Enforcing Licensing Requirements: Implications for Disease Transmission in the Sex Market *

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JOB MARKET PAPER DRAFT

November 7, 2005

Abstract

Several countries are pursuing the regulation of commercial sex work in order to decrease the spread of sexually transmitted infections (STIs) and reduce the probability of a generalized HIV/AIDS epidemic. In poor countries in particular, the commercial sex market is characterized by two sectors, brothel and street, where the latter is marked by riskier behavior (e.g., lower rates of condom use) and higher prevalence of STIs. This paper studies the public health effects of enforcing licensing requirements in a two-sector commercial sex market, where enforcement varies between sectors. Specifically, we use nationally representative data from eight cities in Ecuador to examine the effects on condom use and STI prevalence of enforcement in brothels vs. enforcement in the street. We exploit regional variation in the frequency of police visits to verify sex worker compliance with licensing requirements. The findings indicate that increasing enforcement in the street sector significantly increases condom use and decreases sexually transmitted infections, yet increasing enforcement in brothels has no such effect. This paper proposes a theoretical model that explains this divergence as a consequence of sex workers' sectoral choice. Increasing enforcement on the street unambiguously improves public health outcomes by encouraging sex workers to enter the more regulated brothel sector, where STI prevalence is lower. Increasing enforcement in the brothel sector induces counteracting effects, as some sex workers choose to comply with the licensing requirements (and undertake less risky behavior as a result), but others move to the street sector and are exposed to greater risk of infection. To minimize perverse incentive effects of regulation, enforcement should take into account the underlying characteristics of the commercial sex market, and should be concentrated in the sector which is marked by lower condom use and higher STI prevalence.

*This paper has benefited from useful comments from Raj Arunachalam, Paul Gertler, Seema Jayachandran, Ethan Ligon, Ted Miguel, Nancy Padian, Elisabeth Sadoulet, and participants of the Berkeley development lunch and workshop. I am also indebted to Juan Pablo Gutierrez and Diana Molina for assistance in the design and implementation of the survey. Finally, I gratefully acknowledge financial assistance from the UCMEXUS Foundation, IBER and the Center for Health Research at UC Berkeley. As always, the usual disclaimers apply.

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1 Introduction

Developing countries are increasingly looking to new policies to stave off a likely HIV/AIDS epidemic. Several countries are pursuing the regulation of commercial sex work in order to decrease the spread of sexually transmitted infections (STIs), and reduce the probability of a generalized HIV/AIDS epidemic.[1] Elevated rates of sexually transmitted infections raise concerns as untreated STIs facilitate HIV transmission (Centers for Disease Control & Prevention 2004; Oster 2005). Sex workers are central in preventing the spread of sexually transmitted infections. In most poor countries, they report higher infection rates and more sexual partners relative to the general adult population (UNAIDS 2002). Therefore, regulating sex workers could be instrumental in reducing the spread of disease to the population as a whole.

Regulation creates a legal sex sector in which sex workers are monitored for disease and encouraged to use condoms. In Latin America, it generally entails a license requiring frequent STI and HIV/AIDS testing as well as medical check-ups. Maintaining the license is costly and sex workers typically bear the costs of regulation. As a result, enforcement of health regulation may have unintended consequences. For example, since regulation is costly to sex workers and clients are willing to pay a premium for non-condom, risky sex (Gertler, Shah, and Bertozzi 2005), enforcement may actually promote risky behavior. A highly regulated sector and a riskier sector would co-exist side by side.

This paper studies the public health effects of enforcing sex worker licensing requirements in a two-sector commercial sex market where enforcement varies between sectors. Specifically, we use nationally representative 2003-4 data from eight cities in Ecuador to examine the effects on condom use and STI prevalence of enforcement in brothels vs. enforcement in the street, exploiting regional variation in the frequency of police visits to verify sex worker compliance with licensing requirements. Enforcement is simply the frequency of police visits to each sector per month to check the license. A fine is collected when a sex worker is found to be in non-compliance of the licensing requirements;[2] this imposes a cost on sex workers. In the brothel sector, enforcement is relatively higher and the majority of sex workers have the license. The street sector, however, is characterized by riskier behavior, higher STI prevalence, and significantly fewer police visits per month. Empirical results indicate that increasing enforcement by one police visit per month in the street significantly increases condom use by 10 percent and decreases sexually transmitted infections by 8 percent. Yet increasing enforcement by one police visit per month in the brothel sector has no such effect. We propose a structural model which explains these findings.

In the model, the mechanism driving the results is the sectoral choice decision. In other words, a sex worker chooses the sector which maximizes her utility. She has three possible choices: (i) the

[1] Some countries where regulation policies have been debated and/or implemented are New Zealand, Belgium, Australia, Canada, Thailand, Mexico, Argentina, and Kenya (Jordan 2005; Platt 2001; Kohm and Selwood 2004).

[2] This is simply a fine. Enforcement does not imply mandated medical visits.

brothel sector where she can comply with licensing requirements, (ii) the brothel sector where she can choose not to comply and stay unlicensed (and thus have the possibility of getting caught), and (iii) the street sector where low enforcement levels provide little need to comply with licensing requirements. Enforcement imposes a cost on sex workers in the street sector and on non-compliers in the brothel sector. Increasing enforcement decreases the relative benefit of working without a license whether in the street or the unlicensed brothel sector, and induces sex worker sectoral movement. In the street sector, increasing enforcement will unambiguously improve public health outcomes by encouraging sex workers to enter the more regulated brothel sector, where STI prevalence is lower. In the brothel sector however, increasing enforcement induces counteracting effects, as some sex workers choose to comply with the licensing requirements (and undertake less risky behavior as a result), but others move to the street sector and are exposed to greater risk of infection. Enforcement has the potential to induce sex workers to move into the wrong sector.

The empirical part of this paper estimates the sectoral choice model as a multinomial probit. Consistent with the theoretical prediction, we find that just one extra police visit per month in the street sector, decreases the probability of sex workers choosing that sector relative to the licensed brothel sector by 15 percent. However, increasing enforcement in the brothel sector by one police visit per month decreases the probability of choosing this sector by only 2 percent. These results explain the previous empirical findings that increasing enforcement in the street results in improved public health outcomes but increasing enforcement in the brothel sector has no effect.

An important implication of the theory is that enforcement affects the sectoral choice decision by imposing a cost on sex workers. However, enforcement does not affect the optimal time allocated to condom and non-condom use. We exploit this result in the estimation. We use enforcement to predict the sectoral choice decision as a multinomial probit and then estimate selection corrected condom use and STI outcomes by sector. Past research (Smith and Smith 1986) has shown that licensed sex workers have lower rates of HIV relative to unlicensed sex workers, without controlling for unobservables that might affect both sectoral choice and risk behavior decisions. In contrast, this paper addresses the selection issue in the estimation.

This paper links recent work in the areas of enforcement and sexually transmitted infections. A vast economics literature exists suggesting that increased enforcement of various types of regulation decreases crime rates (Becker 1968), environmental pollution (Downing and Watson 1974), drug use (Desimone and Farrelly 2001), and tax diversion (Desai, Dyck, and Zingales 2004). While we also find that increases in enforcement can improve public health outcomes, the findings in this paper illustrate that the design of enforcement is critical. We distinguish between two types of enforcement, and find that only one is effective. More specifically, increasing enforcement in the brothel sector has the potential to result in suboptimal public health outcomes. The results suggest that it is not simply enforcement which matters, but how and where enforcement is targeted.

The economics literature on sexually transmitted infections includes work by Kremer (1996)

in which he proposes that policies with good public health intentions have the potential to go awry. In places of high HIV prevalence, increased HIV risk creates incentives for low risk people to reduce sexual activity but may make highly active individuals either more sexually active or reduce activity slightly. In either case, the composition of the pool of available partners worsens leading to a situation of increased HIV risk. This paper departs from Kremer (1996) in that we propose a simple, partial equilibrium model in a low-level HIV prevalent state,[3] yet we also show the potential for perverse public health outcomes of regulation policies. Increasing enforcement changes the composition of women across sectors, and this affects public health outcomes as incentives to use condoms and disease prevalence differ across sectors.

The findings in this paper indicate that the efficacy of regulation does not result from stricter enforcement in the brothel market but rather from clamping down on sex workers in the street market. To minimize perverse effects of regulation, enforcement should take into account the underlying characteristics of the commercial sex market and should be concentrated in the sector which is marked by lower condom use and higher STI prevalence.

The remainder of this paper is organized as follows. Section 2 discusses the health regulation, the survey, and the data. Section 3 offers reduced form estimation results which suggest that enforcement in the street sector increases condom use and decreases STIs, yet additional police visits in the brothel sector have no effect on public health outcomes. Section 4 presents a model in which sex worker sectoral choice is the mechanism driving the street and brothel findings. Section 5 explains the multinomial probit results from the estimation of the structural model. Section 6 concludes.

2 Background and Data

2.1 The Health Regulation

The regulation of sex work is mentioned in the national Health Code of Ecuador (Tamayo 2004). This law states that sex work inside of "sitios cerrados" (closed establishments) is to be tolerated and monitored by the Ministry of Health. The law says nothing about open sites such as the street. In practice however, we will see that sex work is monitored in both closed establishments such as brothels, bars, and nightclubs as well as open sites such as the street, but the level of monitoring varies. Enforcement of licensing requirements is much higher in the brothel sector relative to the street sector. Jurisdiction over enforcement of the regulation occurs at the city level. We exploit variation in enforcement at both the sector and city level.

Sex workers in establishments are required to have a carnet, an occupational license which certifies good health. To obtain this license, sex workers must have proper identification, two photographs and negative test results for syphilis, chlamydia, herpes, hepatitis, and HIV/AIDS.

[3]This is particulary important as most poor countries outside of Africa still have relatively low prevalence of HIV.

The initial cost of all this is approximately 24 dollars. To keep the license updated, sex workers are required to return to the clinic every 15 days for a gynaecological check-up. Each visit costs approximately 2.00 dollars, not including medicine and potential treatment. Sex workers are also required to take HIV tests every 6 months (3 dollars for an Elisa,[4] 18 dollars for a Western Blot[5] but the Western Blot only happens if the results from the Elisa are inconclusive) syphilis tests every 2 months (1 dollar), and chlamydia and herpes every 4 months (10 dollars). They bear the costs of lab fees associated with STI and HIV tests, medicine, transportation to the health clinic, and all other costs associated with acquiring and keeping the license. The license is revoked with a positive HIV test result and suspended or revoked during STI outbreaks.

The point to note about the license is that it is expensive. Acquiring and maintaining a license costs approximately 3.4-6.5 percent of the average sex worker's annual earnings,[6] when opportunity costs of time are included.

The national Ecuadorian adult HIV/AIDS prevalence is low. In 2003 it was was 0.3 percent (UNAIDS 2004). The 2000 HIV/AIDS prevalence of sex workers in Guayaquil was 1.7 percent, 0.5 percent in Quito, and 1.1 percent in Esmeraldas (Chiribofa et al. 2001). However, while the risk of HIV infection is low, the risk of being infected with another STI is much higher. Twenty-three percent of sex workers in our sample had some STI in the last year. The fact that the STI infection rate is so much higher than the HIV rate raises the concern of a likely rise in HIV infection in the near future (Centers for Disease Control & Prevention 2004).

2.2 Sex Worker Data

In Ecuador, there are approximately 30,000 female sex workers (IJCG/INSP 2003). This number is obviously an underestimate as sex workers are a hard-to-reach population due to the clandestine nature of their work.

As part of the evaluation of the Frontiers Prevention Project (FPP), a national Ecuadorian HIV/AIDS and STI prevention project, a survey of female sex workers was conducted by the Juan Cesar Garcia Institute in 2003-04. The cities that were selected for the FPP were identified as cities with relatively high HIV/AIDS prevalence. The baseline survey was conducted in the following eight cities: Quito, Guayaquil, Machala, Esmeraldas, Santo Domingo, Quevedo, Milagro, and Daule. Three of these cities, Machala, Milagro, and Daule were randomly selected to be comparison sites for the intervention.[7] This paper uses only the first round of data collection as

[4] A sensitive immunoassay that uses an enzyme linked to an antibody or antigen as a marker for the detection of a specific protein, especially an antigen or antibody. It is often used as a diagnostic test to determine exposure to a particular infectious agent, such as the AIDS virus, by identifying antibodies present in a blood sample

[5] A more specific HIV test to confirm if someone is truly HIV positive, as there are other conditions which may give a false positive ELISA screening test (eg. lupus, lyme disease, syphilis).

[6] There is some variation across cities in terms of licensing costs due to availability of services. For example, one city might charge $1.50 for the gynaecological check-up while another city's Ministry of Health will charge $2.00. We use averages in our calculations

[7] The intervention targets "high risk" groups and consists of HIV/AIDS prevention and education activities to

the second round is yet to be collected.

2.3 The Survey

The universe of sex workers in each city was mapped to develop a sample frame. Potential sites were identified through interviews with key informants (i.e. taxi drivers, police, sex workers, pimps, madams, bar owners, workers at nongovernmental organizations, medical personnel, etc.). Every attempt was made to ensure that the survey was representative of the sex worker population. However, this type of mapping will obviously miss some informal situations such as the case in which a woman occasionally sells sex out of her home. The bias in favor of more formal sex work sites implies a likely bias in favor of sex workers who have a larger number of clients.

Sample size was calculated in order to measure changes in condom use between the baseline and follow-up surveys with 90 percent power and a 5 percent significance level. Information was collected from approximately 3000 female sex workers. This is the largest survey of sex workers ever conducted in Ecuador, and is quite large in general. Very few, if any countries have conducted a national survey of their sex worker population.

In order to minimize misreporting and collect the highest quality data, sex workers were trained and hired to be the interviewers. It has been shown that members of groups often feel more comfortable responding to sensitive issues with members of their own peer groups (Ozer et al. 1997). The interviews took place at sex worker work places and sex worker meeting points.

The socioeconomic questionnaire was developed by a multidisciplinary team with the participation of local researchers. The survey includes detailed sex worker characteristics and retrospective information of the last three transactions. A very unique component of this survey was the collection of urine and blood samples from each sex worker. Sex workers were tested for syphilis, chlamydia, gonorrhea, and HSV, and the results are part of the data set. In this paper, data from the syphilis, chlamydia, and gonorrhea tests are used as these infections are easily treated with antibiotics. In contrast, once infected with HSV, a woman will have it for life and will always test positive. Thus it is a cumulative measure of disease. The STI measure used in this paper captures a positive test outcome for syphilis, chlamydia, and/or gonorrhea.

Community level surveys were also implemented in each city. Police officers, establishment owners, and Ministry of Health officials were interviewed to gain a better understanding of health regulation enforcement.

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increase risk knowledge and decrease risky behavior among these groups.

2.4 Descriptive Statistics

2.4.1 Sex workers

Table 1 provides a description of sex workers from the street and brothel sex sectors in Ecuador. The sample sizes are 1633 licensed brothel workers, 667 unlicensed brothel workers, and 640 street sex workers. Licensed sex workers earn slightly more per hour than unlicensed brothel sex workers (5.51 dollars vs. 5.19 dollars) and significantly more than street sex workers who earn 4.13 dollars per hour. Eighty-eight percent of licensed sex workers used condoms in all three transactions compared to 77 percent of unlicensed brothel sex workers and 61 percent in the street sector. In terms of STI prevalence, 7 percent of sex workers with a license tested positive compared to 8 percent on the street. In other words, street sex workers are engaging in riskier behavior as they use condoms less and have higher STI rates.

Sex workers in the brothel sector have an average of one more year of education and are younger. In terms of demographics such as children and marital status, women in the street and brothel sectors appear to be fairly similar.

At the end of each interview, sex workers were rated by their interviewer on personal characteristics such as beauty, personality, and communication abilities. The scores indicate that brothel sex workers are more attractive, and have better personalities and communication skills than street sex workers.

2.4.2 Clients

Client characteristics as reported by sex workers are summarized in Table 2. Sex workers from the street sector report a higher percentage of regular clients relative to sex workers in the brothel sectors. Clients who frequent the brothel sector tend to be slightly richer and more handsome than street clients. Interestingly, sex worker perceptions of clients across sectors are fairly similar in terms of client cleanliness.

2.4.3 Enforcement index

In each city, police officers were interviewed about the frequency of visits to the brothel and street sector to verify if sex workers were fulfilling their licensing requirements. These enforcement levels are reported in Table 3 and this is the explanatory variable of interest. The values in Table 3 are the mean visits per month by the police to each sector by city. On average, the mean number of visits is 0.2 visits per month in the street sector and 1.2 visits per month in the brothel sector.

The punishment for getting caught without a license is approximately 20 dollars for the first infraction. However, each additional time a sex worker gets caught, the fine increases with the potential for a jail sentence. In addition, establishment owners are often fined if they allow sex workers to provide services without a license.

The reader might wonder why positive levels of enforcement are reported in the street sector. This is simply because police conduct street sweeps, just as they do brothel raids, but at a lower frequency. They know they can extract fines from sex workers on the street, so they do. Qualitative evidence suggests that fines are similar across sectors. Since it is the same police force conducting the raids on the street and the brothel sector in each city, the fines extracted are the same. The only difference is that in the brothel sector, the owner of the establishment may offer some protection from police harassment

3 Reduced Form Effect of Regulation

The purpose of this section is to determine whether or not enforcement of health regulation affects public health outcomes. The variables of interest, enforcement in the brothel and street sectors are regressed on condom use and sex workers' STI test results in Tables 4 and 5 respectively. Since the dependent variables are dichotomous, estimation best takes the form of probit regressions.[8]

In Column (1) of both Tables, we establish a base model with a small set of individual characteristics and one city level characteristic as regressors. In Columns (2)-(3), we increase the set of regressors to include demand side client characteristics and more city level characteristics in order to ensure robustness of our estimates. Here, variables such as non-sex worker female earnings and male earnings are included to control for geographic characteristics. In order to address concerns that large cities are driving the results, we omit sex workers from the largest city in the sample, Guayaquil in Column (4). All specifications are clustered and the reported coefficients are marginal effects.

To credibly isolate the effect of enforcement of health regulation on public health outcomes, it is necessary to examine the nature of enforcement itself. Clearly, if enforcement is correlated with city or sex worker characteristics, this would introduce bias into the empirical results. The reduced form results demand that enforcement be exogenous. We explore this topic in depth in this section and provide suggestive evidence to support the claim that enforcement is exogenous.

3.1 Condom Use

In Table 4 we find that increasing enforcement in the street sector increases condom use but has no such effect in the brothel sector. In every specification, the coefficient on street enforcement is approximately 11 percent and significant. However, in no specification does enforcement in the brothel sector have a significant effect on condom use.

In Column (1), we find that increasing enforcement in the street sector by one police visit per month increases overall condom use by 11 percent. This result is significant at the 95 percent level. In Column (2) we include some client characteristics to control for demand side heterogeneity and

[8]The same specifications in Tables 4 and 5 were estimated using OLS, and the results are very similar.

still find that increasing enforcement by one police visit per month in the street sector significantly increases condom use by 11 percent. Column (3) includes more city level characteristics such as non-sex worker earnings and male earnings. The enforcement results are robust to these additional city level controls. In Column (4) we exclude Guayaquil from the estimation to verify that the largest city is not driving the results, and none of the main results change significantly. In all cases, the coefficient on enforcement in the brothel sector is never significantly different from zero.

The regression sheds light on other noteworthy points. Many of the individual sex worker characteristics are highly correlated with condom use. For example, a sex worker with risk knowledge is 8 percent more likely to use a condom, and this is significant at the 99 percent level. In addition, if a sex worker does not like taking risks, she is 11 percent more likely to use a condom. The risk measure estimates are extremely robust to every specification at the 99 percent significance level. We also find that younger, attractive sex workers are more likely to use condoms. This might be due to the fact that younger, prettier sex workers have more bargaining power with clients than do older, less attractive women.

In Column (2) we include client characteristics to control for demand side heterogeneity. Interestingly, sex workers are less likely to use condoms with regular and handsome clients, but they are more likely to use condoms with rich clients. However, the enforcement estimates are robust to demand side heterogeneity.

3.2 Sexually Transmitted Infections

In Table 5 we regress the enforcement variables on STI outcomes. We find that increasing enforcement in the street sector by an additional police visit per month significantly reduces disease outcomes by 8 percent. This result is robust to all the specifications at the 95 percent confidence level. However, enforcement in the brothel sector does not significantly affect STI outcomes.

The coefficients indicate that sex workers with children are more likely to have an STI. In addition, older women are slightly less likely to have an STI. This finding is not entirely intuitive as older women are also less likely to use condoms. However, age might be capturing experience, and more experience could be negatively correlated with disease. Sex workers with better communication abilities are significantly less likely to have an STI. This result once again may be due to bargaining power. Sex workers with better communication abilities are able to negotiate condom use or better work conditions for themselves.

In Column (2) client characteristics are included as regressors, but none are significant. In Column (3), additional city level characteristics are included in the specification. The sex ratio is a significant predictor of STI outcomes. The results imply that the more men relative to women, the more likely a sex worker will test positive for an STI.

After controlling for various sex worker, client, and city level characteristics, Tables 4 and 5 indicate that increasing enforcement in the street sector by one police visit per month increases

overall condom use by 11 percent and decreases disease by 8 percent. Yet increasing enforcement in the brothel sector has no effect on condom use or STI outcomes.

3.3 Is enforcement exogenous?

It is important to understand if enforcement levels are correlated with city and/or sex worker characteristics. Any systematic correlation between enforcement levels and city or sex worker characteristics would bias the empirical results. For example, if enforcement levels are determined by rates of sex worker infection, then our empirical results would be correspondingly biased. The same is true if enforcement levels are correlated with city level characteristics.

With this in mind, the data collection process included numerous in-depth interviews with police and health officials to gain a better understanding of how enforcement levels in each city are determined. From this process we learned that while jurisdiction of enforcement was officially given to each city,[9] in reality a single person has jurisdiction over the enforcement process —the director of police.

A doctor at the Ministry of Health in Quito confirmed that city enforcement levels are indeed determined by the whims of the local police director. "The Ministry of Health does not have the capacity or funding to go out and enforce licensing requirements. That is up to the local police. However, the police are not terribly motivated by health concerns and enforce whenever they feel like it, depending on who the current director is" Tamayo (2004). Therefore, it seems that enforcement levels simply depend on how much or how little this person is concerned by the health regulation.

On top of this, appointments to this position are politically motivated, and the volatile nature of Ecuadorian politics leads to brief tenures and high turnover rates. While this situation is not ideal for those motivated by health concerns, the qualitative evidence suggests that city enforcement levels are fairly random. None of the interviews with police officials suggest that enforcement levels are determined by sex worker characteristics. Nevertheless, the possibility does exist and must be scrutinized to show that our empirical results are robust to these concerns.

Enforcement of health licensing has the potential to bias the estimation results in two ways. First and foremost, governments could select enforcement levels based on characteristics of the population. Secondly, sex workers could migrate to cities with lower (or higher) levels of enforcement based on individual risk preferences. This would result in selection problems. Now, let's examine each case in turn.

Jurisdiction over enforcement of the licensing requirement occurs at the city level. If local governments base enforcement levels on characteristics of the population,[10], then the estimation results will be biased. Logically, one might expect enforcement to be greater in richer cities so

[9] This happened when Ecuadorian health care was decentralized in the late early 1990s.

[10] Also known as endogenous program placement.

that local police can extract higher fines. To investigate the relationship between enforcement and income levels, average non-sex worker female earnings are compared with brothel and street enforcement levels by city. The results of this exercise are given in Figure 1. As the figure indicates, there is no discernable relationship between female non-sex worker earnings and enforcement.

In addition, enforcement might be greater in places with higher male demand for commercial sex. To study the relationship between enforcement and demand for commercial sex, we make use of the sex ratio (male/female) to represent this demand and compare it to enforcement levels. The results of this exercise are graphed in Figure 2, and do not suggest a significant relationship between the sex ratio and enforcement.

Another concern may be that sex workers migrate to cities with lower (or higher) levels of enforcement based on personal risk preferences. Since risk preferences are likely to be correlated with condom use, we regress the decision to migrate on condom use. The results of this exercise are given in Table 6.

A sex worker is categorized as a migrant if she responded positively to moving to her current city of residence for work reasons. Approximately 30 percent of the women in the sample report having moved for work. However, the results in column (1) of Table 6 indicate that there is no significant relationship between the decision to migrate and condom use. So, we conclude that the decision to migrate is not correlated with risk behavior.

We also test if enforcement is driving the decision to migrate. Column (2) of Table 6 offers the results from this regression. There is no significant relationship between enforcement in either the brothel or street sector and migration. In fact, it seems that prices are driving the decision to migrate. These results reinforce findings from qualitative work. In focus groups, most sex workers responded they migrate for financial opportunities. When condom use prices are high, women are less likely to migrate.

Therefore, it seems that enforcement is not significantly correlated with the individual decision to migrate or city level characteristics that would bias our results. In addition, because the licenses are enforced at the city level, they are non-transferable by law across cities. Therefore, licensed sex workers find it difficult to migrate for work as the fixed cost of obtaining another one is quite high.

In the next section, we develop a model to fully understand why additional police visits in the street sector improve public health outcomes yet additional police visits in the brothel sector do not. The proposed model links enforcement of health regulation to condom use and STIs through the sectoral choice decision. Enforcement affects the sectoral choice decision which in turn results in optimal levels of condom use for sex workers In Section 4, we describe the sectoral choice as a random utility model, and then test the model predictions.

The model predicts that increasing enforcement on the street will shift women off the street into the brothel sectors, where incentives to use condoms are higher and STI prevalence lower. The model also predicts that increasing enforcement in the brothel sector will induce unlicensed brothel

sex workers to leave this sector, but the health outcomes are ambiguous. Increasing enforcement in the brothel sector induces counteracting effects, as non-compliant sex workers either choose to comply with the health regulation or move to the street sector, which is characterized by riskier behavior and a higher prevalence of sexually transmitted infections.

4 A Model of Sex Worker Regulation

In order to formally model the sex market, we conducted numerous in-depth interviews and focus groups with sex workers. Sex workers factor in many different issues when deciding which sector to join. In general, the brothel sector is characterized by higher rates of condom use and lower disease prevalence. Sex workers who dislike risk are more likely to join the brothel sector. Certain characteristics may influence the sectoral choice decision. For example, older women may choose the street relative to younger women, thus we allow for sex worker heterogeneity across sectors.

On average brothel sex workers have more clients, as the brothel sector is characterized by a higher rate of client arrival. The tradeoff is that enforcement of licensing requirements in this sector is also high. Obtaining and maintaining the license is costly, but staying unlicensed is also costly due to frequent police visits. In the street sector, while sex workers have fewer clients, they do report more flexibility in terms of licensing requirements. The street is characterized by far fewer police visits per month. The street sector has a higher STI prevalence and is thus a riskier place to work. Clients who frequent the street sector have higher STI rates than clients who frequent the brothel sector. While men know that a higher proportion of women in the brothel sector have the license, the license is not outwardly visible to them. In focus groups, sex workers report that clients almost never ask to see their occupational license.

Transaction prices depend both on the sector and whether or not a condom is used. Sex workers report that clients are willing to pay more for non-condom sex.[11] Sex workers choose to work where they earn the most. From discussions with sex workers, it seems that the average service provided is vaginal sex (with or without a condom) in each sector. There is a fairly standard price for this service, and if anything above and beyond this is desired by the client, then a premium is paid. In the formal model, we assume that prices for condom and non-condom use are given by the sector. The premium is captured by the price differential between non-condom and condom use.

Explicit demand side characteristics include prices and STI prevalence. For the purposes of the model, we assume that all men are the same, except for the STI prevalence across sectors. We relax this assumption in the estimation to check if male heterogeneity affects our empirical results. We find that it does not.

In addition to the sectoral choice decision, sex workers will have to decide how much of their time to allocate to condom and non-condom use. This decision will be driven by the sectoral price

[11] This result is shown empirically in Gertler, Shah, and Bertozzi (2005) and Rao et al. (2003).

differential as well as her risk preferences. While there is a premium associated with non-condom use, sex without a condom adds to the likelihood of getting an STI. This of course imposes a health cost on the sex worker. Also, sex workers who do not like taking risks, will be more likely to allocate a greater share of time to condom use, as they get more disutility from non-condom use.

We now formalize these choices in a simple partial equilibrium model. We first solve the time allocation problem within each sector and then describe the sectoral decision sex workers face. Let us first consider the decision of a sex worker on the street.

4.1 Street Sector

A sex worker in the street sector allocates some share of time to non-condom use, t, and the rest to condom use $1-t$.[12] Her earnings from condom sex are given by $p_s^c(1-t_s)$ and her earnings from non-condom sex are given by $p_s^n t_s$. While the price of non-condom use is greater than the price of condom use such that $p_s^n > p_s^c$, sex without a condom adds to the likelihood of her getting an STI. The probability of STI infection is defined as $I(t_s) = \alpha_s t_s$, where α_s is the sectoral STI prevalence and t_s is the share of time allocated to non-condom use. The disutility associated with non-condom use is captured by $\gamma(\alpha_s t_s)^2$, where γ captures risk preferences. The disutility term is squared as disutility increases in a non-linear fashion with increases in the likelihood of infection. The sectoral STI prevalence, α_s is bounded between $0 \geq \alpha_s > 1$. We let $\alpha_s > \alpha_r$, where α_r is the brothel sector STI prevalence.[13] A sex worker in the street sector also factors in the expected cost of enforcement. Enforcement levels on the street are given by e_s.

Her time allocation decision is:

$$U_s = \max_{t_s}\{[p_s^c(1-t_s) + p_s^n t_s - \gamma(\alpha_s t_s)^2][1-e_s] + \beta_s z + \epsilon_s\} \tag{1}$$

where ϵ_s is a random error term and z is a vector of individual sex worker characteristics. The first order condition from the maximization problem yields:

$$p_r^n - p_r^c - 2\gamma\alpha_s t_s = 0 \tag{2}$$

The time allocation solutions are given by:

$$t_s^* = \frac{p_s^n - p_s^c}{2\gamma\alpha_s} \tag{3}$$

[12] For simplicity, we assume away leisure.

[13] One might argue that α is endogenous. However we are simply assuming that there exists an equilibrium such that $\alpha_r < \alpha_s$ and that is the equilibrium we refer to. Imagine on the demand side there are two types of clients: one type has an STI and the other type does not. The type of man who does not have a STI is willing to pay more for sex that is STI free. He will go the brothel sector. The STI infected client does not care about who he has sex with and will therefore go to the street sector where sex is cheaper. On the supply side, sex workers that are STI free apply for the license and work in the brothel, licensed sector. Those with STIs cannot apply for a license and work on the street. There is no incentive on either side to deviate and STI prevalence is higher in the street sector.

and

$$1 - t_s^* = 1 - \frac{p_s^n - p_s^c}{2\gamma\alpha_s} \tag{4}$$

The solutions indicate that the optimal share of time allocated to non-condom and condom use will depend on both the price differential and the disutility associated with non-condom use. As the price differential increases, the share of time allocated to non-condom use will increase since a sex worker responds positively to prices. The solution also suggests that as STI prevalence increases, a sex worker allocates a greater share of time to condom use. The same is true for increases in γ. This is a sensible result as sex workers face higher costs from infection.[14] As the likelihood of infection increases, a sex worker will allocate a greater share of time to condom use.

The optimal solutions indicate that enforcement of the license will not affect the time allocation decision. In other words increased police visits have no affect on sex worker condom use decisions. However, the utility function suggests that enforcement affects the sectoral choice decision. Increasing enforcement imposes a cost on street sex workers and thus affects the sectoral choice decision; but not condom use. In the next section we discuss the time allocation decision of sex workers in the brothel sector who choose not to comply with licensing requirements.

4.2 Brothel Sector, Unlicensed

An unlicensed sex worker in the brothel sector also allocates some share of her time to condom use and the rest to non-condom use. Her earnings from condom and non-condom use are given by $p_u^c(1-t_u)+p_u^n t_u$. In the brothel sector, a sex worker also earns more for non-condom use. However, once again there is disutility associated with non-condom use due to the potential for STI infection. This disutility is given by $\gamma(\alpha_u t_u)^2$, where α_u is the brothel sector STI prevalence and is bounded between $0 \geq \alpha_u > 1$.

An unlicensed brothel sex worker is working in non-compliance of the regulation requirements. This implies she has some probability of getting caught by local police authorities. We let e_u be the city level health regulation enforcement in the brothel sector. The higher the level of enforcement, the more likely a sex worker will be checked and have to pay a fine for non-compliance.

In the brothel sector, an unlicensed sex worker (indexed by u) solves:

$$U_u = \max_{t_u}\{[p_u^c(1-t_u) + p_u^n t_u - \gamma(\alpha_u t_u)^2][1-e_u] + \beta_u z + \epsilon_u\} \tag{5}$$

where ϵ_u is a random error and z is individual sex worker characteristics. Within the brothel sector, since men cannot differentiate between licensed and unlicensed sex workers, prices and sectoral STI prevalence are the same. This implies that $p_r^c = p_u^c$, $p_r^n = p_u^n$, and $\alpha_r = \alpha_u$ where the subscript r denotes registered brothel sex workers.

[14] In the Appendix, we differentiate Equation 2, the first order condition, with respect to α_s and γ. We find that both $\frac{dt_s^*}{d\gamma}$ and $\frac{dt_s^*}{d\alpha_s}$ are negative.

The first order condition yields:[15]

$$p_r^n - p_r^c - 2\gamma\alpha_r t_u = 0 \tag{7}$$

The optimal amount of time allocated to non-condom use is:

$$t_u^* = \frac{p_r^n - p_r^c}{2\gamma\alpha_r} \tag{8}$$

and the optimal time allocated to condom use is:

$$1 - t_u^* = 1 - \frac{p_r^n - p_r^c}{2\gamma\alpha_r} \tag{9}$$

The optimal share of time allocated to non-condom use is a function of the price differential, risk preferences and the disutility associated with non-condom use. The share of time allocated to non-condom use is increasing in the price differential. As the disutility associated with non-condom use increases, sex workers will increase the share or time allocated to condom use relative to non-condom use. In addition, as the sectoral STI prevalence increases, sex workers will engage in less non-condom sex. Both of these results are very intuitive.[16]

An important implication of this solution is that enforcement enters the utility function and thus affects the sectoral choice decision. However, it does not affect the time allocation decision.[17] Therefore, enforcement of the health regulation in the brothel sector, like in the street sector, does not affect condom and non-condom use. In the next section we discuss the time allocation decision of sex workers in the brothel sector who comply with licensing requirements.

4.3 Brothel Sector, Licensed

Sex workers in the brothel sector who comply with licensing requirements also decide on the share of time to allocate to condom and non-condom use. Once again, sex workers in this sector earn more for non-condom use, but as before, there is a disutility associated with non-condom use given by $\gamma(\alpha_r t_r)^2$. Recall that in the street and unlicensed brothel sector, there was an additional cost of enforcement. For licensed women in the brothel sector, there is no cost associated with enforcement. This is because licensed sex workers are in compliance with the regulation. However, they do pay a fixed cost for obtaining and maintaining the license. This amount is given by τ. In addition, sex workers in the licensed brothel sector bear an additional job-related cost with STI infection.

[15] The second order condition give us:

$$-2\gamma\alpha_r < 0 \tag{6}$$

[16] The math for these comparative statics results is given in the Appendix. Both $\frac{dt_u^*}{d\gamma}$ and $\frac{dt_u^*}{d\alpha_r}$ are negative.

[17] Note that $\frac{dt_u}{de_u} = 0$

So far, there has been some disutility associated with non-condom use. We can think about this term as an individual level health concern. In the licensed brothel sector, there is an additional cost associated with STI infection in that a sex worker will lose her job. Therefore we include an additional job-related health cost as $[1 - \alpha_r t_r]$, which is simply the probability of infection. The higher the probability of infection, the more likely she will lose her job. This is not the case in the street and unlicensed brothel sector as employment status is not tied to STI status. We can think about this cost with the following example. When a sex worker in the licensed brothel sector loses her job due to a revoked license she also loses years of reputational capital which she has built up with her clients in the brothel. Therefore, it would be costly for her to have an STI and lose her brothel job.[18]

A sex worker who is registered (indexed by r) with a license solves:

$$U_r = \max_{t_r}\{[p_r^c(1-t_r) + p_r^n t_r - \gamma(\alpha_r t_r)^2][1 - \alpha_r t_r] - \tau + \beta_r z + \epsilon_r\} \tag{10}$$

where ϵ_r is a random error term. The first order condition to this problem is:[19]

$$\frac{\partial U_r}{t_r} = [p_r^n - p_r^c - 2\gamma(\alpha_r t_r)][1 - \alpha_r t_r] - \alpha_r[p_r^c(1-t_r) + p_r^n t_r - \gamma(\alpha_r t)^2] = 0 \tag{12}$$

Rearranging the first order condition and setting marginal benefit equal to marginal cost yields :

$$(p_r^n - p_r^c)(1 - 2\alpha_r t_r) - \alpha_r p_r^c = \gamma\alpha_r t_r(2 - 2\alpha_r t_r - \alpha_r^2 t_r) \tag{13}$$

This implies that for a given increase in the time allocated to non-condom use, t_r, the marginal benefit will decrease relative to the marginal cost.[20] In the Appendix, we differentiate Equation 12, the first order condition in order to understand how various parameters affect the condom use decision. We find that as γ, the disutility associated with non-condom use increases, sex workers will allocate a greater share of time to condom use. We also find that as the sectoral STI prevalence, α_r increases, sex workers use condoms more often.

Note that enforcement of the health regulation license does not enter the utility function for licensed brothel sex workers. This is simply because these women are already complying with the

[18] An implicit assumption is that if these women were to re-optimize, they would still choose the licensed brothel sector, and the fact that they cannot due to STI status, imposes a cost on them.

[19] The second order condition is:

$$-2\gamma\alpha_r(1 - \alpha_r t_r - \alpha_r^2 t_r) - \alpha_r(p_r^n - p_r^c - 2\gamma\alpha_r t_r) + \alpha(p_r^c - p_r^n) < 0 \tag{11}$$

[20] Simplifying the first order condition into a quadratic yields:

$$t_r^2(3\alpha_r^2\gamma) + t_r(2\alpha_r)(p_r^c - p_r^n - \gamma) + (p_r^n - p_r^c(1 - \alpha_r)) = 0 \tag{14}$$

Using the quadratic equation, we solve for $t_r^* = \frac{-(p_r^c - p_r^n - \gamma) \pm \sqrt{(p_r^c - p_r^n)^2 + \gamma(\gamma + p_r^c - p_r^n - 3p_r^c\alpha_r)}}{3\alpha_r\gamma}$

health regulation, so enforcement will not be costly for them. Enforcement is only costly in the case of non-compliant brothel and street sex workers.

4.3.1 Comparing non-condom use across sectors

Now that we have solved for the optimal share of time allocated to condom and non-condom use for all three work choices, we would like to compare the solutions. This will help us understand how incentives to use condoms vary across choices.

From inspection of the utility functions, time allocated to non-condom use in the brothel sector is greater among the unlicensed women such that $t_u^* > t_r^*$. This simply means that non-compliant sex workers in the brothel sector will allocate more time to non-condom use relative to compliant sex workers. A sex worker with the license bears an additional cost for having sex without a condom. Unlike non-compliant sex workers, a licensed sex worker has the potential to lose her job if she gets infected. Therefore, a licensed brothel sex worker will engage in less risky activity.

The relative sizes of t_s^* to t_u^* will depend on the relative price differential and the relative STI prevalence across sector. However, recall we assumed that the price differential and the STI prevalence was greater in the street sector. This implies that for a given γ, we can argue that there exist many cases such that $t_s^* > t_u^*$. The optimal time allocated to non-condom use in the street sector will be higher than the brothel sector in most cases.

Now that we have formalized the time allocation decisions, let us turn to the sex worker sectoral choice decision.

4.4 Sectoral Choice

A sex worker deciding whether to join a sector will base the decision on her expected costs and benefits from the sector. She picks the choice which maximizes her utility. A sex worker will choose between the following payoffs in the brothel and street sectors:

$$\max\{U_r, U_u, U_s\} \tag{15}$$

The utility functions as defined in the previous sections suggest that the important factors in determining the final choice will depend on sectoral prices, individual characteristics including risk preferences and levels of enforcement. Previously we solved the time allocation problems for each sector. We found that increasing enforcement induces a cost and shifts women across sectors; however, it never affects condom use decisions (except through sectoral choice). We use the optimal t^* from each sector and solve for the respective optimal utility functions.

Substituting t_s^* into U_s, the utility function for street sector yields:

$$U_s^* = p_s^c + (p_s^n - p_s^c)^2 \frac{1}{2}\left(\frac{1}{\gamma\alpha_s} - \alpha_s\right)(1 - e_s) + \beta_s z + \epsilon_s \tag{16}$$

Substituting t_u^* into U_u, the utility function for the unlicensed brothel sector yields:

$$U_u^* = p_r^c + (p_r^n - p_r^c)^2 \frac{1}{2}(\frac{1}{\gamma\alpha_r} - \alpha_r)(1 - e_u) + \beta_u z + \epsilon_u \tag{17}$$

The optimal utility for the licensed brothel sector is given by

$$U_r^* = p_r^c + t^{*3}(\alpha_r^3\gamma) - \alpha t^{*2}(p_r^n - p_r^c + \alpha_r\gamma) + t^*(p_r^n - p_r^c(1 + \alpha_r)) + \beta_r z + \epsilon_r \tag{18}$$

where $t_r^* = \frac{-(p_r^c - p_r^n - \gamma) \pm \sqrt{(p_r^c - p_r^n)^2 + \gamma(\gamma + p_r^c - p_r^n - 3p_r^c\alpha_r)}}{3\alpha_r\gamma}$. We leave U_r^* in this form due to the solution for t_r^*.

The optimal utility functions in Equations 16-18 suggest which variables should be used when predicting sectoral choice in the multinomial probit estimation. We stay as close as possible to the specified variables. The utility functions indicate that utility in each sector is a function of p^c, the price of condom use; $p^n - p^c$, the price differential between non-condom and condom use; e, enforcement; and individual sex worker characteristics including risk preferences.

These are the variables used in the estimation of the multinomial probit. We estimate predicted prices for condom and non-condom use conditional on sex worker characteristics for each woman. The Appendix specifies how these variables are constructed. The price of condom use can be interpreted as the price of sex and the price differential as the marginal amount the sex worker needs to be compensated for taking on extra risk. As expected, utility is an increasing function of both the price of condom use and the price differential.

The utility functions also indicate that as we increase or decrease enforcement of the health regulation, the relative utilities of the three choices change. Enforcement shifts women across sectors. Increasing street enforcement, e_s, induces sex workers leave the street sector and shift to the brothel sector, ceteris paribus. Similarly, increasing enforcement within the brothel sector, results in non-compliant women leaving this sector. They shift to the licensed brothel sector or the street sector, depending on the relative size of the price differential and α. If these women choose to comply with the licensing requirements (and undertake less risky behavior as a result), we would expect improvements in public health outcomes. But if they move to the street sector where they are exposed to greater risk of infection, then the opposite is true. It is important to note that enforcement never affects the decision to engage in condom and non-condom sex; only the sectoral choice decision.

Individual characteristics and risk preferences are also important in predicting sectoral choice. We include variables on marital status, age, children and education. These characteristics will also be correlated with risk preferences. We also include direct measures of risk based on risk knowledge and sex worker reports on personal risk taking. In addition, we include interview reports of sex worker communication skills and beauty.

The random utility model generates the following predictions that we test with the data:

1. The probability of street sectoral choice decreases as enforcement in the street sector increases. When we increase enforcement in the street sector, the relative utility from the street sector decreases so we expect street sex workers to move to the brothel sector.

2. The probability of unlicensed brothel sectoral choice decreases as enforcement in the brothel sector increases. When we increase enforcement in the brothel sector, the relative utility for non-compliant sex workers in this sector decreases. We expect sex workers to either get a license or move to the street.

5 Empirical Specification

In order to assess the sectoral decision made by sex workers, we require a methodology which allows us to simultaneously estimate how individual characteristics and sectoral characteristics affect the sectoral decision in a three-sector setting. The multinomial probit (MNP) allows for this (Hausman and Wise 1978). The multinomial probit model estimates the coefficients of the model without worrying about the implications of the assumption of uncorrelated errors since we do not have to assume the errors are identically and independently distributed.[21] Instead, we can assume the errors are correlated(Alvarez and Nagler 1994).

In Section 4, we defined the sectoral choice as a random utility function for individual i over each choice j, where $j = r, u, s$, such that:

$$U_{ij} = \overline{U}(X_{ij}; z_i) + \varepsilon(X_{ij}; z_i) = Z_{ij}\beta_j + \varepsilon_{ij} \tag{19}$$

where X_{ij} is a vector of characteristics unique to choice j relative to decision maker i, z_i is a vector of characteristics unique to the individual decision maker i, and ε_{ij} is a random variable with a normal distribution and mean zero. We estimate respective parameters that vary across sectors for the choice and individual-specific characteristics. However, a normalization sets one of the choices to zero; and hence $j-1$ vectors of parameters are actually estimated. In the estimation, U_r, the licensed brothel sector is normalized to zero.

The probability a sex worker will choose sector r is:

$$P_{i,r} = \Pr[(\overline{U}_{i,r} > \overline{U}_{i,u}) \ \& \ (\overline{U}_{i,r} > \overline{U}_{i,s})]$$

which is equivalent to:

$$P_{i,r} = \Pr[(\varepsilon_{i,u} - \varepsilon_{i,r} < \overline{U}_{i,r} - \overline{U}_{i,u}) \ \& \ (\varepsilon_{i,s} - \varepsilon_{i,r} < \overline{U}_{i,r} - \overline{U}_{i,s})]$$

[21] The multinomial logit model and the conditional logit model are unattractive because they do not allow for correlation between the error terms (i.e., assume $\varepsilon_{ij} \perp \varepsilon_{ik}$ for $j \neq k$) This assumption is known as the independence of irrelevant alternatives (Hausman and Wise 1978).

The probabilities for the other choices, u and s, are defined similarly. Letting N_j represent the total number of sex workers with each outcome j, the log likelihood function can be expressed as:

$$L = \sum_{j=1}^{3} \Big[\sum_{i=1}^{N_j} \ln P_{i,j} \Big] \tag{20}$$

We maximize equation 20 with respect to individual and sector specific characteristics. The results of this regression are indicated in Table 7.

5.1 Multinomial Probit Results

Table 7 reports the results from the sectoral choice multinomial probit. The omitted base category in each specification is the licensed brothel sector. Column (1) reports the probability of sectoral choice regressed on enforcement. Column (2) reports coefficients from the specification of the the theoretical model. We restrict the coefficients on the price of condom use and the compensating differential across sectors to be the same. This is because the model does not allow for price heterogeneity across sectors. In Column (3) we estimate the same regression but this time allow for price heterogeneity. The coefficients on interest on the enforcement variable do not change significantly.

Column (2) illustrates that enforcement is a strong predictor of sectoral choice. In both the street and the unlicensed brothel sector, increasing enforcement reduces the probability of sex workers choosing these sectors; these results are significant at the 99 percent level. Table 8 reports the marginal effects calculation for enforcement.[22] We find that for an additional police visit per month, there is a 15 percent decrease in the probability of sex workers choosing the street sector relative to the licensed brothel sector. Similarly, but to a smaller magnitude, increasing enforcement in the unlicensed brothel sector leads to a 2 percent decrease in this sector relative to the base sector. These results are consistent with the predictions from the model.

Both the price of condom use and the compensating price differential between non-condom and condom use are highly significant predictors of sectoral choice. As expected price of condom use and the compensating price differential are positively correlated with sectoral choice. For a ln one dollar increase in the price differential, there is an 85 percent increase in the street sector choice relative to the base. Similarly, there is over a 100 percent increase in the unlicensed brothel sector for a one dollar increase in ln price of the compensating differential.

In terms of individual level characteristics, the more risk knowledge a sex worker has, the more likely she will join the licensed brothel sector. The same woman is least likely to choose the street, as might be expected. The street sector is characterized by more risky behavior so women with high γ's would choose the licensed brothel sector or even the unlicensed brothel, relative to the street

[22]The marginal effects are calculated at the mean level of enforcement.

sector. The results also indicate that the better communicators, the more educated, attractive and younger sex workers are least likely to choose the street sector. These results allude to the fact that the most "ideal" sex workers in terms of observables such as education and beauty will choose the licensed regulated sector.

One concern with the estimation strategy is that we do not control for potential demand-side client heterogeneity. Client characteristics may also be important in terms of determining the probability of sectoral choice. In Column (4) of Table 7, we include several client characteristics in the multinomial probit as a robustness check. The coefficients on our variable of interest, enforcement do not change significantly with the inclusion of client characteristics. Handsome clients increase the probability of the unlicensed brothel sector being chosen while regular clients increase the probability of the street being chosen relative to the licensed brothel sector.

5.2 Condom Use and STIs by Sector

We are interested in understanding how condom use and STI rates differ by sector. The model predicts that incentives to use condoms vary by sector, and each sector proposes an optimal share of time allocated to condom and non-condom use. Under most circumstances, sex workers in the licensed brothel sector will allocate more time to condom use than unlicensed and street sex workers. Street sex workers will allocate more time to non-condom use than brothel sex sectors.[23] Since enforcement shifts women across sectors, increasing enforcement will affect overall condom use. In this section we predict condom use by sector. Unfortunately, characteristics of a woman that determine her sectoral choice decision may also be correlated with her decision to use a condom (or not). For example, a woman with a low γ, might be more likely to choose the street sector as she is less afraid of risk and also less likely to use condoms. If we were to estimate her predicted probability of condom use without controlling for sectoral choice, then our estimate would be biased.

We exploit the result from the model that enforcement is correlated with the sectoral choice decision but not with condom use. We use enforcement to predict sectoral choice and then estimate condom use and STI outcomes controlling for sectoral choice. The overall probability of STI infection is equal to the sum of the prevalence, α, times the probability of non-condom use, times the probability of choosing a sector, where i indexes the individual and j the sector. The equation of interest is:

$$Pr(STI_i) = \sum_{j=1}^{3} \alpha_{i,j}(1 - Pr(condom_{i,j}))Pr(y_i = j) \tag{21}$$

We use the the multinomial probit sectoral choice results in Table 7 to construct Mills Ratios for each sector and then estimate selection corrected probit regressions for condom use and STI by sector. Table 9 displays the results from the condom use regressions by sector. The predicted probability of condom use in the licensed brothel sector is 93 percent; it is 86 percent in the

[23] This of course also depends on the price differential and α.

unlicensed brothel sector and 72 percent in the street sector. These results confirm the predictions of the theoretical model as condom use is lower on the street. Price of condom use and individual risk measures are significant predictors of condom use. The more risk knowledge a sex worker has, the more likely to use a condom. The higher the price of condom use, the more likely she will use in the brothel sector. This is not true in the street sector. None of the Mills ratios are significant so we cannot reject the null hypothesis that there is no selection on unobservables.

Table 10 reports the coefficients for the STI probit regressions. The predictions indicate that the probability a given sex worker will have an STI in the brothel sectors ranges from 6-7 percent. However, the same woman has a 9 percent probability of having an STI in the street sector. These results confirm that sex work on the street is in fact riskier. Interestingly, very few of the demographic characteristics and risk measures are significant. This suggests that many of these characteristics are important in predicting sectoral choice; however once that choice has been made, the characteristics do not affect STI outcomes. Some caveats to this are the street sector, where beauty and communication skills do significantly affect STI outcomes after controlling for selection. Attractive sex workers on the street are more likely to have an STI but better communicators on the street are less likely. In addition, older sex workers in the brothel sector are less likely to have an STI. The only Mills Ratio which is significant is the unlicensed brothel. The results suggest that unobservable that are correlated with the sectoral choice decision are positively correlated with STI outcomes.

5.2.1 Enforcement simulations and public health outcomes

In Table 11, we simulate changes in street enforcement in order to understand how the sectoral choice changes; and how that in turn affects public health outcomes. We use the multinomial probit estimates and increase the level of street enforcement from 0 to 4 visits per month, keeping brothel sector enforcement constant. As the model predicts, increasing enforcement in the street sector decreases the probability of sex workers choosing this sector. At zero street visits per month, 22 percent of women are in the street, compared to 55.5 percent in the licensed brothel sector and 22.5 percent in the unlicensed brothel sector. As enforcement increases, sex workers leave the street for the brothel sectors. When street enforcement is one police visit per month, 16.5 percent of women are on the street compared to 59 percent in the licensed brothel and 24.5 percent in the unlicensed brothel. This is a 25 percent decrease in the share of sex workers choosing the street sector. As street enforcement increases, the share of sex workers in the street sector decreases steadily. However, the biggest impact is the increase from 0 to 1 police visits per month. At 4 police visit per month, 12 percent of women are on the street compared to 63.5 percent in the licensed brothel and 24.5 percent in the unlicensed brothel.

This exercise illustrates how increasing enforcement in the street shifts women to the brothel sector where incentives to use condoms are higher and STI prevalence lower. In fact more street

sex workers shift to the licensed brothel sector relative to the unlicensed brothel sector. In Table 11, we calculate the overall changes in condom use and STI prevalence that result from less women choosing the street sector. We use the predicted condom use and STI rates by sector given in Table 9 and 10. We find that increasing street enforcement from 0 to 1 visits per month, increases condom use by 1.2 percent and decreases overall STI prevalence by nearly two percent. Figures 3 and 4 are simply graphical representations of Table 11. The figures makes it quite clear that increasing enforcement in the street sector unambiguously increases overall public health outcomes.

6 Conclusions

It is widely believed that regulating the sex market improves overall public health outcome. However, very little research exists testing this claim. This paper offers both empirical and theoretical insights into this issue.

We find that enforcing licensing requirements in Ecuador has the potential to improve public health outcomes, but only under certain conditions. Licensing works not so much by enforcing the license in the highly regulated brothel sector, but by clamping down on the street market. The multinomial probit results indicate that increasing enforcement in the street sector by one police visit per month decreases the probability of sex workers choosing this sector by 15 percent. Moving women off the street and into the less risky brothel sector, unambiguously improves public health outcomes. Calibrating the model, we find that increasing street enforcement from 0 to 1 visits per mont results in a 1.2 percent increase in condom use and a 2 percent decrease in STI prevalence.

The model also suggest that increasing enforcement in the regulated sector has the potential to exacerbate public health problems. Increasing enforcement in the brothel sector induces unlicensed sex workers to either comply with health regulations or shift to the risky street sector. If more sex workers choose the street, then increasing enforcement in the brothel sector will result in worse public health outcomes. Therefore, it is not simply enforcement which matters, but the type of enforcement.

The findings suggest that the most effective type of enforcement should take into account the underlying characteristics of the commercial sex market, and should be concentrated in the sector which is marked by lower condom use and higher STI prevalence. If unlicensed women are choosing the street due to high licensing costs, then offering them financial incentives to keep them in the regulated brothel sector is a policy option to consider. For example, making condoms, STI and HIV/AIDS testing more available and at cheaper prices makes non-condom use relatively more expensive. In addition, interventions to educate street sex workers about the risks of unprotected sex serve may change their risk preferences and reduce the share of time allocated to non-condom use and possibly induce sex workers into the brothel sector.

This paper has focused on supply side issues of the commercial sex market. However, if clients are willing to frequent the street sector in search of risky sex, then sex workers in the street sector

will continue to provide risky services. In fact, very little is known about the demand side of the commercial sex market as clients are numerous and more difficult to target. Analyzing demand side heterogeneity and its effects on public health outcomes is an area of further research.

7 Appendix

7.1 Comparative Statics from the Model

To understand how time allocated to non-condom use varies with changes in γ and α, we do some comparative statics by sector. We differentiate the first order conditions in each sector with respect to γ and α. Not surprisingly, we find that with increased disutility from non-condom sex (γ), there is decreased non-condom sex. We also find that for a given increase in the STI prevalence (α), the time allocated to non-condom use will decrease relative to condom use. For example, with increased risk of STI infection, sex workers will use condoms more often, a sensible result. These comparative results are unambiguously true for the unlicensed brothel and street sectors. For the licensed brothel sector two simple conditions are imposed. However, the conditions are extremely general and would be true under most cases.

7.1.1 Licensed Brothel Sector

We use the implicit function theorem to solve $\frac{dt_r}{d\alpha_r}$ and $\frac{dt_r}{d\gamma}$.

$$\frac{dt_r}{d\gamma} = -\frac{-2\alpha_r t_r(1-\alpha_r t_r-\alpha_r)}{-2\gamma\alpha_r(1-\alpha_r t_r-\alpha_r^2 t_r)-\alpha_r(p_r^n-p_r^c-2\gamma\alpha_r t_r)+\alpha_r(p_r^c-p_r^n)} < 0 \quad if \quad \alpha \leq \frac{1}{t_r+1} \tag{22}$$

The derivative of $\frac{dt_r}{d\alpha_r}$ is given by:

$$\frac{dt_r}{d\alpha_r} = -\frac{-p_r^c-2t_r(p_r^n-p_r^c)-\gamma t_r(2-4\alpha_r t_r-3\alpha_r^2 t_r)}{-2\gamma\alpha_r(1-\alpha_r t_r-\alpha_r^2 t_r)-\alpha_r(p_r^n-p_r^c-2\gamma\alpha_r t_r)+\alpha_r(p_r^c-p_r^n)} < 0 \quad if \quad (2-4\alpha_r t_r-3\alpha_r^2 t_r) > 0 \tag{23}$$

7.1.2 Unlicensed Brothel Sector

From the first order equation, $p_r^n - p_r^c - 2\gamma\alpha_r t_u = 0$, we solve:

$$\frac{dt_u}{d\gamma} = -\frac{(p_r^n-p_r^c)}{2\gamma^2\alpha_r} < 0 \tag{24}$$

$$\frac{dt_u}{d\alpha_r} = -\frac{(p_r^n-p_r^c)}{2\gamma\alpha_r^2} < 0 \tag{25}$$

7.1.3 Street Sector

From the first order equation, $p_r^n - p_r^c - 2\gamma\alpha_s t_s = 0$, we solve:

$$\frac{dt_s}{d\gamma} = -\frac{(p_s^n-p_s^c)}{2\gamma^2\alpha_s} < 0 \tag{26}$$

$$\frac{dt_s}{d\alpha_s} = -\frac{(p_s^n - p_s^c)}{2\gamma\alpha_s^2} < 0 \tag{27}$$

7.2 Condom and Non-Condom Use Prices

The model predicts that condom and non-condom use prices are a key factor in determining the sectoral choice decision. This implies that the predicted price of condom use and the predicted price differential $(p_n - p_c)$ must be used in the estimation of the multinomial probit. Condom and non-condom use prices are imputed conditional on sex worker characteristics and city fixed effects for each woman. Table 12 illustrates the regression results from this exercise; and Table 13 reports the summary statistics of the predicted prices by brothel and street sector.[24]

In both the brothel and street sector, the mean price for condom use is 1.57 ln dollars. This may seem strange as women in the brothel sector tend to be better educated, more attractive, and score higher on observable characteristics. However, transaction prices are computed as net prices. In the brothel sector, sex workers often share some portion of their transaction earnings with the brothel owner. That amount is generally .50-1.00 dollars. In the street sector, women typically take the entire amount home, as they work for themselves. The tradeoff is in the number of clients. In the brothel sector, sex workers have more transactions due to higher rates of client arrival.[25]

The predicted price of non-condom use is about 1.66 ln dollars in the brothel sector compared to 1.71 ln dollars in the street sector. The compensating differential between non-condom and condom use is greater in the street sector.

[24] We do not differentiate between licensed and unlicensed sex worker prices in the brothel sector as clients are unable to distinguish between them.

[25] In addition, we do not control for types of services provided. This might explain some patterns in the prices. For example, street sex workers may provide riskier services. In fact, the data indicates that street sex worker provide relatively more anal sex, which is much riskier than vaginal sex.

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Table 1: Sex Worker Summary Statistics

Variable	**Brothel Licensed** Mean (Std. dev.)	**Brothel Unlicensed** Mean (Std. dev.)	**Street** Mean (Std. dev.)
Hourly earnings($)	5.51	5.19	4.13
	(9.16)	(9.35)	(7.88)
Clients per week	26.274	18.702	13.005
	(30.576)	(28.56)	(19.616)
Condom always used(=1)	.881	.774	.606
	(.324)	(.419)	(.489)
STI(=1)	0.074	0.081	0.083
	(0.262)	(0.273)	(0.276)
HSV(=1)	.834	.791	.869
	(.371)	(.407)	(.337)
Experience(years)	3.919	3.022	6.471
	(4.167)	(4.202)	(6.844)
Age	27.372	25.915	31.59
	(7.028)	(7.140)	(9.94)
Education(years)	7.795	7.486	6.484
	(3.274)	(3.337)	(3.644)
Married/Civil union(=1)	0.486	0.444	0.472
	(0.5)	(0.497)	(0.5)
Children(=1)	0.849	0.849	0.88
	(0.358)	(0.359)	(0.326)
Attractive(=1)	0.317	0.292	0.161
	(0.465)	(0.455)	(0.368)
Good personality(=1)	0.334	0.292	0.175
	(0.472)	(0.455)	(0.38)
Good communication(=1)	0.799	0.801	0.633
	(0.401)	(0.4)	(0.482)
Sample Size	1633	667	640

Table 2: Client Summary Statistics

Variable	**Brothel Licensed** Mean (Std. dev.)	**Brothel Unlicensed** Mean (Std. dev.)	**Street** Mean (Std. dev.)
Regular client(=1)	.477	.413	.606
	(.415)	(.408)	(.40)
Clean client(=1)	.887	.870	.869
	(.256)	(.265)	(.281)
Handsome client(=1)	.115	.149	.099
	(.21)	(.241)	(.211)
Rich client(=1)	.079	.083	.06
	(.207)	(.213)	(.169)
Sample Size	1633	667	640

Table 3: Enforcement: Police Visits (per month)

City	**Enforcement, Brothel (per month)** Mean	**Enforcement, Street (per month)** Mean	SW Sample Size
Machala	4.0	0.507	457
Quito	3.68	0.13	416
Milagro	0.4	0.4	298
Quevedo	0.4	0.38	419
Esmeraldas	0.2	0.05	303
Guayaquil	0.088	0.012	418
Daule	0.034	0.018	281
Santo Domingo	0.034	.034	347
All cities	1.28	0.203	2939
(std. dev)	(1.68)	(.194)	

Note: The overall enforcement mean is 1.01 visits per month with a standard deviation of 1.54.

Table 4: "Was a Condom Used?" Probit

	Condom (1)	Condom (2)	Condom (3)	Condom (4)
	Base Model	Client Characs	City Characs	Exclude Guayaquil
Enforcement brothel	0.013	0.011	0.014	0.015
	(0.01)	(0.01)	(0.01)	(0.01)
Enforcement street	0.113	0.110	0.106	0.118
	(0.05)**	(0.05)**	(0.04)**	(0.04)**
Risk knowledge	0.081	0.084	0.089	0.093
	(0.02)***	(0.02)***	(0.02)***	(0.02)***
Doesn't take risks	0.110	0.096	0.093	0.080
	(0.03)***	(0.03)***	(0.03)***	(0.03)**
Age	-0.003	-0.002	-0.002	-0.002
	(0.00)***	(0.00)***	(0.00)**	(0.00)
Children	0.010	0.009	0.006	0.012
	(0.02)	(0.02)	(0.02)	(0.02)
Married/Civ union	-0.004	-0.004	-0.004	-0.009
	(0.01)	(0.01)	(0.01)	(0.01)
Education	0.001	0.001	0.001	0.001
	(0.00)	(0.00)	(0.00)	(0.00)
Attractive	0.025	0.020	0.019	0.018
	(0.01)**	(0.01)	(0.01)	(0.01)
Communication	0.019	0.022	0.021	0.018
	(0.01)	(0.01)*	(0.01)	(0.01)
Sex ratio	-0.006	-0.006	-0.008	-0.002
	(0.00)**	(0.00)**	(0.01)	(0.01)
Regular client		-0.013	-0.013	-0.011
		(0.01)**	(0.01)**	(0.01)*
Clean client		0.001	-0.000	0.003
		(0.00)	(0.00)	(0.00)
Handsome client		-0.058	-0.059	-0.046
		(0.02)**	(0.02)**	(0.02)**
Rich client		0.124	0.126	0.121
		(0.04)***	(0.04)***	(0.04)**
Female earnings			-0.013	-0.004
			(0.01)	(0.02)
Male earnings			-0.001	0.000
			(0.00)	(0.00)
Clustered	Y	Y	Y	Y
Chi2	128.68	152.16	161.20	170.31
Sample Size	8742	8742	8742	7340

Note: The reported coefficients are marginal effects. The marginal effects for the dummy variables are discrete change from 0 to 1.

Table 5: "STI Positive" Probit

	STI (1)	STI (2)	STI (3)	STI (4)
	Base Model	Client Characs	City Characs	Exclude Guayaquil
Enforcement brothel	-0.002	-0.002	-0.004	-0.010
	(0.00)	(0.00)	(0.01)	(0.01)
Enforcement street	-0.084	-0.083	-0.075	-0.079
	(0.04)**	(0.04)**	(0.04)*	(0.04)**
Risk knowledge	0.009	0.010	0.012	0.008
	(0.01)	(0.01)	(0.01)	(0.01)
Doesn't take risks	-0.011	-0.011	-0.007	-0.004
	(0.02)	(0.02)	(0.02)	(0.02)
Age	-0.001	-0.001	-0.002	-0.002
	(0.00)*	(0.00)*	(0.00)*	(0.00)**
Children	0.028	0.028	0.029	0.031
	(0.01)**	(0.01)**	(0.01)**	(0.01)**
Married/Civil union	0.004	0.005	0.004	-0.001
	(0.01)	(0.01)	(0.01)	(0.01)
Education	-0.002	-0.002	-0.002	-0.003
	(0.00)	(0.00)	(0.00)	(0.00)
Attractive	-0.013	-0.013	-0.017	-0.018
	(0.01)	(0.01)	(0.01)	(0.01)
Communication	-0.032	-0.032	-0.033	-0.029
	(0.01)*	(0.01)*	(0.01)*	(0.02)
Sex ratio	0.006	0.006	0.007	0.006
	(0.00)***	(0.00)***	(0.00)**	(0.00)**
Regular client		-0.010	-0.008	0.000
		(0.01)	(0.01)	(0.01)
Clean client		0.005	0.009	0.014
		(0.02)	(0.02)	(0.02)
Handsome client		0.002	-0.003	-0.008
		(0.02)	(0.03)	(0.03)
Rich client		-0.002	-0.000	0.003
		(0.02)	(0.02)	(0.03)
Female earnings			0.011	0.010
			(0.01)	(0.01)
Male earnings			0.051	0.168
			(0.16)	(0.17)
Clustered	Y	Y	Y	Y
Chi2	54.33	62.14	97.03	93.91
Sample Size	2857	2857	2857	2075

Note: The reported coefficients are marginal effects. The marginal effects for the dummy variables are discrete change from 0 to 1.

Table 6: Is Enforcement Exogenous?

	Condom use (1)	Migrates (2)
Enforcement brothel		-0.005
		(0.03)
Enforcement street		-0.211
		(0.12)
Migrate	0.008	
	(0.01)	
Risk knowledge	0.084	0.012
	(0.02)***	(0.02)
Doesn't take risks	0.104	-0.038
	(0.03)***	(0.05)
Age	-0.002	-0.009
	(0.00)*	(0.00)***
Children	0.010	0.003
	(0.02)	(0.03)
Married/Civil union	-0.001	-0.061
	(0.01)	(0.02)**
Education	0.001	0.019
	(0.00)	(0.01)**
Attractive	0.034	0.105
	(0.01)**	(0.02)***
Communication	0.025	0.079
	(0.01)	(0.03)**
Price condom use(p_c)	0.043	-0.359
	(0.05)	(0.18)**
Compensating diff($p_n - p_c$)	-0.178	-0.876
	(0.05)***	(0.14)***
Sex ratio	0.010	0.015
	(0.01)	(0.02)
Female Earnings	-0.023	0.008
	(0.02)	(0.04)
Male Earnings	0.004	-0.001
	(0.00)***	(0.00)
Clustered	Y	Y
Chi2	131.26	296.93
Sample Size	2857	2857

Note: The reported coefficients are marginal effects from probit regressions. The marginal effects for the dummy variables are discrete change from 0 to 1.

Table 7: Multinomial Probit Results

	(1)		(2)		(3)		(4)	
Sector choice	Brothel Unlicensed	Street	Brothel Unlicensed	Street	Brothel Unlicensed	Street	Brothel Unlicensed	Street
Enforcement	-.046 (.029)	-.979 (.331)***	-.219 (.066)***	-.979 (.145)***	-.188 (.061)***	-.914 (.112)***	-.196 (.061)***	-.906 (.109)***
Compensating diff ($p_n - p_c$)			7.006 (.588)***	7.006 (.588)***	7.133 (.665)***	6.777 (.738)***	7.236 (.646)***	6.774 (.725)***
Price condom use (p_c)			1.475 (.409)***	1.475 (.409)***	.422 (.454)	2.653 (.492)***	.459 (.456)	2.72 (.492)***
Risk knowledge			-.209 (.095)**	-.206 (.112)*	-.207 (.095)**	-.211 (.112)*	-.221 (.098)**	-.236 (.113)**
Doesn't take risks			-.182 (.214)	-.245 (.199)	-.152 (.217)	-.278 (.209)	-.14 (.223)	-.329 (.203)
Age			-.012 (.012)	.042 (.01)***	-.012 (.011)	.043 (.011)***	-.009 (.011)	.038 (.011)***
Children			.161 (.124)	.074 (.152)	.16 (.12)	.076 (.154)	.158 (.117)	.063 (.153)
Married/Civ union			-.209 (.092)**	-.084 (.101)	-.211 (.092)**	-.074 (.101)	-.176 (.09)*	-.078 (.104)
Attractive			-.498 (.115)***	-.642 (.141)***	-.473 (.116)***	-.653 (.143)***	-.486 (.116)***	-.647 (.145)***
Communication			-.226 (.108)**	-.61 (.142)***	-.218 (.109)**	-.654 (.147)***	-.222 (.112)**	-.669 (.147)***
Education			-.102 (.028)***	-.115 (.032)***	-.075 (.026)***	-.144 (.034)***	-.079 (.027)***	-.144 (.034)***
Rich client							-.049 (.239)	.178 (.203)
Handsome client							.877 (.242)***	.167 (.212)
Clean client							-.178 (.149)	-.013 (.152)
Regular client							-.156 (.119)	.437 (.116)***
Constant	-.676 (.083)***	-.326 (.136)**	-1.567 (.814)*	-2.337 (.745)***	-.196 (.81)	-3.969 (.83)***	-.182 (.811)	-4.075 (.837)***
Clustered	Y	Y	Y	Y	Y	Y	Y	Y
Chi2	9.06	9.06	399.45	399.45	544.04	544.04	776.60	776.60
Sample Size	2914	2914	2914	2914	2914	2914	2914	2914

Note: The omitted sector is licensed brothel.

Table 8: Multinomial Probit Marginal Effects

Sector choice	Brothel, Unlicensed Marginal Effect	Street Marginal Effect
Enforcement	-0.018*	-0.149***
	(0.01)	(0.028)
Compensating diff($p_n - p_c$)	1.125***	0.850***
	(0.122)	(0.151)
Price condom use(p_c)	0.031	0.439***
	(0.076)	(0.110)
	(0.040)	(0.040)
Age	-0.003	0.008***
	(0.002)	(0.001)
	(0.019)	(0.037)
Education	-0.011*	-0.021**
	(0.004)	(0.007)
Sample Size	2914	2914

Note: This table provided marginal effects from specification (2) of Table 7 (for the continuous variables).

Table 9: Selection and non-Selection Corrected Condom Regressions

Variable	**Brothel Licensed Condom**		**Brothel Unlicensed Condom**		**Street Condom**	
	Selection Corrected	No Selection	Selection Corrected	No Selection	Selection Corrected	No Selection
Compensating diff	0.004	0.023	0.121	0.177	0.154	0.189
$(p_n - p_c)$	(0.07)	(0.06)	(0.12)	(0.10)	(0.14)	(0.14)
Price condom use	0.123	0.129	0.325	0.295	0.343	0.084
	(0.03)***	(0.03)***	(0.09)***	(0.09)***	(0.24)	(0.10)
Risk knowledge	0.036	0.034	0.112	0.114	0.144	0.147
	(0.02)**	(0.02)**	(0.03)***	(0.03)***	(0.04)***	(0.04)***
Doesn't take risks	0.140	0.133	0.063	0.066	0.096	0.102
	(0.05)***	(0.05)***	(0.07)	(0.07)	(0.07)	(0.07)
Age	-0.002	-0.002	-0.001	-0.003	0.001	-0.003
	(0.00)	(0.00)	(0.00)	(0.00)*	(0.00)	(0.00)*
Children	-0.003	-0.003	-0.004	0.003	0.120	0.120
	(0.02)	(0.02)	(0.04)	(0.04)	(0.06)**	(0.06)**
Married/Civil union	0.013	0.013	-0.003	-0.010	-0.053	-0.066
	(0.01)	(0.01)	(0.03)	(0.03)	(0.04)	(0.04)*
Attractive	0.024	0.023	-0.021	-0.015	-0.017	0.011
	(0.01)*	(0.01)*	(0.03)	(0.02)	(0.05)	(0.04)
Communication	-0.001	-0.003	-0.010	0.005	0.001	0.040
	(0.01)	(0.02)	(0.03)	(0.03)	(0.05)	(0.03)
Education	-0.002	-0.003	-0.009	-0.008	-0.011	-0.003
	(0.00)	(0.00)	(0.00)*	(0.00)*	(0.01)	(0.01)
Mills ratio	0.018		-0.064		0.193	
	(0.03)		(0.05)		(0.15)	
Clustered	Y	Y	Y	Y	Y	Y
Chi2	43.74	35.82	51.60	52.38	62.94	59.41
Predicted Condom	.928	.928	.865	.841	.719	.804
Sample size	4887	4887	1998	1998	1857	1857

Note: These are probit regressions and the coefficients are marginal effects.

Table 10: Selection and non-Selection Corrected STI Regressions

Variable	**Brothel Licensed STI**		**Brothel Unlicensed STI**		**Street STI**	
	Selection Corrected	No Selection	Selection Corrected	No Selection	Selection Corrected	No Selection
Compensating diff	-0.001	-0.001	0.054	0.013	0.304	0.294
$(p_n - p_c)$	(0.05)	(0.05)	(0.08)	(0.08)	(0.10)***	(0.09)***
Price condom use	-0.067	-0.067	-0.158	-0.134	-0.150	-0.065
	(0.05)	(0.05)	(0.05)***	(0.05)*	(0.15)	(0.06)
Risk knowledge	0.005	0.005	0.024	0.022	0.006	0.005
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Doesn't take risks	-0.021	-0.021	0.011	0.011	0.013	0.012
	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)
Age	-0.002	-0.002	-0.006	-0.004	-0.001	0.000
	(0.00)*	(0.00)*	(0.00)***	(0.00)**	(0.00)	(0.00)
Children	0.011	0.011	0.059	0.059	0.042	0.043
	(0.01)	(0.01)	(0.02)**	(0.02)**	(0.02)	(0.02)
Married/Civil union	-0.013	-0.013	-0.001	0.004	0.032	0.036
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Attractive	-0.020	-0.020	-0.021	-0.025	0.074	0.059
	(0.01)*	(0.01)*	(0.02)	(0.02)	(0.04)**	(0.04)*
Communication	-0.018	-0.018	-0.004	-0.015	-0.083	-0.101
	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)**	(0.03)***
Education	-0.000	-0.000	0.003	0.002	0.001	-0.002
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)
Mills ratio	-0.000		0.055		-0.065	
	(0.02)		(0.03)**		(0.09)	
Clustered	Y	Y	Y	Y	Y	Y
Chi2	17.96	17.54	34.65	22.28	38.11	38.83
Predicted STI	.074	.074	.063	.074	.094	.066
Sample size	1629	1629	666	666	619	619

Note: These are probit regressions and the coefficients are marginal effects.

Table 11: Street Enforcement Simulations and Public Health Outcomes

Street Enforcement	Brothel Lic	Brothel Unlic	Street	% Decrease	Condom Use	% Increase	STI Prev	% Decrease
Level	%in sector	%in sector	%in sector	in Street	All%	All	All%	All
0	55.5	22.5	22		86.78		7.59	
1	59	24.5	16.5	25	87.8	1.18	7.46	1.74
2	60.5	25.1	14.4	34.5	88.21	1.64	7.41	2.38
3	62	25	13	40.9	88.51	1.99	7.38	2.73
4	63.5	24.5	12	45.5	88.75	2.26	7.35	2.92

Note: We vary street enforcement and hold regulated sector enforcement constant.

Table 12: OLS Price Regression

	ln price
Age	-.008 (.001)***
Married/Civ union	-.065 (.022)***
Education	.021 (.003)***
Attractive	.039 (.027)
Communication	.012 (.028)
Carnet	-.095 (.024)***
Condom	-.037 (.036)
Machala	-.058 (.041)
Milagro	-.363 (.046)***
Daule	-.345 (.047)***
Esmeraldas	.064 (.045)
Santo Domingo	-.112 (.045)**
Quevedo	-.369 (.042)***
Quito	.011 (.041)
Constant	1.893 (.072)***
F statistic	24.926
Sample Size	2714

Note: The omitted city is Guayaquil.

Table 13: Condom and Non-Condom Use Prices

Variable	**Brothel Sector** Mean (Std. dev.)	**Street Sector** Mean (Std. dev.)
Predicted price(condom)	1.57 (.208)	1.57 (.214)
Predicted price (no condom)	1.66 (.302)	1.71 (.299)
Sample Size	2285	607

Note: The prices are ln dollar.

Figure 1: Female Non-Sex Worker Earnings and Enforcement

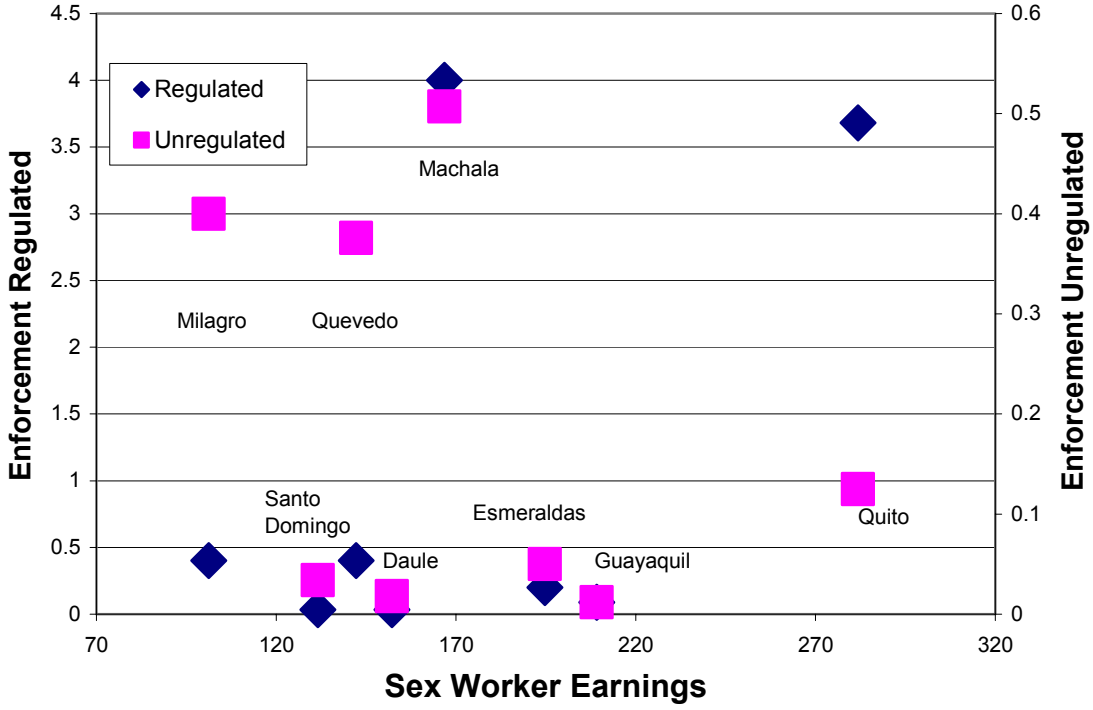

Figure 2: Sex Ratio and Enforcement

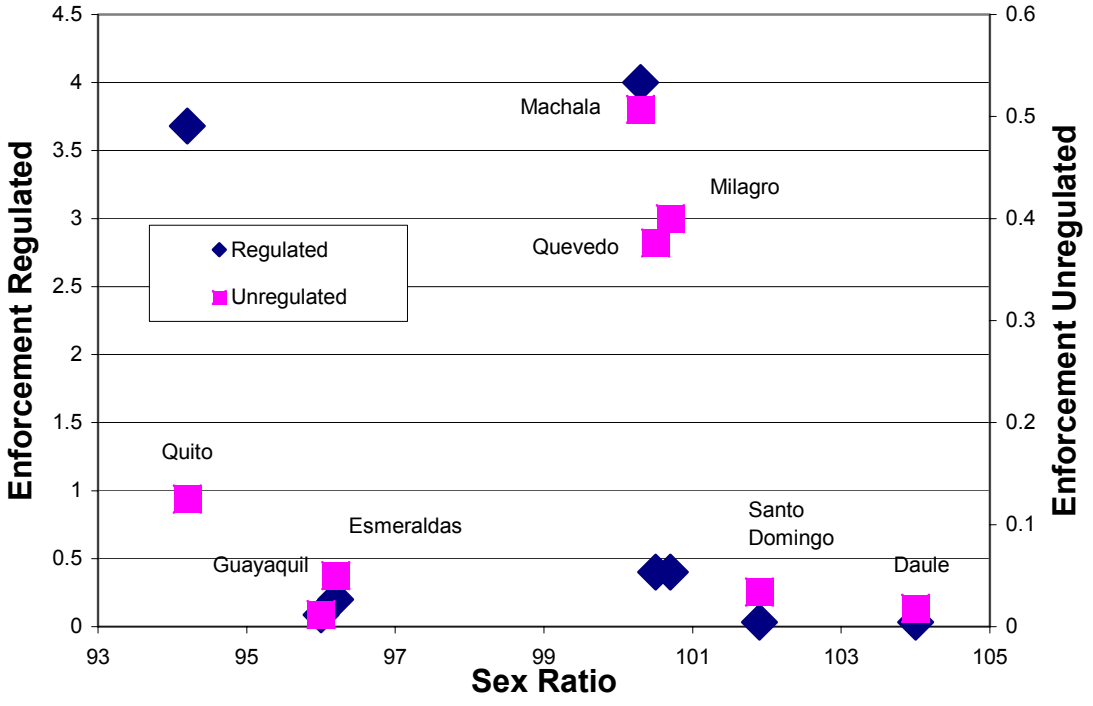

Figure 3: Increasing Street Enforcement & Condom Use

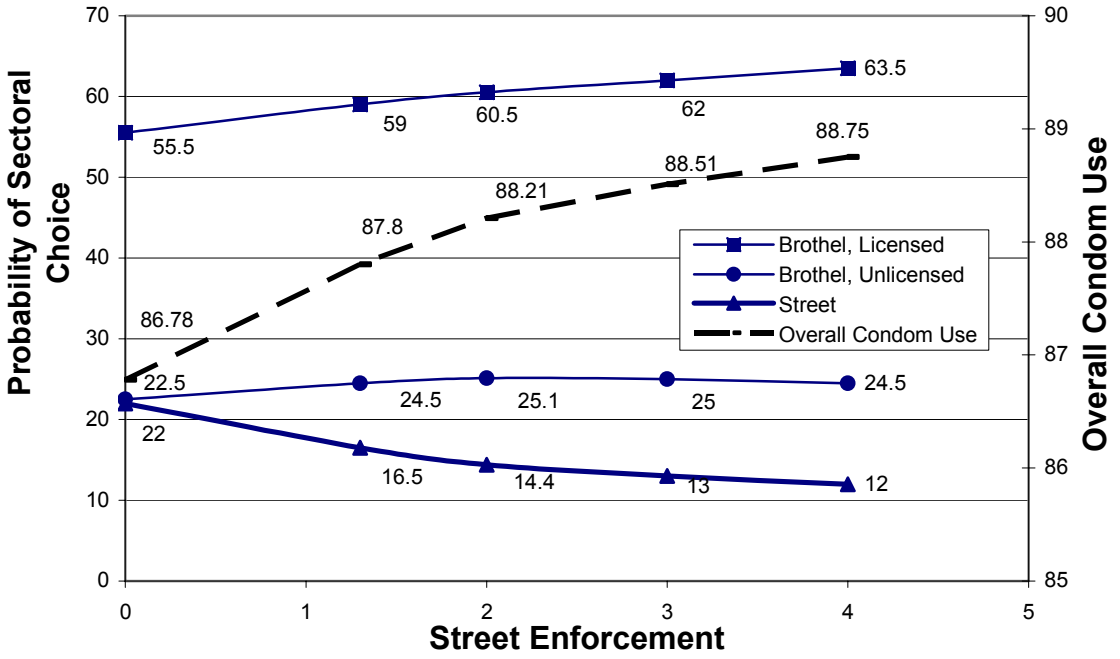

Figure 4: Increasing Street Enforcement & STI Outcomes