Risky Business: The Market for Unprotected Commercial Sex

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While condoms are an effective defense against the transmission of HIV, large numbers of sex workers are not using them. We argue that some sex workers are willing to take the risk because clients are willing to pay more to avoid using condoms. Using data from Mexico, we estimate that sex workers received a 23 percent premium for unprotected sex. The premium represents a value of one life year of between $14,760 and $51,832 or one to five times annual earnings. The premium jumped to 46 percent if the sex worker was considered very attractive, a measure of bargaining power.

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Each day over 20,000 people become infected with the human immunodeficiency virus (HIV) worldwide, a large proportion of whom are infected through unprotected sex with sex workers (UNAIDS 2002). Although condoms are an effective defense against the transmission of HIV and other sexually transmitted infections (STIs) and there has been substantial education of sex workers regarding the risk of infection, large numbers of sex workers are not using condoms with their clients (UNAIDS 2002). Indeed, infection rates among sex workers are among the highest of any group, especially in developing countries with widely disseminated epidemics (World Bank 1999). A major question confronting policy makers who design and implement interventions for the prevention of acquired immunodeficiency syndrome (AIDS) and STIs is Why do sex workers risk infection by not using condoms in their work?

Much of the health policy literature argues that in many cases sex workers engage in unprotected sex because they are uninformed of the risks (World Bank 1999; Lau et al. 2002). And in the cases in which sex workers are aware of the risk, many hypothesize that non–condom use occurs because condoms are either very expensive or not available at all (Negroni et al. 2002) or because sex workers are forced to have unprotected sex (Karim et al. 1995; World Bank 1999; Bronfman, Leyva-Flores, and Negroni 2002).

Ignorance does exist and the forced exploitation of sex workers does occur. However, another possible explanation is that sex workers are willing to risk infection by not using condoms with clients if they are adequately compensated. Indeed, economic theory has long posited the general principle of compensating wage differentials (e.g., Rosen 1986), and a number of authors have documented wage differentials that compensate for risky work activities in other labor sectors (e.g., Viscusi 1992; Siebert and Wei 1998). Similarly, automobiles with antilock brakes, homes with fire sprinklers, and other risk-reducing products are priced higher by the market because consumers are willing to pay for safer products (Viscusi, Vernon, and Harrington 2000). While there is anecdotal evidence that sex workers charge more for sex without a condom (Ahlburg and Jensen 1998), there has been little published work that has tried to test this claim.[1]

Understanding why sex workers do not use condoms is critical for

[1] The one exception is the article by Rao et al. (2003), who report that Indian sex workers who always use condoms earn 66 percent less than those who do not always use condoms. However, they did not have the data to distinguish between the return to taking risk and other differences between the two populations. They regress average price against a sex worker's characteristics and whether she reported always using condoms. They instrumented for condom use with exposure to an education program about the health risks of not using condoms. However, the educational intervention was intended to increase condom use by changing knowledge about risks and risk preferences, and possibly by changing bargaining power.

the development of policy that is effective in increasing condom use and consequently in reducing the transmission of STIs including HIV. The usual policy recommendations are to intervene on the supply side (World Bank 1999). These policies include (1) educating sex workers about the risks, (2) increasing access to inexpensive condoms, (3) reducing environmental barriers to condom use by working with gatekeepers such as brothel owners and the police, and (4) empowering sex workers by, for example, improving their negotiating skills and fostering self-help organizations. Additionally, governments are urged to implement and enforce laws against human trafficking, rape, assault, and indentured servitude.

However, if some clients are willing to pay substantially larger sums for unprotected sex, supply-side interventions alone are less likely to sufficiently reduce unprotected commercial sex. Even knowledgeable sex workers with condoms, who are free to turn down clients, might be willing to supply unprotected sex if the price is right. In this case, complementary interventions on the client side that reduce the demand for unprotected sex are also necessary in order to increase condom use. However, client-based interventions are likely to be more difficult and more expensive to implement.

In this paper, we investigate why sex workers may not be using condoms. We begin by constructing a simple bargaining model of commercial sex that has a number of empirically testable predictions. The model predicts that a condom will not be used when the client's maximum willingness to pay not to use a condom is greater than the minimum the sex worker is willing to accept to take the risk. Surprisingly, however, the model also predicts that when the client is worried about the risk of infection from unprotected sex, he may be charged more for using a condom than for unprotected sex. Similarly, when the sex worker prefers not to use a condom, the client is given a discount for not using a condom. The price differential between protected and unprotected sex is a weighted average of the maximum the client is willing to pay for not using a condom and the minimum the sex worker is willing to accept to take the risk of infection by not using a condom. The weights are a function of the relative bargaining power of the client and sex worker.

We test these predictions using a panel data set that we recently collected from the Mexican states of Michoacan and Morelos. We use the panel to control for the likelihood that condom use is not exogenous because of sex worker heterogeneity and client sorting based on sex worker characteristics. Sex workers who have a preference for condom use may also charge higher prices regardless of condom use. For example, if better-educated sex workers have a preference for condom use and are better able to negotiate higher prices, then price and con-

dom use will be positively correlated. However, the price will not reflect compensation for risk taking. Another source of bias comes from the possibility that clients who have preferences for condom use select sex workers who also have preferences for condom use. If these clients were, say, better educated and wealthier, then they would also be willing to pay more for the sex workers' services. This situation again introduces a positive correlation between price and condom use that does not reflect compensation for risk taking. Both of these are similar to the unobserved heterogeneity bias introduced from omitted productivity characteristics in estimating compensating wage differentials (Garen 1988; Hwang, Reed, and Hubbard 1992). To control for the endogeneity of condom use, we collected information on the last three to four transactions for each sex worker to create a panel data set. We then estimated a model with a sex worker fixed effect to control for bias from both unobserved sex worker heterogeneity and client selection.

We find that Mexican sex workers received a 23 percent premium for unprotected sex from clients who requested not to use a condom, and this premium jumped to 46 percent if the sex worker was considered very attractive. We also found that clients who requested condom use paid 9 percent more for protected sex, and sex workers who requested not to use a condom gave clients a 20 percent discount. These results are completely consistent with our theoretical predictions.

Mexico is an interesting country to study these issues because it does not yet have a generalized HIV/AIDS epidemic. In fact, the risk of HIV infection is low: 0.35 percent of sex workers and 0.128 percent of the general population are infected with HIV (Conde et al. 1993). In contrast, the risk of being infected with another STI is much higher since 17 percent of sex workers in our sample report having an STI in the last year.[2] The fact that the STI rate is so much higher than the HIV rate raises the concern of a likely rise in HIV infection in the near future because the STI rate is a marker for sexual risk behavior (Centers for Disease Control and Prevention 2004). The Mexican government and governments in other countries at risk of developing a generalized HIV/AIDS epidemic are keenly interested in policies that increase condom use, especially among those populations at greatest risk of becoming infected or transmitting the infection (CONASIDA 2001, 2002; UNAIDS 2004).

One reason why the STI and HIV infection rates are relatively low is that sex work is regulated in many Mexican states and massive education

[2] From our in-depth interviews and focus groups, we also believe that self-reporting of STIs during the questionnaire application was underreported. The reason is that there are bars/clubs in certain areas in which regulation of sex workers will not allow a sex worker to work if she suffers from an STI. Therefore, since these women fear losing their job, they may well underreport STI or vaginal problems.

campaigns for sex workers have been conducted over the last 10 years.[3] As a result, condom use is fairly high among sex workers in Mexico. Female sex workers in Chiapas used condoms 55 percent of the time (Valin and Egremy 2002), and in our data set described below, 84 percent of the sex workers reported always using condoms. Increasing condom use beyond these levels may be quite difficult, and education alone may not be able to do it.

I. A Model of Commercial Sex Transactions

In order to model commercial sex transactions, we conducted a number of in-depth interviews and focus groups with female sex workers and their clients in Mexico. The market for commercial sex is characterized by substantial product heterogeneity. Sex workers differ in their physical and personality characteristics and in the services that they are willing to provide. Clients' tastes for sex worker characteristics are also highly heterogeneous, and clients are attracted to specific sex workers on the basis of their characteristics and the services they are willing to provide. This means that other sex workers are ex ante inferior in their eyes. Clients also face substantial search costs not only in terms of time and money but also in terms of psychological costs from possible embarrassment. Clients search for sex workers in specific locations such as in the streets, brothels, massage parlors, bars, and classified advertisements and on the Internet. Clients have a general idea about the price and quality distribution but do not know the price and quality of any particular sex worker unless they have purchased her services in the past.

Clients typically approach sex workers on the basis of physical appearance and superficial personality characteristics that they value. The client and sex worker (or her agent) then negotiate over price and services, including whether a condom will be used. Client heterogeneity in tastes for sex worker characteristics and the high search costs allow sex workers to charge different prices to different clients. The sex worker collects information about the client from his appearance and from conversation in order to establish his approximate willingness to pay. She will use signals such as his clothes, the car he drives, his level of cleanliness, his communication style, and many other signals to determine an asking price. While initial terms are almost always negotiated up-front, the terms are typically renegotiated again later as client preferences are typically revealed over time. In some locations an intermediary, such as her manager or the owner of the brothel or massage

[3] The regulation typically includes periodic medical screening to detect HIV and other STIs as well as periodic inspections of work sites by government agencies (Cuadra et al. 2002).

parlor, may conduct the initial negotiation. However, terms are regularly renegotiated directly with the sex worker in the room because many clients ask for more or different services.

Condom use is almost always negotiated directly between the client and the sex worker. While condom use among sex workers in Mexico is relatively high (Negroni et al. 2002; Valin and Egremy 2002), there is also substantial heterogeneity in preferences over condom use. Many clients report that they prefer not using condoms because it enhances pleasure and they do not believe that the risk of infection is high; others said that they were indifferent; and some said that they insist on using condoms because of the risk of infection. Similarly, while the vast majority of sex workers reported that they always use condoms, a small number indicated that they prefer not to use condoms for comfort reasons. Indeed, in our sample described below, less than 2 percent of the non–condom use transactions occur at the suggestion of the sex worker.

In the focus groups, both sex workers and clients reported that they had some awareness of the risk of HIV and other STIs. However, both groups reported that their risk perceptions did not change on the basis of the characteristics of the specific partner including his or her preferences over condom use. This implies that client risk perceptions are not conditional on the characteristics of the sex worker, including whether the sex worker prefers to use a condom or not, and sex workers' risk perceptions are not conditional on the characteristics of clients, including their condom preferences.[4] Therefore, we ignore the individual infection status and the possibility that the revelation of preferences for condom use provides information about infection status in the formal model. However, this assumption could be possible only in countries with a low prevalence of HIV/AIDS and would not reflect the situation in high-prevalence countries.

We now formalize this view of commercial sex transactions in a simple bargaining model. We begin by specifying the payoff functions and describe the equilibrium condom use and price conditions.

A. Payoff Functions

Let the client's maximum willingness to pay (utility) from having unprotected sex with the sex worker be V and his maximum willingness to pay not to use a condom (disutility) be β. Then his payoff from condom-protected sex with the sex worker is $V - \beta - P^c$, where P^c is the price he pays her for protected sex; his payoff from having unprotected

[4] The only reported exception was the case in which the client was a regular customer. In this case, both client and sex worker reported lower perceived risk.

sex with her is $V - P^{nc}$, where P^{nc} is the price he pays her for unprotected sex. Without loss of generality, we normalize the client's payoff from the next-best alternative use of his time to be zero. The client's disutility from using a condom need not be positive. Indeed, if he prefers not to risk infection and therefore prefers to use a condom, then β is negative.

The sex worker's payoff for supplying protected sex is simply the price she receives, P^c. However, her payoff from supplying sex without a condom is $P^{nc} - \gamma$, where γ is her disutility from exposing herself to risk of infection by not using a condom. We assume that the sex worker expects to get W from the next-best use of her time. The value of W is the sum of what she earns from her next-best activity plus the disutility of providing sexual services, which can include risk of violence, risk of arrest, and so forth. The value of the outside option W is the minimum that the sex worker is willing to accept to provide protected sex, and $W + \gamma$ is the minimum she is willing to accept to provide unprotected sex. Here too we do not assume that γ is necessarily positive; if she prefers to supply sex without a condom, her disutility associated with not using a condom would be negative.

B. Equilibrium Condom Use and Prices

Since this is a model of free choice, the sex worker will supply unprotected sex only if both agree not to use a condom. This will be the case if the payoff from non–condom use is greater than or equal to the payoff from condom use for both parties. For the client this implies that the marginal cost of not using a condom ($P^{nc} - P^c$) is less than or equal to his disutility from condom use, β. For the sex worker, this implies that her marginal revenue from not using a condom ($P^{nc} - P^c$) is greater than or equal to her disutility from risking infection by not using a condom, γ. Therefore, if they are able to negotiate an acceptable price for sex, they will not use a condom if $\beta > \gamma$; that is, the maximum that he is willing to pay not to use a condom is greater than the minimum that she is willing to accept to take the risk.

We solve for the equilibrium prices using a Roth-Nash bargaining framework. We begin with the case in which they use a condom. In this case, we choose P^c to maximize $(V - \beta - P^c)^{\alpha}(P^c - W)^{1-\alpha}$, where α is the client's bargaining power and $1 - \alpha$ is the sex worker's bargaining power. Then the equilibrium price of protected sex is

$$P^c = (1 - \alpha)(V - \beta) + \alpha W. \tag{1}$$

The equilibrium price is a weighted average of the maximum that the client is willing to pay for protected sex and the minimum the sex worker is willing to accept to supply protected sex. The weights are the sex

worker's and the client's relative bargaining powers, respectively. The more the client values sex with the sex worker, the higher the price, bounded by his maximum willingness to pay for protected sex. The more the client dislikes using a condom, the lower the price, bounded by the sex worker's minimum willingness to accept. The better the sex worker's outside option, the higher the price. And the greater her bargaining power relative to the client's, the closer the price is to his maximum willingness to pay.

In the case in which $\beta > \gamma$, we solve for the price of unprotected sex by maximizing $(V - P^{nc})^{\alpha}(P^{nc} - \gamma - W)^{1-\alpha}$. The equilibrium price of unprotected sex is

$$P^{nc} = (1 - \alpha)V + \alpha(W + \gamma). \tag{2}$$

The price of unprotected sex is a weighted average of the maximum the client is willing to pay for unprotected sex with the sex worker and the minimum that she is willing to accept for supplying unprotected sex. The minimum she is willing to accept is her expected payoff from her outside option plus her disutility from taking the risk by not using a condom. The more the client values unprotected sex with the sex worker, the higher the price will be. Similarly, the greater her outside option, the greater the price. Also, the greater her disutility from not using a condom and the greater her bargaining power, the higher the price and the closer it is to the client's maximum willingness to pay.

C. Price Differential for Unprotected Sex

Subtracting (1) from (2) gives us the price differential between unprotected and protected sex:

$$P^{nc} - P^{c} = (1 - \alpha)\beta + \alpha\gamma. \tag{3}$$

The price differential increases the larger the client's disutility from using a condom and the bigger the sex worker's disutility from taking the risk. The greater the sex worker's bargaining power, the higher the price differential and the closer it gets to the client's maximum willingness to pay to not use a condom

As long as both β and γ are positive, the price premium for unprotected sex is positive. However, an interesting result from (3) is the possibility that the client is charged a higher price for condom use than for non–condom use. This can occur two ways. First, suppose that the client is concerned about the risk of infection and gains utility from condom use. If his bargaining power weighted utility of condom use is greater than the sex worker's bargaining power weighted utility of condom use, then he will pay her more to use a condom. In this case β is negative and large enough so that (3) becomes negative. This result

just says that if the client wants to use a condom more than she does, he will pay her to do so. Alternatively, the sex worker may prefer to take the risk. If she prefers not to use a condom more than the client prefers not to use a condom, then she will pay him for more unprotected sex. In this case, γ is negative and large enough so that (3) becomes negative.

II. Identification and Estimation

Our empirical objectives are to get consistent estimates of the price differential between condom and non–condom use and to understand how this differential varies with client and sex worker preferences. To get an estimable model, we combine the expressions for P^{nc} and P^{c} from equations (1) and (2) into the following single equation:

$$P_{ij} = (1 - \alpha)V_{ij} + \alpha(W_j + \gamma_j) - [(1 - \alpha)\beta_i + \alpha\gamma_j]C_{ij}, \tag{4}$$

where subscript i denotes the client, j denotes the sex worker, and C_{ij} indicates whether the sex worker used a condom with the client ($= 1$).

We specify the first term on the right-hand side of equation (4), that is, client i's bargaining power weighted value of having unprotected sex with worker j, to be

$$(1 - \alpha)V_{ij} = \lambda + \sum_k \phi_k X_{ik} + \sum_l \delta_l S_{ijl} + \psi_j + \epsilon_{ij}, \tag{5}$$

where the X_{ik} are characteristics of the client, the S_{ijl} are the services that the sex worker provided to the client, ψ_j is a sex worker fixed effect, and ϵ_{ij} is a zero mean random disturbance. The expression allows the maximum a client is willing to pay to differ by his characteristics (e.g., wealth, education, or whether he has been drinking), the services provided (e.g., vaginal or oral sex), and sex worker characteristics (e.g., physical attractiveness).

We then substitute equation (5) into equation (4), to get

$$P_{ij} = \lambda + \sum_k \phi_k X_{ik} + \sum_l \delta_l S_{ijl} + \rho(\beta_i, \gamma_j)C_{ij} + \theta_j + \epsilon_{ij}, \tag{6}$$

where

$$\rho(\beta_i, \gamma_j) = -[(1 - \alpha)\beta_i + \alpha\gamma_j] \tag{7}$$

and

$$\theta_j = \psi_j + \alpha(W_j + \gamma_j). \tag{8}$$

Our empirical model includes equation (6) along with the following condition for condom use:

$$C_{ij} = \begin{cases} 1 & \text{if } \beta_i \leq \gamma_j \\ 0 & \text{otherwise.} \end{cases} \tag{9}$$

Equations (6) and (9) describe the joint determination of price and condom use.

Our objective is to estimate the price differential, $\rho(\beta_i, \gamma_j)$, between condom and non–condom use. While we do not observe both condom and non–condom use in a single transaction, the price differential compares how much more the client paid for not using a condom to the counterfactual of what he would have paid had he used a condom, and vice versa. However, as predicted by our theory and specified in (6), the price differential is a function of the relative preferences of the client and sex worker. We measure four preference states using information on who suggested using the condom (client vs. sex worker) if a condom was used and who suggested not using a condom if no condom was used. We assume that the information on who suggested it represents the relative values of β and γ and whether they are positive or negative. For example, if they did not use a condom at the client's suggestion, then his maximum willingness to pay not to use a condom was higher than the sex worker's minimum willingness to accept to take the risk. However, this assumption is maintained and is not directly testable. Under this assumption, the four cases, as described in table 1, also allow us to test the predictions of the theoretical models.

One concern is that condom use may be correlated with the error term in the price equation (6), resulting in biased estimates. Indeed,

TABLE 1
MAPPING OF CONDOM USE INFORMATION INTO THEORETICAL PREDICTIONS

	Condom Used	Condom Not Used
Sex worker suggested	Default case ($\beta < \gamma$): The client's willingness to pay not to use a condom is less than the minimum compensation to the sex worker to take the risk	$-\beta > \gamma$: The client's willingness to pay to use a condom (β is negative) is a larger minimum compensation for the sex worker's willingness to take the risk; the price should be higher than in the default case
Client suggested	$-\gamma > \beta$: The sex worker's willingness to pay not to use a condom (γ is negative) is larger than the client's willingness to pay; we expect the price to be lower than in the default case	$\beta > \gamma$: The client is willing to pay more for not using a condom than the minimum compensation for the sex worker to take the risk; we expect the price to be higher than in the default case

condom use as indicated in equation (9) is a function of both the client's and the sex worker's risk preferences. Sex worker condom preferences, γ, enter the price equation both linearly and interacted with condom use and client condom preferences, β, enter interacted with condom use. Since γ enters (6) as part of the error, condom use will be correlated with the error term in the price equation. Moreover, if β is measured with error, then condom use may also be correlated with the error term in the price equation.

A common approach to this problem is to use instrumental variables. However, in principle, there are no omitted variables that could be used as instruments for condom use in the price equation. Condom use is a function of only β and γ, and both are directly included in the price equation.[5]

Instead we shall take advantage of the fact that we have transaction data and multiple transactions for each sex worker by including a sex worker fixed effect. The sex worker fixed effect specified in equation (6) controls not only for γ but also for the value of the sex worker's outside option and the fixed effect from the client's value function in equation (5), ψ_j. The fixed effect controls for bias from both unobserved sex worker heterogeneity and client selection based on unobserved sex worker characteristics.

While the sex worker fixed effect controls for γ, we still need to include measures of β interacted with condom use. While we try to directly measure β using the information on who suggested condom and non–condom use, there still might be unobserved portions of the β distribution that are salient in the price differential and a determinant of condom use. Such measurement error would lead to a correlation between condom use and the error term in the price equation.

We test the extent to which there might be measurement error by further interacting the "who suggested" variables with observed client characteristics that predict condom use. We do so by first estimating a random-effects multinomial logit predicting who suggested condom/non–condom use as a function of sex worker and client characteristics. Those characteristics that significantly predict who suggested condom/non–condom use are correlated with β and γ. We then take those significant predictors and interact them with who suggested condom/non–condom use in the price equation. If the client interactions are not significant, this suggests that the variables on who suggested condom/non–condom use capture the salient parts of the β distribution and that

[5] One possibility is to use condom prices as an instrument. However, the price is subsumed in the price of the transaction, and if it were broken out would be part of the price differential. Moreover, the condom price is a very small fraction of the total transaction price, and there is very little cross-section variation in condom prices.

there are unlikely to be unmeasured portions of β in the error term that bias the estimates.

III. The Survey and Sample Characteristics

In the summer of 2001, we surveyed female sex workers in the Mexican states of Morelos and Michoacan. Morelos borders Mexico City to the south and Michoacan is northwest of the city. Morelos has one of the highest rates of reported HIV/AIDS in the country, and Michoacan is closer to the median rate (CONASIDA 2003). We selected these states on the basis of HIV/AIDS prevalence, previous experience with behavioral studies, and willingness of the local AIDS programs to collaborate.

We mapped the universe of sex workers to develop a sample frame. The mapping methodology first identified the gathering points for sex workers and then estimated the population size at each site. This is more feasible for developing a sample frame for mobile and hard-to-reach populations such as sex workers than enumerating each individual in the target population. Potential sites were identified through interviews with key informants (i.e., taxi drivers, police, pimps, madams, bar owners, workers at nongovernmental organizations, medical personnel, etc.), and a snowball method implemented; that is, as additional sex work sites are located, people in the new sites asked about the location of other sites. Such an approach is biased in favor of sites that concentrate formal sex work and will miss most of the informal situations such as the case in which a woman occasionally sells sex out of her home. The bias in favor of the more formal sites implies a likely bias in favor of sex workers who have a larger number of clients.

Target sample sizes were calculated on the basis of estimates of the prevalence of condom use, with 90 percent power and a 5 percent significance level. A sample of 1,029 sex workers responded to the socioeconomic survey, about three-quarters of whom were from Michoacan and one-quarter from Morelos. The survey includes sex worker characteristics and retrospective details of the last four transactions per sex worker in Michoacan and the last three transactions in Morelos, for a total of 3,837 observations. Most sex workers have more than three transactions per week, so the retrospective data are less than a week old. By asking retrospective information, we create a panel consisting of multiple transactions for each sex worker without attrition.

A. Sex Worker Characteristics

The sample of women who responded to the socioeconomic questionnaire is described in table 2. The average sex worker is 28 years old, had her first sexual experience at age 16, and had her first compensated

TABLE 2
SEX WORKER CHARACTERISTICS

		CONDOM USED SAMPLE		CONDOM NOT USED SAMPLE		
	WHOLE SAMPLE (1)	Sex Worker Suggested (2)	Client Suggested (3)	Sex Worker Suggested (4)	Client Suggested (5)	Did Not Have Condom (6)
Number of sex workers*	1,029	877	63	18	110	36
Age	27.82	27.52	28.52	29.5	29.93	27.28
	(7.77)	(7.55)	(7.59)	(8.75)	(9.24)	(8.41)
Age of first sexual experience	15.65	15.65	15.24	14.94	14.91	14.81
	(2.36)	(2.14)	(2.01)	(2.21)	(1.73)	(2.18)
Age of first compensated sex	21.79	21.86	21.16	22.18	21.88	19.05
	(5.72)	(5.66)	(5.61)	(6.78)	(6.62)	(3.10)
Very attractive (=1)	.21	.20	.212	.02	.11	.11
Have children (=1)	.62	.71	.89	.90	.82	.82
Literate	.84	.85	.83	.78	.74	.79
Had HIV test (=1)	.89	.89	.92	.92	.89	.88
Had STIs/vaginal problems (=1)	.17	.16	.21	.34	.22	.14
Civil status:						
Single (=1)	.41	.41	.31	.16	.33	.46
Married (=1)	.22	.05	.10	0	.05	0
Divorced or widowed (=1)	.38	.15	.12	.18	.13	.09
Primary work site:						
Bar/club (=1)	.82	.83	.70	.92	.69	.86
Street (=1)	.12	.12	.21	.08	.30	.14
Other (=1)	.06	.05	.08	0	.01	0

NOTE.—The table reports the means and standard deviations (in parentheses) for nonbinary variables for the whole sample and by transaction type. The descriptive statistics in cols. 2–6 are transaction weighted. The descriptive statistics for the whole sample are simple means and standard deviations.

* The number of sex workers reported in this row indicates the number of sex workers who had at least one transaction of the type specified in the column. Therefore, the cells in the row are not mutually exclusive and do not sum to the total number of sex workers.

sex experience at 22. Seventeen percent of the women reported experiencing STIs or other vaginal problems, 21 percent were considered to be very attractive by the interviewers, 84 percent are literate, 22 percent are married, and 62 percent have children. The majority of the women in this sample work in bars/clubs. Indeed, 50 percent reported consuming alcohol every day for the four weeks prior to the administration of the survey. This high percentage is indicative of the fact that bar owners pay sex workers a commission per unit of beverage consumed by both her and her client. Since the more alcohol consumed the higher the payment, the incentive to drink is extremely high.

Columns 2–6 of table 2 decompose sex worker characteristics by condom/non–condom use and who suggested it. While the numbers of

observations report the number of sex workers who had at least one transaction in that category, the descriptive statistics are transaction-weighted. There are a number of interesting differences across the categories. In particular, sex workers who use condoms are more literate, less likely to have had an STI or vaginal problem, and more attractive than sex workers who provide unprotected services.

B. Transaction and Client Characteristics

Table 3 provides a description of the transactions as reported by the sex workers. Column 1 reports the descriptive statistics for the whole sample. Columns 2–6 disaggregate the data by who suggested using and not using a condom. If the sex worker suggested condom use, we take this to be a signal that she is more risk averse than the client. Alternatively, if the client suggested using the condom, we take this as a signal that he is more risk averse. Similarly, if the sex worker suggested not using a condom, we take this to mean that she is less risk averse than he. Finally, we have some observations for which the sex worker wanted to use a condom but did not because one was not available. We hypothesize that this reflects the case in which the sex worker preferred to use a condom more than the client; there should be no difference between this case and the case in which a condom was used at the suggestion of the sex worker.

A condom was used approximately 90 percent of the time. The sex worker suggested condom use in the vast majority of transactions, whereas the client suggested condom use only in 152 of the 3,485 transactions that used condoms. Not surprisingly, the client suggested not using a condom in 234 or 66 percent of the 351 transactions that did not use a condom. However, in 52 cases (2 percent of total transactions), the sex worker suggested not using a condom, indicating either ignorance of the risk, preference for risk, or other disutility associated with condom use (e.g., latex allergy, irritation, or desire to become pregnant). More interestingly, condoms were not used because of supply constraints in only 65 of the cases, suggesting that supply constraints were not a big problem.

The overall average price per act was 447 Mexican pesos (about U.S.$45). The price is large relative to female wages for non–sex workers. As shown in data from a 2000 Mexican national labor force survey (Encuesta Nacional de Empleo Urbano) for the same states by the Instituto Nacional de Estadistica Geografía e Informática (INEGI), the average hourly wage for women over the same age range is about 62 pesos per hour. The price for one sexual transaction is equal to about 7.2 hours of work for non–sex workers. If we multiply the sex workers' transaction price times the number of clients last week, we get average

TABLE 3
TRANSACTION DESCRIPTIVE STATISTICS

		Condom Used Sample		Condom Not Used Sample		
	Whole Sample (1)	Sex Worker Suggested (2)	Client Suggested (3)	Sex Worker Suggested (4)	Client Suggested (5)	Did Not Have Condom (6)
Sample size	3,836	3,333	152	52	234	65
Transaction price (pesos)	447.48 (426.09)	458.14 (434.45)	381.06 (361.91)	425.20 (430.54)	347.76 (315.50)	429.65 (416.93)
Condom used (=1)	.91	1.00	1.00	.00	.00	.00
Services provided:*						
Vaginal sex (=1)	.99	.99	.97	1.00	.99	.93
Oral sex (=1)	.03	.03	.04	.02	.05	.05
Dance (=1)	.05	.06	.04	.06	.01	.07
Strip (=1)	.03	.03	.00	.00	.01	.00
Talk (=1)	.27	.31	.07	.04	.07	.07
Client characteristics:						
Age	34.19 (10.22)	33.76 (9.77)	34.93 (12.29)	35.06 (9.58)	38.50 (13.48)	39.72 (10.19)
Regular client (=1)	.55	.54	.60	.80	.55	.56
Nice personality (=1)	.65	.66	.72	.54	.61	.54
Wealth:						
Poor (=1)	.17	.16	.18	.50	.21	.11
Average wealth (=1)	.71	.72	.73	.36	.62	.84
Wealthy (=1)	.08	.08	.03	0	.10	.04
Very wealthy (=1)	.04	.04	.06	.14	.07	.01
Cleanliness:						
Dirty (=1)	.13	.13	.05	.20	.21	.03
Clean (=1)	.74	.74	.69	.54	.68	.86
Very clean (=1)	.13	.13	.26	.26	.11	.11
Attractiveness:						
Ugly (=1)	.30	.30	.21	.34	.33	.21
Average (=1)	.60	.60	.68	.56	.58	.67
Handsome (=1)	.10	.10	.11	.10	.09	.12
Other activities:						
Client drank alcohol (=1)	.84	.85	.45	.76	.723	.79
Client took drugs (=1)	.05	.04	.23	.04	.10	.04
Sex worker drank alcohol (=1)	.73	.74	.49	.74	.68	.75
Sex worker took drugs (=1)	.05	.04	.12	.00	.09	.04
Client abused/hit sex worker (=1)	.02	.02	.00	.00	.05	.02

* In some cases, more than one service per transaction was provided. Therefore, the means of the services do not sum to one.

weekly earnings of 3,245 pesos for a sex worker compared to 2,073 pesos for a non–sex worker. Dividing weekly earning by hours worked last week, we find that sex workers' average hourly wage is about 83 pesos. Therefore, sex workers' hourly wage is about 34 percent higher than that of non–sex workers, and they earn about 56 percent more per week. These numbers understate total earnings from sex work since they do not include payments from the bars directly to the sex workers.

Almost all transactions included vaginal sex regardless of condom use. Other services such as oral sex, dancing, and stripping were provided in less than 10 percent of all transactions. The average client was estimated to be 34 years old, and about 55 percent of the clients were regular customers. Interestingly, when the sex worker suggested non–condom use, 80 percent of those clients were regulars, indicating that sex workers are more willing to suggest non–condom use when they know the client. Fourteen percent of the clients were perceived to be very wealthy when sex workers suggested non–condom use. In other categories of condom/non–condom use, very wealthy clients range from only 1 to 6 percent. This suggests that the sex worker is more likely to suggest non–condom use when she believes that the client is very wealthy. The dirtier clients were also the clients who used condoms less.

While most transactions included alcohol consumption by both parties, few involved drug use. There was very little reporting that clients physically abused the sex worker in her last three to four transactions.

The key variable in the analysis is condom use. However, identification of the coefficient on condom use in the fixed-effects estimator comes from the variation of condom use across clients for each sex worker and not variation in condom use between sex workers. Figure 1 reports the percentage of sex workers who used condoms in all transactions, in some but not all of the transactions, and in none of the transactions. Here we find that 83.7 percent of sex workers used condoms in all three of their last transactions, 11.7 percent used them sometimes, and 4.6 percent did not use them in any of the transactions.

IV. Estimation Results

In this section we report the results from estimating equation (4) by replacing P with log P because the price distribution is skewed to the right.[6] We disaggregate non–condom use and condom use according to who suggested it. The default category is sex worker suggested condom use. We build up to equation (4) by starting with simple random-effects models that include only the condom use variables (col. 1 of

[6] Equation (4) with log P as the left-hand-side variable can be explicitly derived from assuming that the utility functions are multiplicative rather than linear.

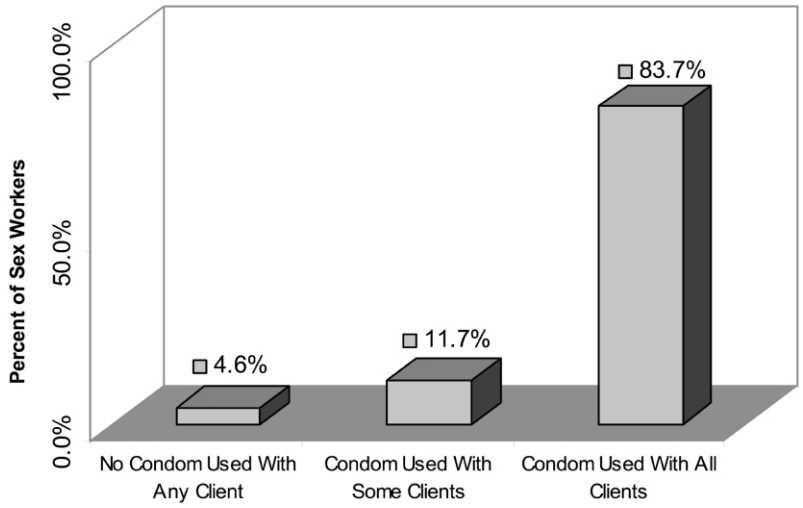

FIG. 1.—Condom use by sex workers with last three clients

table 4); we then include sex worker characteristics (col. 2) as well as client and transaction characteristics (col. 3). The final two specifications (cols. 4 and 5) are estimated using fixed-effects estimates of equation (4). The model in column 4 uses the whole data set, and the model in column 5 excludes sex workers who never or always use condoms. The reason for the last model is that we are concerned that sex workers who always use condoms and those who never use condoms may have different risk preferences and attract different types of clients along some unobservable dimensions than sex workers who sometimes use condoms. In order to check the robustness of this specification, we run the same model excluding both those who never and those who always use condoms.

The estimation results are presented in table 4. Remarkably, in the first four rows of table 4, the coefficients on condom use are very similar and robust across all the specifications, and they are completely consistent with our theoretical predictions. In all the models, the coefficient on no condom use suggested by the client is positive, the estimated premium varies from 18 to 23 percent, and all are statistically significant from zero at the .01 level. Similarly, the estimated coefficients on no condom used suggested by the sex worker are all negative and statistically different from zero, and the estimated discount is between 15 and 25 percent. The estimated coefficients on not using a condom because one was not available are small and not significantly different from zero in all models. This suggests that not using a condom because one was not available is priced similarly to the case in which a condom was used

at the suggestion of the sex worker. Finally, the estimated coefficients on using a condom at the client's suggestion are all positive and range from an estimated premium of 5 percent to 12 percent. However, the estimated coefficient is significant only in the fixed-effects model with the full sample.

Our preferred estimates, presented in column 4 of table 4, are the fixed-effects estimates with the full sample. Using Hausman tests, we reject random effects, and there is no statistical difference between the fixed effects using the whole sample in column 4 and the model that excludes sex workers who always or who never use condoms in column 5.

The results from this model (and all other specifications) are completely consistent with those from the theoretical model. They indicate that when no condom is used upon the clients' suggestion, the price differential is 23 percent. In the theoretical model, this is reflective of clients who are willing to pay more for not using a condom than the minimum that the sex worker needs to be compensated to take the risk. When no condom is used at the sex worker's suggestion, clients are given a 20 percent discount, reflecting that sex workers prefer to take the risk more than clients prefer non–condom use. Finally, clients are charged a 9 percent premium when a condom is used at their suggestion, reflective of the case in which clients value condom use more than sex workers.

Some other coefficients of interest from the fixed-effects specification were in the categories of services provided and client characteristics. Almost all transactions included vaginal sex, and there was little variation in data. Clients paid 11 percent more for talking with the sex worker (company), 18 percent more for oral sex, and 27 percent more for stripping. Contact made at a bar or on the street is more likely to command a higher price than contact made in massage parlors, escort services, hotels, or brothels. This coefficient may pick up the fact that these sex workers are meeting some clients outside of their work establishment and not having to pay the middleman. It may also reflect that more successful sex workers are more likely to be able to work independently than their less successful colleagues. Finally, wealthier clients paid more and clients who drank alcohol paid less.

Finally, the random-effects models provide information on how sex worker characteristics are correlated with prices. The price declines with characteristics that clients find less desirable and increases with characteristics that clients find more attractive. The price declines with the age of the sex worker at about 2 percent per year. There is an 11 percent premium for secondary education or more and a 29 percent premium for physical attractiveness. Interestingly, sex workers who have had an HIV test charge 22 percent more, possibly reflecting risk preferences.

TABLE 4
Log Price Regressions

Independent Variable	Whole Sample				Exclude Always and Never Use Condom: Fixed Effects
	Random Effects (1)	Random Effects (2)	Random Effects (3)	Fixed Effects (4)	(5)
Condom use:					
No condom used:					
Client suggested (=1)	.221	.207	.181	.225	.231
	(8.04)***	(7.60)***	(6.52)***	(8.10)***	(6.14)***
Sex worker suggested (=1)	−.179	−.168	−.151	−.203	−.252
	(2.38)***	(2.26)**	(2.03)**	(2.59)***	(2.14)**
Did not have one (=1)	−.038	−.043	−.028	−.041	−.031
	(.80)	(.90)	(.59)	(.86)	(.48)
Condom used: client suggested (=1)	.063	.051	.053	.087	.120
	(1.43)	(1.18)	(1.23)	(1.92)*	(1.49)
Services provided by sex worker:					
Talked with client (=1)		.058	.004	.113	.316
		(1.52)	(.11)	(2.34)*	(3.44)***
Vaginal sex (=1)		−.058	−.038	−.067	.024
		(1.03)	(.66)	(1.19)	(.20)
Oral sex (=1)		.184	.181	.148	.121
		(6.13)***	(5.88)***	(4.95)**	(1.87)*
Danced with client (=1)		.049	.078	.020	.110
		(.92)	(1.49)	(.31)	(.90)
Stripped for client (=1)		.409	.418	.265	.112
		(7.96)***	(8.11)***	(5.05)**	(.77)
Sex worker characteristics:					
Age		−.025	−.021		
		(6.93)***	(6.29)***		
Age of first compensated sex		.006	.003		
		(1.13)	(.77)		
Single (=1)		.064	.057		
		(1.11)	(1.13)		
Divorced/separated (=1)		.159	.155		
		(2.64)***	(2.92)***		
Widow (=1)		.201	.220		
		(1.93)**	(2.39)***		
Has children (=1)		−.085	−.086		
		(1.62)	(1.86)*		
Literate (=1)		.120	.052		
		(1.91)**	(.93)		
Had secondary school or more (=1)		.136	.108		
		(2.88)***	(2.60)***		
Was HIV tested (=1)		.254	.224		
		(3.70)***	(3.69)***		
Had an STI or vaginal problem (=1)		−.007	−.006		
		(.11)	(.12)		
Attractive (=1)		.300	.289		
		(5.52)***	(5.97)***		
Transaction location:					
Met client at a bar/club (=1)			.395	.190	.383
			(5.99)***	(1.89)*	(2.09)**
Met client on the street (=1)			.150	.348	.662
			(2.02)**	(3.23)***	(3.26)***
Client characteristics:					
Regular client (=1)			.011	.018	.083
			(.70)	(1.15)	(2.35)**
Age			.001	.001	.001
			(1.02)	(1.57)	(.48)

TABLE 4
(*Continued*)

Independent Variable	Whole Sample				Exclude Always and Never Use Condom: Fixed Effects
	Random Effects (1)	Random Effects (2)	Random Effects (3)	Fixed Effects (4)	(5)
Average wealth (=1)			.100	.060	.110
			(5.42)***	(3.22)***	(2.80)***
Wealthy (=1)			.210	.141	.180
			(7.74)***	(5.21)***	(2.90)***
Very wealthy (=1)			.302	.243	.267
			(9.48)***	(7.68)***	(4.39)***
Nice personality (=1)			.026	−.022	.000
			(1.47)	(1.19)	(.00)
Dirty (=1)			.015	.022	.018
			(.77)	(1.11)	(.40)
Very clean (=1)			.023	.023	−.005
			(.84)	(.78)	(.09)
Ugly (=1)			−.041	−.026	−.012
			(2.53)***	(1.60)	(.32)
Handsome (=1)			−.017	−.029	−.057
			(.88)	(1.53)	(1.38)
Other activities:					
Client abused sex worker (=1)			−.004	.018	.077
			(.09)	(.47)	(1.05)
Client drank alcohol (=1)			.034	−.057	−.111
			(1.50)	(2.42)**	(2.23)**
Client took drugs (=1)			.023	.036	.074
			(.86)	(1.38)	(1.52)
Sex worker drank alcohol (=1)			.099	.019	.045
			(4.54)***	(.81)	(.71)
Sex worker took drugs (=1)			.064	.039	.002
			(1.92)**	(1.17)	(.03)
Summary statistics:					
Within R^2	.0337	.0563	.0725	.0967	.1377
Hausman test (χ^2)	47.0	702.49	459.65		
F-statistic for joint significance of sex worker fixed effects				27.67	16.48
Number of observations	3,814	3,806	3,806	3,814	1,234
Number of sex workers	1,027	1,025	1,025	1,027	347

NOTE.—The table reports the coefficients and *t*-statistics (in parentheses) for regression models in which the dependent variable is the log of the price charged to the client by the sex worker.
* Significant at the 10 percent level.
** Significant at the 5 percent level.
*** Significant at the 1 percent level.

Finally, the sex worker's STI status has no bearing on the price, consistent with the assumption that infection status does not enter into the negotiation.

V. Robustness

Recall that one of our main concerns was that condom use is endogenous and is determined by client and sex worker preferences, β and

γ, respectively. While sex worker fixed effects control for correlation with any omitted sex worker preferences, there may be correlation between condom use and omitted client preferences if β is measured with error. In this case then, condom use might be correlated with the error term in the price equation (6), resulting in biased estimates. In other words, there still might be unobserved portions of the β distribution that are salient for the price differential and determinants of condom use.

We attempted to directly measure risk preferences by using the variables on who suggested condom/non–condom use. If the sex worker suggests condom use, this implies that she has a high γ and the client has a low β. If the client suggests condom use, then he has a negative β. If the client suggests non–condom use, then he has a high β. Finally, if the sex worker suggests non–condom use, then both she and the client have very low γ and β, respectively.

If this technique does not completely measure the salient portion of β, then some of β that is correlated with condom use will be in the error term. We check for possible bias by further interacting who suggested condom use with observed client characteristics that are correlated with β. To identify client characteristics that are correlated with β, we estimate a random-effects multinomial logit predicting who suggested condom/non–condom use as a function of sex worker and client characteristics. Those characteristics that significantly predict who suggested condom/non–condom use are correlated with β and γ.

Table 5 provides the results of this random-effects multinomial logit condom choice regression in which the options were sex worker suggested condom use (default), client suggested non–condom use, and client suggested condom use. We subsumed the non–condom use because one was not available into the default option of sex worker suggested condom use. There were too few observations in the she suggested non–condom use category, and therefore we omitted those observations and that category from the analysis. Characteristics that are significant determinants of client suggested non–condom use are his age and level of cleanliness as well as her literacy, attractiveness, and age at first sex. Characteristics that are significant determinants of client suggested condom use are whether the client has a nice personality and is handsome and the sex worker's attractiveness, age, and age of first compensated sex.

We then take those significant predictors and interact them with who suggested condom/non–condom use in the price equation. Table 6 reports the results of this estimation. While the estimation included all the variables reported in table 4, we report only the coefficients on who suggested condom and non–condom use and interactions. Column 1 reports the fixed-effects regression results without any interactions for

TABLE 5
RANDOM-EFFECTS MULTINOMIAL LOGIT CONDOM CHOICE REGRESSION

	No Condom Use: Client Suggested	Condom Use: Client Suggested
Sex worker characteristics:		
Literate (=1)	.374	1.084
	(1.75)*	(.10)
Attractive (=1)	.339	.223
	(1.94)*	(1.65)*
Married (=1)	.488	2.100
	(.76)	(.80)
Was HIV tested (=1)	.902	.419
	(.18)	(1.05)
Had an STI or vaginal problem (=1)	1.775	2.249
	(1.01)	(1.29)
Age	.998	1.156
	(.06)	(1.85)*
Age of first sex	.607	1.153
	(4.00)***	(1.18)
Age of first compensated sex	.961	.825
	(.73)	(1.76)*
Client characteristics:		
Regular client (=1)	1.174	1.747
	(.40)	(.99)
Age	1.051	.977
	(3.66)***	(.88)
Average wealth (=1)	2.502	.787
	(1.58)	(.29)
Very wealthy (=1)	3.192	.572
	(1.55)	(.47)
Nice personality (=1)	.910	6.178
	(.22)	(2.38)**
Dirty (=1)	2.406	1.498
	(1.97)**	(.51)
Very clean (=1)	1.000	2.320
	(.00)	(1.18)
Ugly (=1)	.628	1.936
	(1.15)	(1.08)
Handsome (=1)	2.270	4.497
	(1.59)	(2.38)**

NOTE.—The table reports the coefficients as odds ratios and absolute values of z-statistics (in parentheses). The default category is sex worker suggested condom use. The model was estimated using 3,393 observations from 930 sex workers. The number of observations decreases here because of missing values for some of the sex worker characteristics. The value of the log likelihood was −802.62.

* Significant at the 10 percent level.
** Significant at the 5 percent level.
*** Significant at the 1 percent level.

reference. Column 2 reports the results in which the client and sex worker characteristics that were significant in the condom choice multinomial logit are interacted with client suggested non–condom use and client suggested condom use. The results indicate that client risk interactions are neither individually nor jointly significantly different from zero. This suggests that our estimations of the price differentials in table 4 are less likely to be biased from unobserved portions of β.

TABLE 6
LOG PRICE FIXED-EFFECTS REGRESSIONS WITH CLIENT/SEX WORKER CHARACTERISTICS INTERACTIONS

	MODEL		
	(1)	(2)	(3)
	Who Suggested Condom and Non–Condom Use		
Non–condom use:			
Client suggested	.246	.331	.253
	(8.64)***	(1.47)	(1.18)
Sex worker suggested	−.184	−.187	−.185
	(2.15)**	(2.20)**	(2.18)**
Client suggested condom use	.086	−.304	.088
	(1.84)*	(1.14)	(1.90)*
	Sex Worker Risk Characteristics Interacted with Client Suggested *Not* Using a Condom		
Literate × client suggested non–condom use		−.004	
		(.05)	
Attractive × client suggested non–condom use		.181	.211
		(2.08)**	(2.52)**
Age of first sex × client suggested non–condom use		−.000	
		(.02)	
F-statistic for joint significance of sex worker risk variables		1.50	
	Sex Worker Risk Characteristics Interacted with Client Suggested Using a Condom		
Attractive × client suggested condom use		−.084	
		(.60)	
Age × client suggested condom use		−.014	
		(1.54)	
Age of first compensated sex × client suggested condom use		.035	−.002
		(2.41)**	(.15)
F-statistic for joint significance of sex worker risk interactions		2.66**	
	Client Risk Characteristics Interacted with Client Suggested *Not* Using a Condom		
Age × client suggested non–condom use		−.002	
		(1.39)	
Dirty × client suggested non–condom use		−.051	
		(.88)	
F-statistic for joint significance of client risk interactions		1.26	
	Client Risk Characteristics Interacted with Client Suggested Using a Condom		
Nice personality × client suggested condom use		.067	
		(.86)	

TABLE 6
(*Continued*)

	Model		
	(1)	(2)	(3)
Handsome × client suggested condom use		−.009 (.10)	
F-statistic for joint significance of client risk interactions		.37	
Within R^2	.08	.09	.08
Number of transactions	3,585	3,585	3,585
Number of sex workers	956	956	956

NOTE.—The table reports the coefficients and *t*-statistics (in parentheses) for fixed-effects regression models in which the dependent variable is the log of the price charged the client by the sex worker. Included in the regressions but not reported are all the independent variables included in the models reported in table 4. Once again, the sample size is smaller because of missing values for some of the sex worker characteristics.

* Significant at the 10 percent level.
** Significant at the 5 percent level.
*** Significant at the 1 percent level.

While the interactions with client characteristics are insignificant, the interactions with some of the sex worker characteristics are significant. In model 3 in table 6, we report the results for a model that excludes the interactions with client characteristics and the interactions with sex worker characteristics that were insignificant in model 2. In this case we find that the sex worker interaction of age of first compensated sex with client suggested condom use is no longer significant. Attractive interacted with client suggested not using a condom is still significant. This suggests that clients who want to have unprotected sex with an attractive sex worker must pay a 46 percent premium.

We find that beauty affects both the price level and the premium for condom use. From the price regression in table 4, we estimate that beauty commands a 19 percent premium. This is consistent with the returns to beauty in the general labor literature (Biddle and Hamermesh 1998; Hamermesh, Meng, and Zhang 2002). In addition, more attractive sex workers are able to charge a higher premium for taking the risk of supplying unprotected sex. This could reflect increased bargaining power or that attractiveness is a complement to non–condom use in the client's utility function.

VI. Discussion

We find that sex workers in Mexico are responding rationally to financial incentives given their risk preferences. Consistent with our bargaining model, we find that sex workers are willing to assume the risks associated with providing unprotected sex to clients who request not using a condom for a 23 percent higher price. This premium increased to 46 percent if the sex worker was considered very attractive, a likely indication

of her bargaining power. However, clients who preferred condom use paid a 9 percent premium to use condoms, and sex workers who did not want to use condoms had to reduce the price by 20 percent to compensate clients for taking the risk.

The 23 percent premium charged clients who want unprotected sex is quite large in terms of value of life. In the Appendix we estimate the value of life for Mexican sex workers implied by the estimated price premium for risking infection by having unprotected sex with a client. Specifically, the premium is a function of the probability that the sex worker becomes infected and the value of her loss in health status or life expectancy or both should she become infected. Our approach is similar to the literature on wage-risk premiums (Viscusi 1992, 1993; Miller 2000; Shanmugam 2000) in which the implicit value of a statistical life can be imputed from individual preferences regarding the value of employment with increased risk to health and the compensating wage differential associated with riskier employment.

We estimate that the value of a life year is between $14,760 and $51,832. To put these figures in context, annual earnings for sex workers are about $15,340 on the basis of our survey, and annual earnings for women of the same age range in the same states employed in other occupations are about $9,800 (INEGI labor survey). Thus the value of life implied by the risk premium is about one to five times annual earnings of this demographic group. To put these results in the context of previous efforts to estimate compensating wage differentials, Viscusi (1993) reviews 27 studies and reports the value of a year of life between 1.4 and 28 times annual income.

These findings suggest that the most effective interventions for reducing HIV/STI transmission through commercial sex will be those that target both the supply side (the sex workers and their agents) and the demand side (the clients) of the market. Interventions to educate sex workers about the risks of unprotected sex serve to reduce the number of transactions in which a condom is not used. Interventions to empower sex workers or improve their negotiating skills serve to increase their bargaining power so that they are able to capture more of their clients' willingness to pay and improve their incomes (which can also increase their disutility from non–condom use, further reducing unprotected sex). Making condoms more available or available more cheaply serves to make non–condom use relatively more expensive. All three of these types of interventions would thus be expected to reduce unprotected sex and HIV transmission.

However, if, despite an increase in the sex worker's disutility from non–condom use, clients are still willing to pay more than enough to compensate sex workers for taking the risk (not unlikely if clients are, on average, wealthier than the sex workers they hire), then a significant

amount of unprotected commercial sex will continue to occur, albeit at a higher price. This implies that efforts to reduce clients' disutility of condom use, by educating them about the risks of unsafe sex or marketing the "joy of safe sex" to them, may be as important as or more important than interventions designed to change sex workers' disutility from non–condom use—and that the relative importance of client-side interventions increases as the inequality in willingness to pay/accept between clients and sex workers increases. Unfortunately, because clients are both more numerous and usually more difficult to target (especially in sex work sites because health educators who scare away clients are not especially welcome), targeting both the supply and the demand sides of commercial sex is likely to cost much more than supply-side efforts alone.

Appendix

Estimates of the Implied Value of Life

In this appendix we estimate the value of life for Mexican sex workers implied by the estimated price premium for risking infection by having unprotected sex with a client. Specifically, the premium is a function of the probability that the sex worker becomes infected and the value of her loss in health status or life expectancy should she become infected. One complication is that unprotected sex may result in a number of different infections including HIV and all the other traditional sexually transmitted diseases. In order to account for the possibility of different infections with a range of impacts on morbidity and mortality, we estimate the implied value of life in terms of disability-adjusted life years (DALY) lost as a result of infection. DALYs are one of the means of aggregating disabilities resulting from illness across a large number of illness types with early mortality as a result of illness into a single index of health loss (Murray 1994). We use DALYs because, unlike other composite health measures, they are calibrated for developing countries and used by the World Health Organization (2004) to estimate global burden of disease.

The price premium equals the expected value of a DALY times the net present value of the additional risk to her health that she exposes herself to by not using a condom, that is, the net present value of the expected DALY loss. Then, the implicit value of a DALY is the ratio between the observed price differential and the net present value of the additional risk to her health that she exposes herself to by not using a condom:

$$V(\text{DALY}) = \frac{P_{\Delta C}}{\text{NPV}(\text{DALY}_{\Delta C})}, \tag{A1}$$

where $P_{\Delta C}$ is the difference in the price with and without a condom, and $\text{NPV}(\text{DALY}_{\Delta C})$ is the difference in the expected net present value of DALYs lost with and without a condom.

We estimate $\text{NPV}(\text{DALY}_{\Delta C})$ using a simple epidemiological model that calculates the expected health risk due to acquiring HIV infection and to the risk

of suffering a serious complication or death from other STIs.[7] For any infection w, the expected DALY loss resulting from a decision not to use a condom is

$$\text{NPV}(\text{DALY}_{\Delta C\_w}) = A_w E_w \text{NPV}(\text{DALY}_w), \tag{A2}$$

where A_w is the probability that infection w is acquired by the sex worker, E_w is the effectiveness of a condom at preventing the transmission[8] of w (i.e., the proportional reduction in transmission from condom use), and $\text{NPV}(\text{DALY}_w)$ is the net present value of the DALY loss if infected with w.

The DALY loss associated with an infection w is the net present value of the sum of the expected loss due to years spent with a disability and the expected loss due to early mortality. The former is the sum, for n different health states caused by w, of the product of the expected duration and the amount of disability of each health state.[9] The latter is the difference between the life expectancy at infection and the expected duration of infection prior to death. Formally,

$$\text{DALY}_w = \sum_n D_n B_n + \left[\text{LE}(28) - \sum_n D_n\right], \tag{A3}$$

where D_n is the expected duration of health state n conditional on infection with w, B_n is the disability weight[10] of health state n, and LE(28) is the life expectancy for a 28-year-old woman.

The net present value of the DALY loss, $\text{NPV}(\text{DALY}_w)$, is the sum of the stream of discounted DALY losses from infection to LE(28), or

$$\text{NPV}(\text{DALY}_w) = \sum_{i=1}^{\text{LE}(28)} \frac{\text{DALY}_{w,i}}{(1+r)^i}, \tag{A4}$$

where r is the discount rate and $\text{DALY}_{w,i}$ is the expected DALY loss due to infection w in year i from infection.

The DALY losses vary depending on the type of infection. In the case of HIV infection, we consider DALY losses due to the mild disability associated with HIV infection, the severe disability associated with AIDS, and the years of life lost as a result of early death from AIDS. In the case of DALY loss due to STIs, we consider DALY losses due to the serious consequences of *Neisseria gonorrhea* and *Chlamydia trachomatis*. In a proportion of each of these two infections, women develop moderate disability from pelvic inflammatory disease (PID) and in a smaller proportion lose years of life from early death caused directly or indirectly by PID.

[7] To avoid double counting years of life lost due to HIV and STIs, DALY loss due to STI accrues only for the vast majority of sex workers who are not HIV infected.

[8] Condom effectiveness is expressed on a 0–1 scale in which 100 percent effectiveness refers to 100 percent reduction in the transmission of infection (or pregnancy) that would have occurred in the absence of a condom. Thus the absolute reduction in DALY loss that results from condom use is the product of condom effectiveness and the expected DALY loss if a condom is not used.

[9] We ignore the impact of competing cause of mortality for these 28–38-year-old infected women on the disability calculation given that most of the effect of competing cause of mortality is captured by the life expectancy at infection.

[10] Disability weights range from 0 to 1, where 0 represents no disability (perfect health) and 1 represents 100 percent disability, which is equivalent to death.

As in equation (A2), the probability that the sex worker acquires infection w if she does not use a condom is

$$A_w = (1 - P_w^{SW})P_w^C T_w, \tag{A5}$$

where $1 - P_w^{SW}$ is the probability that the sex worker is *not* already infected (i.e., is still susceptible to w), P_w^C is the probability that the client *is* infected with w, and T_w is the probability that w is transmitted if a condom is not used conditional on the sex worker being susceptible and the client infected.

The probability that HIV is acquired is further complicated because the transmission probability is a function of whether either partner has a concomitant STI.[11] Different STIs facilitate HIV transmission to different degrees, and even the same STI can have a differential impact on transmission depending on the phase of its infection. However, given the wide ranges of uncertainty in these estimated parameters, we simply specify the HIV transmission probability to be the weighted average of the transmission probability in the absence of any STI and the transmission probability in the presence of at least one STI between the sex worker and her client. Formally, the probability of HIV transmission is

$$T_{\text{HIV}} = P_{\text{STI}}^{SW/C} T_{\text{HIV}}^{\text{STI}} + (1 - P_{\text{STI}}^{SW/C}) T_{\text{HIV}}^{\text{NoSTI}}, \tag{A6}$$

where $P_{\text{STI}}^{SW/C} = 1 - \prod_n \prod_w (1 - P_w^n)$ for all infections w and $n = SW, C$; $P_{\text{STI}}^{SW/C}$ is the probability that either the sex worker or the client has at least one STI; $T_{\text{HIV}}^{\text{STI}}$ is the HIV transmission probability conditional on at least one of the pair having an STI; and $T_{\text{HIV}}^{\text{NoSTI}}$ is the HIV transmission probability conditional on neither having an STI. We consider four STIs for their impact on HIV transmission: chlamydia and gonnorhea, which have been previously discussed, as well as syphilis and herpes simplex type 2 (HSV2).

We now turn to the actual estimates of the implied value of life. Table A1 reports the parameter values and sources that we use in our calculations. For those parameters for which we did not have Mexican sources or that are general biological parameters, we used estimates from other countries. We assumed a discount rate of 3 percent for the calculations. However, there is a great deal of uncertainty about a number of the parameters in the literature. Therefore, we estimate the model under *low*-risk and high-risk scenarios as specified in table A2. Under these assumptions, we estimate that the 23 percent risk premium paid by a client who wants to have unprotected sex represents an implicit value of a life year for the sex worker of $51,832 in the *low*-risk scenario[12] and $14,760 for the *high*-risk scenario.

[11] The probability that an STI is transmitted is almost certainly not constant either, but here it is assumed to be constant both because of the lack of data regarding differential transmissibility in the presence of other STIs and because the magnitude of the effect on change in expected DALYs lost is far smaller for STIs than for HIV.

[12] In the *low* scenario, the risk estimates are low, such that the expected health loss associated with not using a condom is low; thus, for the same risk premium, the implicit value of a life year is high.

TABLE A1
PARAMETER VALUES AND SOURCES FOR VALUE OF LIFE CALCULATIONS

Parameter	Low	High	Source
HIV prevalence:			
Sex workers (P_{HIV}^{SW})	.35%	.35%	Uribe-Salas et al. (1997)
Men who do not have sex with men (antenatal proxy) (P_{HIV}^{GP})	.13%	.13%	Secretaria de Salud, Morbilidad Compendios y Anuarios (http://sociales.reduaz.mx/revista/diciembre/mujeres_its_vih-sida.htm, 1998)
Clients (P_{HIV}^{C})	.25%	.48%	*
HSV2 prevalence:			
Sex workers (P_{HS}^{SW})	62%	62%	Uribe-Salas et al. (1997)
Clients (P_{HS}^{C})	12%	50%	*
% HSV2 active (A_{HS})	20%	20%	Wald et al. (1995)
Syphilis prevalence:			
Sex workers (P_{S}^{SW})	6.4%	6.4%	Uribe-Salas et al. (1997)
Clients (P_{S}^{C})	2%	8%	*
Gonorrhea prevalence:			
Sex workers (P_{GC}^{SW})	3.7%	3.7%	Uribe-Salas et al. (1997)
Clients (P_{GC}^{C})	.9%	2.8%	*
Chlamydia prevalence:			
Sex workers (P_{CT}^{SW})	11.1%	11.1%	Uribe-Salas et al. (1997)
Clients (P_{CT}^{C})	2.8%	8.3%	*
Transmission probability male > female:			
HSV2 (T_{HS})	1%	1%	Garnett et al. (2004)
Syphilis (T_{S})	6%	6%	Garnett and Bowden (2000)
Gonorrhea (T_{GC})	8%	8%	Garnett and Bowden (2000)
Chlamydia (T_{CT})	2%	2%	Garnett and Bowden (2000)
HIV without STI ($T_{\text{HIV}}^{-\text{STI}}$)	.5%	.5%	Rottingen and Garnett (2002)
HIV STI ($T_{\text{HIV}}^{+\text{STI}}$)	1.4%	1.4%	Rottingen and Garnett (2002)
Condom effectiveness:			
HIV (E_{HIV})	90%	90%	Personal communiction with Geoff Garnett
STI bacterial (E_{B})	80%	80%	Personal communiction with Geoff Garnett
STI viral (E_{V})	70%	70%	Personal communiction with Geoff Garnett
Average sex worker age	28	28	Table 2
Age-specific life expectancy (28) (LE(28))	43.7	43.7	Proyecciones de la población de México (Consejo Nacional de Población 2002)
Expected duration of HIV infection (years) (D_{HIV})	8	8	Mellors et al. (1996)
Expected duration of AIDS (years) (D_{AIDS})	2	2	Schwartländer et al. (2001)
HIV disability weight (B_{HIV})†	.135	.135	2001 NIH Disease Control Priorities Project (http://www.fic.nih.gov/dcpp/gbd.html)
AIDS disability weight(B_{AIDS})†	.505	.505	2001 NIH Disease Control Priorities Project

TABLE A1
(*Continued*)

Parameter	Low	High	Source
Average STI duration (years) (D_{STI})	.6	.6	Personal communication with Geoff Garnett
Average STI disability weight (PID) (B_{PID})	.248	.248	2001 NIH Disease Control Priorities Project
Incidence of PID in gonorrhea or chlamydia (P_{PID})	.43%	22.5%	van Valkengoed et al. (2004); Tao et al. (2002)
Average PID duration (years) (D_{PID})	.038	.038	Holmes and Ryan (1999)
PID mortality (M_{STI})	1.6%	3.2%	‡
Price differential (without condom − with condom) ($P_{\Delta C}$)	$15	$15	Table 4
Discount rate (r)	3%	3%	2001 NIH Disease Control Priorities Project

* In the absence of data on prevalence rates among male clients of sex workers, we assume that potential values lie between the prevalence rate in the general population, P^{GP}_{HIV}, and the prevalence rate among sex workers, P^{SW}_{HIV}; for the low scenario, $P^{C}_{HIV} = P^{GP}_{HIV} + 25\%(P^{SW}_{HIV} - P^{GP}_{HIV})$, and for the high scenario, $P^{C}_{HIV} = P^{GP}_{HIV} + 75\%(P^{SW}_{HIV} - P^{GP}_{HIV})$. For other STIs, we calculated the low and high scenarios in the same way as for HIV.

† On a 0–1 scale with 0 representing no disability and 1 representing 100 percent disability.

‡ The *low* estimate assumes that 75 percent of cases are treated; the *high* estimate assumes that only 25 percent are treated. A tubo-ovarian abscess is assumed to occur within the first year and ectopic pregnancy an average of five years following infection for the purposes of discounting.

TABLE A2
Low-Risk and High-Risk Scenarios

Parameter	Low	High
HIV prevalence among sex worker clients	General population prevalence plus 25% of the difference between sex worker and general population prevalence	General population prevalence plus 75% of the difference between sex worker and general population prevalence
Chlamydia, gonorrhea, syphilis, and HSV2 prevalence among sex worker clients	25% of sex worker prevalence	75% of sex worker prevalence
Correlation among STIs	Mean of max STI prevalence and high estimate	Assume they are independent
Proportion of cases of PID that receive treatment	75%	25%

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