failed By Client Ethnicity

	(1) Fixed Effect Logit	(2) Logit	(3) Fixed Effect Logit	(4) Logit
Ethnicity (Base=Chinese)				
White	-2.073 (1.515)	-1.455 (1.420) [-0.139]	-1.812* (1.094)	-1.753 (1.287) [-0.181]
Bangladesh	1.951** (0.781)	2.114*** (0.543) [0.202]	1.358** (0.632)	1.584*** (0.507) [0.164]
Indian	1.705** (0.743)	1.886*** (0.519) [0.181]	1.265** (0.589)	1.479*** (0.471) [0.153]
Only Sex Worker Makes 1st Offer	Yes	Yes	No	No
Sex Worker Characteristics	No	Yes	No	Yes
N	338	563	438	627
Likelihood	-73.253	-171.722	-101.944	-205.423

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

¹ All regressions include sex worker fixed effects and control for client's ethnicity (estimates for Malay, Middle Eastern, East Asian, and black American clients are not shown because there are fewer such observations and are not the interest of this analysis), client's perceived age and age squared, dummies for repeat customer, tourist, client's dress rating above median, client' attractive rating above median, client's "sweet talk" rating above median. Except column (2), all other regressions also control for indicators of above variables being missing.

² Sex worker characteristics: quadratic in age, quadratic in experience, four country of origin dummies, marital status, education, beauty and English skills dummies.

³ Fixed effects logit drops sex workers who always or never approached clients. Their transactions and other cases where success/failure are perfectly predicted are excluded from N.

⁴ Standard errors in parentheses, clustered on sex worker in columns 2 and 4. Marginal effects in brackets.

Appendix A: Survey Design and Data Collection

Before Collection

Survey Design

The early versions of the questionnaire were drafted after conversations and interviews with sex workers and industry insiders. Face-to-face conversations with insiders from different networks enabled us to verify the information they provided. We then pre-tested the questionnaire by having each enumerator interview his/her close contacts, and brief us on the interviewees' responses and how the interviews were actually conducted. We then reworded the questions and modified the set of responses. We also coached enumerators to rephrase questions to help the sex workers understand, when necessary.

The final survey is composed of two parts. Part I is designed to collect sex workers' individual information and Part II is designed to collect detailed information regarding each sex worker's recent business transactions. The first three sections of Part I gather sex workers' personal characteristics (e.g. ethnicity), work-related information (e.g. earnings) as well as information about the nature of their clients including questions designed to capture their attitudes and preferences with respect to client ethnicity. For example, they are asked to rank the factors they use to determine whether they will approach a client and to price the service. They are asked how much they like/dislike clients of different ethnicities and why. The fourth section in Part I asks enumerators to rate the interviewees with respect to beauty, figure, English skills, etc., in the eyes of a potential client. Rating the sex workers in the eyes of the clients is a common practice widely adopted in surveys with sex workers. In Part II, we ask the sex workers a series of questions regarding their most recent 4 to 7 transactions. These questions are designed to obtain information on client's characteristics, sex worker's perception of client's wealth and other transaction-specific information. For client's characteristics, we ask about such items as client's age, ethnicity, whether he is a tourist, whether he is a regular customer, his looks and his dress. The transaction-specific information includes which party made the first move, who initiated the price, what the asking price and contract price of the transaction were, whether the price offer was rejected, venue, type and duration of the service. Both English and Chinese versions of the survey forms were prepared for use.

Enumerators and Administration of the Survey

Four enumerators were hired to conduct the surveys. One was a boyfriend of a female pimp in Orchard Tower and has frequented Geylang as a client for over 10 years. The second enumerator is female, a former Geylang Gang member and worked in a non-sex worker capacity in a night club. The third enumerator was a close friend of Geylang pimps, and the fourth, who did only a small number of interviews, was a pimp. Each was personally involved in the sex market and had in-depth knowledge of this market. During the qualitative stage of the project, we were able to conduct phone and personal interviews with sex workers and pimps

via their connections. They also introduced regular patrons to us which allowed us to learn about client's preferences. This is where we learned that clients see sex workers in Geylang more or less substitutable. Our knowledge on the institutional background of Geylang street was acquired through these interactions with insiders.

Each enumerator was trained independently. The training started with an overview of our project, but we also tested them on their knowledge of the milieu. We then went through each question with them to explain why we asked those questions, how they should explain the questions to the interviewees if necessary and the recording format we desired. We encouraged them to write notes on the survey if the sex worker offered additional feedback.

This training was essential because a) the subject matter is sensitive and b) many of the sex workers speak neither English nor Mandarin well. Enumerators had to be free to rephrase questions, change the order of questions, and even simply skip questions if a sex worker proved too reluctant to discuss some topic. When asked to rate Chinese clients on a predetermined scale, the sex worker provided comparisons with other ethnicities, the enumerator might jump to the comparison section. Thus although the questionnaire was structured, the interviews often more closely resembled guided rather than fully structured interviews.

Data Collection

It is not feasible to fully randomize the sample in this market. Due to its underground nature, we do not have complete information on the composition of the population and exact geographic distribution of each type of sex worker. Geylang is one the key illegal segments of the market and sex workers from this venue represent a considerable proportion of the illegal sex worker population. Some of the sex workers from Geylang are controlled by pimps. Thus, they do not have autonomy to accept the interview invitation, and we needed to invite pimps for drinks or pass the gift vouchers to the pimps to obtain their consent for the interview. Due to social stigma and concerns about being exposed to the authorities, some sex workers are not open about their job details to outsiders, especially when their responses are being recorded. Not surprisingly, we sometimes faced refusals.

Given the limits on our ability to randomize the sample, we sought to obtain a good mixture of different types of sex workers by visiting different lanes, and visiting them at different times of the night and different days of the week. During each trip, enumerators interviewed whoever was available at the time and made arrangements with others to talk during their break or after work. Different streets feature sex workers from different countries, and sex workers from different countries sell their services at different prices. Popular sex workers may start work later than the less popular ones and may be more likely to take a weekday off from the street because they are pre-booked for the whole day or they have earned substantial profit on other days. Our using of insiders, tipping and random visits ensures a fair mixture of the sex workers with different characteristics.

As a result, we claim our data collection practice grants us a moderately randomized sample but make no claim that it is fully random. We recognize that the enumerators have a higher chance of interviewing less attractive sex workers, as they have a longer unemployment period during a shift and are more tempted by the gift

voucher we offer. We found subjects who have longer experience are more open to our interview request.

We are often asked whether the sex workers were controlled by their pimps through violence or other threats. We did not ask this question, but have little doubt that such sex workers, whom we know from the qualitative research exist, are underrepresented in our sample. In this sense, even if we believed that the sex workers would answer such questions honestly, our sample would not be ideal for addressing this issue. However, there is no reason to believe that our sample over- or under-represents sex workers who engage in price discrimination.