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# Transactional Sex as a Response to Risk in Western Kenya

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## Abstract

Formal and informal commercial sex work is a way of life for many poor women in developing countries. Though sex workers have long been identified as crucial in affecting the spread of HIV/AIDS, particularly in Sub-Saharan Africa, the nature of sex-for-money transactions remains poorly understood. Using a unique panel dataset constructed from 192 self-reported sex worker diaries which include detailed information on sexual behavior, labor supply, and health shocks, the authors find that sex workers adjust their supply of risky, better compensated sex to cope with unexpected health shocks, exposing themselves to increased risk of HIV infection.

In particular, women are 3.1 percent more likely to see a client, 21.2 percent more likely to have anal sex, and 19.1 percent more likely to have unprotected sex on days in which a household member falls ill. Women also increase their supply of risky sex on days after missing work due to symptoms from a sexually transmitted infection. Given that HIV prevalence has been estimated at 9.8 percent in this part of Kenya, these behavioral responses entail significant health risks for sex workers and their partners, and suggest that sex workers are unable to cope with risk through other formal or informal consumption smoothing mechanisms.

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This paper—a product of the Knowledge Strategy Group—is part of a larger effort to understand the issues related to risk, behavior, and the prevention of HIV/AIDS. Policy Research Working Papers are also posted on the Web at <http://econ.worldbank.org>. The authors may be contacted at [jmrtwo@ucsc.edu](mailto:jmrtwo@ucsc.edu) and [eyeh@worldbank.org](mailto:eyeh@worldbank.org).

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# Transactional Sex as a Response to Risk in Western Kenya\*

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# 1 Introduction

Exchanging sex for money, goods, or services is a way of life for many poor women in developing countries, yet little is understood about the way that the commercial or transactional sex market functions. While commercial sex workers (CSWs) have long been identified as critical in affecting the spread of the HIV/AIDS epidemic (UNAIDS, 2002; Hawken et al., 2002; Hudson, 1996; Plummer et al., 1991), comparatively little work has gone beyond characterizing sex workers as a high-risk subpopulation.

Even estimating the number of women engaged in transactional sex is notoriously difficult. This is particularly true in Sub-Saharan Africa, where transactional sex is present within many types of sexual relationships, including long-term partnerships and even marriage (Swidler and Watkins, 2007; Caldwell et al., 1989; Luke, 2006; Schoepf, 2004; Hunter, 2002; Wojcicki, 2002a). In Kenya, 14.5% of men and 5.5% of women aged 15-49 report having ever engaged in transactional sex, a figure which is likely an underestimate given the sensitive nature of the question (Central Bureau of Statistics, 2004). In this context, commercial sex work might be thought of as one extreme along a continuum of sexual relationships that feature a transactional component, with either "dating" or monogamous marriage at the other extreme. In this study, we identified 1,205 formal and informal sex workers in Busia, Kenya, a peri-urban town in Western Kenya. This amounts to roughly 12.5% of the population of Busia women aged 15-49.

This paper utilizes a unique panel dataset constructed from 192 daily sex worker diaries to analyze how sex workers decide whether to engage in unprotected sex with clients. The diaries included questions on income, expenditures, transfers given and received, and, most importantly, the specific sexual services provided to each client, the amounts paid for these services, and whether a condom was used for each sex act. In total, the dataset includes information on 19,041 transactions over 12,526 sex worker days.

We study sex workers' decisions in an intertemporal framework, and estimate how the supply of unprotected sex is affected by health shocks. We find compelling evidence that women increase their supply of risky, better compensated sex in response to short-term health shocks at home. Women are 3.1% more likely to see a client, 21.2% more likely to have anal sex, and 19.1% more likely to engage in unprotected sex on days in which another household member (typically

a child) falls ill. Similar responses are observed on days just after a woman recovers from the symptoms of an STI (which arguably might be seen as an exogenous shock to her ability to supply sex). Women do this in order to capture the roughly 42 Kenyan shilling (US \$0.60) premium for unprotected sex and the 77 shilling (US \$1.10) premium to anal sex.

Our results are related to a number of other studies of risk-coping mechanisms in poor countries, especially since the women we study make up a sizeable fraction of the population of adult women in the area. Like most people in developing countries, the women in our sample lack access to formal credit or savings, and the informal risk coping mechanisms that are typically available to people (such as informal insurance systems of gifts and loans between friends and family) have consistently been shown by other authors to be inefficient in insuring risk (i.e., Townsend, 1994; Paxson, 1992; Gertler and Gruber, 2002). The increase in transactional sex we find is similar to the labor supply effect documented by, for instance, Kochar (1995, 1999), though our results are of independent interest because it comes at such a high cost: HIV prevalence has been estimated at 9.8% in Busia District (Central Bureau of Statistics, 2004). Over time, the increases in risky sex that we observe here have enormous health consequences for these women, their sexual partners, and society as a whole as HIV is passed on to the general population. These results are all the more striking because we focus on daily shocks, rather than larger shocks such as annual or seasonal fluctuations in agricultural income.

This paper is one of the few studies to identify and document specific costs to inefficient consumption smoothing, beyond consumption fluctuations themselves. Other examples include Rosenzweig and Wolpin (1993), who show that Indian farmers are forced to use productive assets (bullocks) to smooth consumption, incurring substantial reductions in long-term productivity in the process, and Jacoby and Skoufias (1997), who find that Indian households pull their children out of school to work on the farm when shocks occur, which may reduce the long-term earnings potential of their children. Our study also highlights the difference between income smoothing and consumption smoothing, as discussed in Morduch (1995). Empirically, consumption by the women in our sample is relatively insensitive to health shocks, so that standard tests would conclude that women are well-insured against these shocks. Such tests do not explicitly account

for how consumption smoothing is achieved, which in this case involves a significant health cost.<sup>1</sup>

The results of this study have important implications for understanding the spread of HIV/AIDS, and in designing interventions to limit its spread. Among formal sex workers in Sub-Saharan Africa, the HIV/AIDS prevalence rate has been estimated to be as high as 25 to 75 percent (National AIDS Control Council [Kenya], 2005; UNAIDS, 2004; Morison et al., 2001). The risks are similarly large for women that supply transactional sex more casually. Dunkle et al. (2004) estimated that informal sex workers in South Africa were 54% more likely to be HIV positive than other women. Research on concurrent partners in Sub-Saharan Africa also suggests that these women may have a similar or even greater impact on HIV transmission than "formal" sex workers (Epstein, 2007; Morris and Kretzschmar, 1997; Hudson, 1996). This paper sheds light as to why these women do not choose to use condoms, and finds evidence that unexpected health shocks form part of the explanation.

To our knowledge, the relationship between shocks and the labor supply of sex workers has not been formally studied within economics.<sup>2</sup> However, some qualitative sociological and anthropological research has suggested that women have sex with multiple partners or develop sexual networks for financial support and income security (Swidler and Watkins, 2007; Schoepf, 2004; Hunter, 2002; Wojcicki, 2002b). Researchers have also examined the types and amounts of gifts received from partners in informal or transactional sex relationships (Luke, 2006; Dunkle et al., 2004; Luke, 2003), but not the effect of shocks or risk on those transfers. In economics, our paper is somewhat related to Edlund and Korn (2002) in that we both study sex workers, but our paper adds health risk as an additional dimension and focuses on choices *within* transactional sex over time, rather than on the choice to enter the commercial sex market.

The most closely related economics papers to this one are Gertler, Shah, and Bertozzi (2005) and Rao, Gupta, Lokshin, and Jana (2003), both of which find significant compensating differentials for unprotected sex (compared to protected sex) among CSWs. However, our focus here is not on estimating the premium itself but on testing whether the existence of a premium allows

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<sup>1</sup>Chetty and Looney (2006) also discuss these issues.

<sup>2</sup>One somewhat related paper is Ahlburg and Jensen (1998), which suggests that rural families mitigate interpersonal income risk by sending a family member into urban commercial sex work. Their argument focuses primarily on migration and secondarily on interpersonal risk, whereas we deal with intertemporal risk.

women to increase the amount of unprotected sex that they supply as a strategy to deal with health shocks. In this respect, this paper also contributes to recent work examining whether risky sexual behavior might be rational (Oster, 2007).<sup>3</sup>

## 2 Theoretical Framework

In this section, we present a simple model of sex work in an intertemporal labor supply framework. The model is in the spirit of MaCurdy (1981) and Kochar (1995, 1999). The sex worker is assumed to live for  $T$  periods and to maximize lifetime expected utility over consumption  $c_t$  and health risk  $h_t$  as follows:

$$\max E\left[\sum_{s=t}^{T-t} \delta^{s-t} u(c_s, h_0, \dots, h_{s-1}, h_s) \mid \Omega_t\right] \quad (1)$$

where  $\delta$  is the discount rate, and  $\Omega_t$  is information available at time  $t$ . We assume that  $\frac{\partial u(c_s, h_0, \dots, h_{t-1}, h_t)}{\partial h_t} < 0$ , to reflect disutility from work, as well as the cost of pregnancy or the disutility from certain risky sex acts such as anal sex, experiencing the symptoms of an STI, or the health and socioeconomic consequences of HIV infection. Utility also depends on the history of past health risks taken. In particular, we assume that  $\frac{\partial u(c_s, h_0, \dots, h_{t-1}, h_t)}{\partial h_k} \leq 0$  for all  $k < t$ : quality of life is lower for women that have taken greater health risk in the past and so are at greater risk of being HIV positive.<sup>4</sup>

The woman's intertemporal budget constraint is

$$A_{t+1} = (1 + r_t)(P(h_t) + A_t - c_t) \quad (2)$$

where  $A_t$  represent assets,  $r_t$  is the interest rate, and  $P(h_t)$  is the total price paid by all clients on date  $t$ . The price is assumed to be increasing in  $h_t$  (as it is empirically); otherwise, women

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<sup>3</sup>The paper is also related to Dupas (2007), who evaluates an intervention to reduce risky sex along the intensive (whom to have sex with) rather than extensive (whether to have sex or not) margin. Similarly, our paper is focused on risky choices within transactional sex, rather than on the decision whether to engage in transactional sex or not.

<sup>4</sup>We do not impose any functional form on the utility function, but one example that fits into this framework would be one in which a woman's utility is unaffected until she develops AIDS, is declining thereafter, and is 0 after she dies.

would never have unprotected sex. We follow the literature and assume that this comes from the fact that clients derive utility from unprotected sex and are willing to pay more to forego condom usage.<sup>5</sup>

Assuming an interior solution, the first order conditions at time  $t$  are that

$$\sum_{s=t}^{T-t} \delta^{s-t} \frac{\partial u(c_s, h_0, \dots, h_s)}{\partial h_t} + \lambda_t P'(h_t) = 0 \quad (3)$$

$$\frac{\partial u(c_t, h_0, \dots, h_t)}{\partial c_t} - \lambda_t = 0 \quad (4)$$

$$\lambda_t = \delta(1+r)E[\lambda_{t+1} \mid \Omega_t] \quad (5)$$

where  $\lambda_t$  represents the marginal value of wealth at time  $t$ .

The last equation makes explicit that the marginal value of wealth at time  $t$  depends on expectations of future wealth. If a woman receives a permanent negative shock to her income such that  $E[\lambda_{t+1} \mid \Omega_t]$  increases, then  $\lambda_t$  increases and  $c_t$  decreases. In addition, the amount of health risk that the woman chooses to take increases, from (3). Equation (3) also implies that women that believe themselves to already be at significant risk of being HIV positive will increase their supply of risky sex by more than women that believe their risk is smaller (since the marginal cost of accepting greater risk is smaller for these women).

In this paper, however, we are interested in the effect of transitory shocks that are small relative to lifetime income. Since these shocks are small, they should have no effect on  $E[\lambda_{t+1} \mid \Omega_t]$  or  $\lambda_t$ , and so should have no effect on the amount of health risk that is accepted. Instead, these shocks should be smoothed through the use of savings or other consumption smoothing mechanisms (i.e., Paxson, 1992). However, in areas like rural Africa, formal savings are often completely unable and individuals rely entirely on more informal ways to save, such as Rotating Savings and Credit Associations (Gugerty, 2007) or holding cash at home. However, ROSCAs are not useful in consumption smoothing in Western Kenya, since payments are typically determined in advance and savings cannot be accessed in times of need. Many people also find it

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<sup>5</sup>See Gertler, Shah, and Bertozzi (2006) for a model of sex work that derives this condition explicitly.



difficult to save at home, as individuals are often asked for money by friends and family members and find it difficult to refuse these requests if they have cash on hand. Indeed, mounting evidence suggests that informal savings mechanisms are ineffective, and that the provision of more formal savings services increase savings balances and make individuals less vulnerable to unexpected income shocks (Dupas and Robinson, 2009).

Consequently, individuals in poor countries are often unable to save as much as they would like and are unable to hold savings balances sufficient to deal with unexpected shocks. This in turn will make it more likely that the 1-period budget constraint binds, and make it more likely that a woman may adjust her accepted health risk in response to even small, short-term shocks.<sup>6</sup>

The implication of this simple model - that labor supply may adjust to short-term shocks in the absence of perfect consumption smoothing - is not new, but the importance of our study is that the increase in labor supply comes at great individual cost in terms of increased risk of contracting HIV or other STIs. The increased health risk will also likely impose an external cost on society, as HIV is transmitted between sex workers and clients and then on to other partners. In addition, quite apart from any efficiency calculation, the tests in this paper are of significant importance in terms of designing interventions to limit the spread of HIV-related mortality and morbidity.

### **3 Research Design**

#### **3.1 Background on Busia, Kenya**

This study takes place in Busia District, a rural area in Western Province, Kenya with a semi-urban center, Busia Town. The estimated HIV prevalence in Busia District was 9.8% in 2004, compared to the national average of 6.7% (Central Bureau of Statistics, 2004). Busia Town has a population of 44,196 (Central Bureau of Statistics, 2001) and is located on the Ugandan border, along one of two major trucking routes from the port city of Mombasa (on the Indian Ocean) to Kampala, via Nairobi.

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<sup>6</sup>Few women in our sample have formal savings accounts (see Table 1) or access to bank credit, but most save money informally at their home and have access to gifts and loans from friends and family.

Truck stops are often where sex workers congregate, and Busia was identified as a “hot spot” for commercial sex activity due to the high volume of trucks overnighing. A GIS-based study conducted by the Strengthening STD/HIV Control Project in Kenya (SHCP) found that Busia received approximately one-quarter of the trucks overnighing at the Kenya-Uganda border (National Aids Control Council, 2005).<sup>7</sup> Though sex workers in Busia do in fact make significantly more than other self-employed daily income earners, they do not, in general, think of themselves as commercial sex workers (CSWs). Instead, most think of themselves as women who engage in transactional sex in order "to survive," and most (84%) hold jobs outside of sex work.

### **3.2 Identifying Commercial Sex Workers**

To obtain a representative sample of women engaged in sex work in Busia Town, and to include more "informal" sex workers who are not typically easy to locate, we identified women through a peer group network which was originally established by the Strengthening STD/HIV Control Project in Kenya (SHCP), a Kenyan organization associated with the University of Manitoba and the University of Nairobi that worked with thousands of formal and informal sex workers across Kenya. SHCP began working in Western Kenya in 1999 by organizing women into peer groups of 15 to 30 women each. Each group is led by a peer educator, and the peer groups within each district are supervised by a trained nurse who serves as a field coordinator. SHCP provided training for the peer educators, and facilitated education in HIV and other STIs for all sex workers. Though SHCP was phased over to the government in October 2005, the peer groups within a district continue to operate essentially as community-based organizations.

By 2005, when this study began, SHCP had recruited approximately 400 women into 30 peer groups in Busia Town. The field coordinator for the district was employed as an enumerator for this project and was assisted by one of the peer educators. To identify a sample of formal and informal sex workers, we used the same definition as SHCP: any single, widowed, divorced, or separated woman, aged 18 or older, who had multiple concurrent sex partners. We asked each peer group member to provide a list of all the women living in Busia Town she knew who fit

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<sup>7</sup>The other major border town is Malaba, which receives about three times as many overnight trucks as does Busia.

this description.

We identified 1,205 sex workers in Busia Town from this "snowball" technique.<sup>8</sup> According to the 2003 Kenyan Demographic and Health Survey, women aged 15-49 make up approximately 21.9% of the rural population, which implies that about 12.5% of Busia women aged 15-49 earn some income from sex work. From this, we argue that the women involved in this project are not particularly atypical of the average woman in Busia Town, and that the results of this study are generalizable to a significant proportion of the female population in Kenya.

### 3.3 Data Collection

Of the 1,205 women that were identified, a random sample of 248 women were selected for project participation, stratified by peer group. The data collection took place in two rounds: Round 1 occurred between October and December, 2005, and Round 2 occurred between July and October, 2006. We asked each woman to keep a daily diary for the duration of each round in which she self-reported her income, expenditures, the transfers she had given and received, and the shocks she had encountered that day.

In the diaries, women were also asked to record detailed information on each encounter with a client, including the activities performed, whether a condom was used, and the price that was paid (both in cash and in goods or services).<sup>9</sup> After a preliminary analysis of the Round 1 data, some additional questions were added to the Round 2 diaries. The additions which are relevant to this paper included questions on client characteristics, somewhat more detailed questions on the transfers received from regular clients, and, most importantly, separate measures of unprotected

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<sup>8</sup>Working with a sample identified by women in SHCP-organized peer groups has advantages and disadvantages. One advantage is that women in the peer groups know other single women in their community with multiple concurrent sexual partners, which should have increased the size of the sample, improved its representativeness, and included more informal sex workers. Furthermore, the structure of the peer groups allowed peer educators and peers to better locate the sex workers whom they identified. Finally, SHCP had a long, stable relationship with sex workers in Western Province, so that sex workers trusted the organization, which tended to limit non-participation and attrition among sampled sex workers. The major disadvantage is that the women identified in this way may not be fully representative of the sample of sex workers in Busia Town. As in any snowball sampling technique, the sample includes fewer women right at the margin of participation in transactional sex.

<sup>9</sup>The diaries included questions about a maximum of 3 clients per day.

anal and vaginal sex, respectively (in Round 1, we only have a measure of total unprotected sex and so cannot differentiate between unprotected anal and unprotected vaginal sex). In each round, each respondent was asked to keep the diary for a period of 3 months, though the first few weeks were often not usable in the final analysis due to reporting errors made as women were learning the diaries.

The diaries were extensively pre-tested by the authors, a research assistant, and the two enumerators to maintain respondent confidentiality, meet norms of cultural sensitivity, and to ensure that respondents understood all of the questions. To ensure data quality, the two enumerators conducted diary checks roughly once a week, during which they checked for errors and resolved mistakes with respondents.

In order for women to keep these self-reports, it was of course necessary that they could read and write Kiswahili, one of the official languages in Kenya and the language used in the diaries. Literacy levels in the sample were relatively high: 95% of the sample could read and 88% could write Kiswahili (Table 1). To avoid losing illiterate women, a special effort was made to keep them in the sample. Each illiterate woman was assigned a peer educator who met with her daily to read the diary questions to her and fill in the answers for her.

In addition to the diaries, a background questionnaire was also administered. This survey included questions on family background, household characteristics, education, migration, land and durable good ownership, access to credit and savings, knowledge of HIV/AIDS, attitudes towards sex work, and other related topics. To compensate respondents for keeping the diaries, we paid women 1,000 Kenyan shillings (US \$14) in Round 1, and 1,500 Kenyan shillings (US \$21) in Round 2.<sup>10</sup> Of the 248 women that were sampled, we obtained complete, usable data from 192 of them (77%). The other women could not be included because they refused to participate or stopped filling out the diaries during the sample period, because they moved to another area and could not be traced, or because they kept the diaries poorly or did not fill them completely. In total, the final dataset consists of 192 women, 19,041 transactions, and 12,526 sex worker days.<sup>11</sup>

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<sup>10</sup>Round 2 participants were compensated slightly more because the diaries were more detailed and took more time to complete.

<sup>11</sup>The breakdown of the final sample by round is 84 women in Round 1 and 91 in Round 2, with 17 women

## 3.4 Descriptive Statistics

### 3.4.1 Background Statistics

Background statistics for our sample of sex workers are presented in Table 1. Panel A shows that the average sex worker is 28 years old, has completed over 9 education grades, and has roughly 2 children and 3 dependents.<sup>12</sup> Eighty-four percent of these women are heads of their households. Twenty-three percent of the sex workers in the sample are widowed, 20% are divorced or separated, 13% are currently cohabitating, and 44% were never married and are not currently cohabitating. In total, 43% of the women are previously widowed, divorced, or separated, which is much higher than the proportion of 10.2% found among the general population of Kenyan women aged 15-49 (Central Bureau of Statistics, 2004). The high number of previously married women is consistent with sociological and anthropological studies of sex workers in rural areas, and it is likely that many are HIV widows (Swidler and Watkins, 2007; Wojcicki, 2002a).

Panel A also presents statistics on the effect that sex work has had on sex workers' perceptions of the likelihood that they will eventually marry (or remarry). Only 3% of women report that working in the commercial sex industry has made the prospect of future marriage less likely, but 41% report that working in sex work has made marriage *more* likely. This is notable because one explanation for the significant wage premium to sex work is that it serves as a compensating differential for reduced marriage market possibilities (Edlund and Korn, 2002). These results, however, seem to suggest that this explanation is unlikely to be important for this population of sex workers and is consistent with Arunachalam and Shah (2008).<sup>13</sup>

Statistics on HIV knowledge are shown in Panel B of Table 1. Sixty percent of the sample has been tested for HIV, which is much higher than the national average (14.7%) or the average for 

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in both rounds, so that pooled regressions are in most cases reported for 192 women. The actual number of observations in each regression differs depending on available data.

<sup>12</sup>The education level of women in our sample is similar to that of the average Kenyan woman. Fifty-seven percent of our sample have completed primary school, compared to 56% across Kenya and 67% across Western Province (Central Bureau of Statistics, 2004).

<sup>13</sup>It is also possible that supplying commercial sex affects marriage prospects on the intensive (partner quality) rather than extensive (finding a partner) margin.

Western Province (14.6%) among women aged 15-49 (Central Bureau of Statistics, 2004). The women scored very highly (with an average score of 94 out of 100) on a test of HIV knowledge that covered HIV transmission pathways, the relationship between HIV and AIDS, risk reduction methods, and misconceptions surrounding HIV/AIDS. Taken together, Panel B suggests that most sex workers in Busia are quite aware of the health risks related to HIV/AIDS.

Finally, Panel C presents summary statistics on access to savings. Though 37% of sex workers report having a savings account, almost all of these savings accounts are group arrangements (mostly arranged through SHCP) that do not easily allow for withdrawals. Indeed, among women with accounts, average savings withdrawals in the month prior to the survey were just 73 Kenyan shillings (Ksh), equivalent to about US \$1.04. Instead of relying on formal mechanisms, women tend to save through Rotating Savings and Credit Associations (ROSCAs): sixty-four percent of women participate in ROSCAs, and the average sex worker that participated in a ROSCA saved over 7,000 Kenyan shillings (US \$100) in her ROSCAs in the past year (not shown). However, nearly all of these ROSCAs have a predetermined payout schedules and so are not ideal for consumption smoothing purposes, as discussed in Gugerty (2007).

### 3.4.2 Shocks, Transfers, and Expenditures

In this study, we focus on three types of health shocks that are commonly experienced by sex workers. The first is an indicator that is coded as 1 if the sex worker reported having a fever, cough, diarrhea, typhoid, malaria, cuts, burns, or other injuries or illnesses. The second is whether the sex worker reported that another member of the household suffered from any of these illnesses. The third is the occurrence of sexually transmitted infections (STIs), which should presumably affect a woman's ability to supply sex.<sup>14</sup> Since all of these health shocks require money in order to be treated, women may need to work and earn more in order to be able to afford medicine.

Panel A of Table 2 presents summary statistics for these 3 shocks. Column 1 presents the daily averages. Women reported household sickness on 37% of days, own sickness on 34% of

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<sup>14</sup>We also collected information on other shocks, including the death of a friend or family member, but do not include them in the analysis as they have ambiguous effects on labor supply. For instance, women may need to work more to afford funeral contributions but may work less to attend the funeral itself.

days, and STIs on 3% of days. Column 2 reports the percentage of women that reported these shocks at least once over the 3 month data collection period. Each percentage is high, ranging from 34% for STIs to 98% for own sickness.

Panel B presents statistics on access to informal finance, including transfers given to and received from friends and family members, and gifts received from regular clients. On an average day, women send about 33 Ksh (US \$0.47) in gifts and loans to friends and family, and receive about 55 Ksh (US \$0.79) back. Women receive another 94 Ksh (US \$1.34) per day in gifts from regular clients. Though we do not have a detailed breakdown on the types of gifts given in Round 1, the Round 2 data indicates that most of these gifts came in the form of cash or in-kind payments, though regulars also occasionally pay for rent or other expenses. Overall, women appear to be relatively well connected to these informal credit markets, though the amounts that are typically transferred on an average day are small.

Panel C presents statistics on daily expenditures. Average total expenditures are about 670 Ksh (US \$9.57) per day and average food expenditures are 183 Ksh (US \$2.61) per day. Though national estimates of average per capita expenditures are hard to come by in Kenya, these figures are certain to be significantly higher than the Kenyan average.

### **3.4.3 Labor Supply and Sexual Behavior**

Table 3 presents summary data on labor supply and sexual behavior for the sex workers in the sample. Panel A shows that the average woman makes about 690 Kenyan shillings (US \$9.86) per day in sex work, compared to about 100 shillings (US \$1.43) from other sources (such as agriculture, small business, or salaried work at bars or restaurants). The average woman engages in sex work on a bit more than 3 out of every 4 days and sees an average of 1.52 clients per day.<sup>15</sup> As in other studies of sex work, average income in the sample is very high relative to the average in the area: income from sex work is approximately 4 times that of other female daily income earners in the Busia area (Dupas and Robinson, 2009). This difference is significantly higher than the 56% income premium in Mexico found by Gertler, Shah, and Bertozzi (2005)

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<sup>15</sup>While we do have data on hours worked, we do not report the hours here as it is difficult to determine if they truly represent work. For example, a woman may spend all night with one client, but part of the time may be spent sleeping.

and the 37% wage premium found by Rao et al. (2003) in Calcutta, and more in line with the much larger premium found by Booranapim and Mainwaring (2002) in Thailand.

The next few rows in Table 3 report mean sexual behavior in the sample. For each variable, Column 1 presents the overall daily average, Column 2 presents the daily average for the round 2 sample only (which we present since this is the only sample for which measures of condom usage are available separately for vaginal and anal sex), and Columns 3-5 includes transaction level data. Column 1 indicates that, over all the days covered (including those in which they did not work), women have vaginal sex on 74% of days, anal sex on 22% of days, and oral sex on 19% of days. Women have a large amount of unprotected sex: they have unprotected sex on 18% of days, and have an average of 0.42 unprotected sex acts per day. All of these figures are slightly lower in round 2, perhaps due to seasonal differences in demand or other factors (see Column 2). From Column 3, women have vaginal sex with 95% of clients, anal sex with 24% of clients, oral sex with 19% of clients, and unprotected anal or vaginal sex with 17% of clients. Though the round 2 figures are lower, it appears that unprotected anal sex - which greatly increases the risk of HIV infection - is not uncommon (occurring on 2% of days in Round 2).

One important distinction between clients is those that are considered regulars and those that are considered casuals. Though this distinction is not completely clear, regular clients have had repeated encounters with a given woman and may be considered a boyfriend, lover, or partner. In focus group discussions, women often cite emotional support and love as characteristics associated with a regular client. In contrast, casual clients are often not known to the sex worker before the transaction. Since casual clients can become regular clients over time, and many women have multiple regular clients, the distinction between regulars and casuals can be hard to define. However, since SHCP had already been using the regular and casual client terminology, we allowed respondents to determine on their own if a particular client should be classified as a regular or casual.

Columns 4 and 5 provide transaction level data on services provided to regular and casual clients. The major differences between regular and casual clients are in anal sex and in unprotected sex: women are slightly more likely to have anal sex with casuals (26% of the time, compared to 19% of the time with regulars), but are more likely to have unprotected sex with



regulars (22% of the time, compared to 14% with casuals). This may be because women are more aware of the risk profile of regular clients than they are of casual clients.

Finally, Panel B presents the percentages of women that engaged in various sexual activities at least once during the sample period. Interestingly, 82% of women engaged in anal sex and 71% engaged in unprotected vaginal or anal sex. The anal sex figures are particularly interesting, because they are much higher than those found elsewhere.<sup>16</sup> Again, the averages are lower in round 2. Even with the lower figures, however, 26% of women had unprotected anal sex at least once in the sample period (which is of interest due to the substantial risk of contracting HIV from unprotected anal sex).

As mentioned previously, roughly 44% of the women in this sample participated in peer groups sponsored by the Strengthening STD / HIV Control Project in Kenya and received education about HIV and other STIs. This is one reason why women may have scored so highly on the test of HIV knowledge presented in Table 2. Compared to the marginal sex worker, these women should be more aware of the risks of unprotected sex, so the figures in Table 3 are likely to be lower bounds on the frequency of unprotected sex among sex workers.

## 4 Risk Premium

### 4.1 Estimation

We will estimate a risk premium by performing a fixed effects regression of the price paid by the client on the activities performed, and whether a condom was used. Ideally, this regression should control for client characteristics. However, we only have client information for a small portion of our data, so we will have to assume homogeneity on the demand side for most of what

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<sup>16</sup>For instance, Brody and Potterat (2003) review a wide variety of public health and anthropological studies and find a maximum anal sex prevalence figure of 42.8% in self-reported recall data. The authors argue, however, that most anal sex figures are likely underestimates, as respondents are much more likely to admit to having anal sex in a diary or in a computer questionnaire, neither of which are commonly used in Africa. Among a very similar group of sex workers in Kenya, Ferguson and Morris (2003) find that only 20% of CSWs in the Kenyan Highlands responded that they had ever had anal sex. We thank Damien de Walque for pointing this out to us.

follows. This leaves us with an estimating equation of the type

$$P_{it} = \sum_{h=1}^H \beta_h X_{hit} + \sum_{a=1}^A \beta_a X_{ait} + \alpha_i + v_t + \varepsilon_{it} \quad (6)$$

for sex worker  $i$  at date  $t$ . This is an equation relating the price  $P_{it}$  to the performance of risky sexual activities  $X_{hit}$  and other activities  $X_{ait}$  which do not fundamentally involve an increase in the probability of contracting HIV or another STI (such as kissing or giving a massage). The individual fixed effect  $\alpha_i$  will pick up differences across women in bargaining power and in the willingness to accept risk, while other time-varying effects such as changes in demand on particular days will be captured with date controls  $v_t$  ( $v_t$  includes controls for the day of the week and the month of the year).  $\varepsilon_{it}$  is an error term that may capture unmeasured factors such as a woman's or client's mood at a particular time. To account for the fact that errors are likely correlated for a women, we cluster standard errors at the individual level.<sup>17</sup> If this regression is properly specified,  $\beta_h$  will reflect the risk premium to the risky activity  $X_{hit}$  (mainly unprotected sex).<sup>18</sup>

## 4.2 Results

The results from estimating Equation (6) are presented in Table 4. The regressions in Columns 1-3 are conducted on the entire sample, while the regressions in Columns 4-7 are restricted to the Round 2 sample in order to include client characteristics as explanatory variables and to look at unprotected anal sex and unprotected vaginal sex separately. In addition to the variables shown, all regressions also include a control for the round of data collection. The variable used to estimate the compensating differential for unprotected sex is an indicator variable equal to 1 if the woman had at least 1 unprotected sex act (with anal and vaginal sex aggregated together).<sup>19</sup>

The results suggest a sizeable risk premium to unprotected sex and to the provision of other services. The premium to anal sex is approximately 77 Kenyan shillings (US \$1.10), which can

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<sup>17</sup>We have also run fixed effects regressions that explicitly account for serial correlation in the errors, and get similar standard errors and essentially unchanged statistical significance.

<sup>18</sup>Protected anal sex may be considered risky as well because of the increased likelihood of tearing a condom during anal intercourse.

<sup>19</sup>We obtained similar estimates using the number of unprotected sex acts as a regressor.

be explained partially through the increased health risk.<sup>20</sup> Also of note is the 72 shilling (US \$1.03) return to company, which likely reflects unobserved characteristics of clients that request company. Column 1 shows that unprotected anal or vaginal sex is associated with a 42 shilling (US \$0.60) increase in the price. As the total average price paid is 488 shillings, this amounts to a premium of about 8.6%, which is substantially lower than the risk premium of 23% calculated by Gertler, Shah, and Bertozzi (2005). However, the market for sex work in Mexico, where sex work is legal and regulated and where average incomes are higher, is likely to differ greatly from the Kenya context. The lower risk premium may also be the result of differences in data - Gertler, Shah, and Bertozzi (2005) collect recall data on the last three to four client transactions rather than a longer panel. In addition, only 11.7% of their sample has variation in condom usage with clients, while 71% of our sample has variation in condom usage.

Columns 2 and 3 run the same specification among the regular and casual client samples separately. The differences between regular and casual clients in the prices paid for most activities are not significantly different (tests not shown), but regular clients actually pay more for unprotected sex than do casual clients (though the difference is not significant). In fact, the premium for casual clients is insignificant (though we can not make much of this, as the standard errors in all specifications are quite large). However, the fact that the risk premium is positive and significant on the full sample suggests that, on average, women have some discretion over the activities that they perform and that women are (at least partially) compensated for the health risks that they take. Further, the fact that regular clients also pay premia for various activities suggests that women have similar discretion even within these relatively longer-term relationships.

Columns 4-7 restrict attention to the Round 2 data. First, Column 4 shows the risk premium for the round 2 sample: generally the results are very similar to that of the entire sample. Column 5 separately estimates the risk premia to unprotected anal and vaginal sex. Though the standard

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<sup>20</sup>Studies on HIV transmission through male-to-female anal sex are very rare, and causality is difficult to establish, but sex workers in South Africa that supply anal sex (either protected or unprotected) have been found to have a 10-120% increase in the risk of HIV infection (Karim and Ramjee, 1998). Similarly large increases have been estimated for couples in Europe (European Study Group on Heterosexual Transmission of HIV, 1992). We are not aware of studies that estimate the per-act transmission probability for heterosexual anal sex in Africa.

errors are so large that the coefficients are insignificant, the results suggest a 91 Ksh (US \$1.30) premium to unprotected anal sex and a 38 Ksh (US \$0.54) premium to unprotected vaginal sex. Though it is hard to make much of the point estimates given the large standard errors, the relatively larger anal premium makes sense given the increased risk of HIV associated with anal sex.

Finally, Columns 6 and 7 include client characteristics as controls. These characteristics include whether the client is circumcised, the client's wealth level, attractiveness, and occupation, and whether the sex worker thinks the client is at high risk of having HIV/AIDS. We also include controls for tribe and cleanliness, though we do not include these coefficients in the table. Unfortunately, many of the client characteristics are missing because women often failed to keep track of this information. As these non-responses are non-random, we need to be cautious in interpreting the results (though the inclusion of fixed effects should eliminate some bias across women).

That said, the results in Columns 6 and 7 make intuitive sense. Prices are higher (though the coefficient is insignificant) for wealthier clients and lower (significant at 5% or 10%, depending on the specification) for more attractive clients. The price does not seem to be significantly higher for clients whom the sex worker rates to be at high risk of having HIV/AIDS.

In sum, the results of Table 4 are consistent with the notion that sex workers have some discretion in choosing whether to use a condom, that a risk premium exists to unprotected sex, and that it may be rational for women to choose to engage in unprotected sex to capture the risk premium. In the next section, we test whether women choose to do this in response to short-term shocks.

## **5 Consumption Smoothing and the Supply of Unprotected Sex**

### **5.1 Estimation**

The simple model in Section 2 predicts that consumption and risky sexual behavior may respond to even transitory shocks which do not affect the lifetime budget constraint, since women do not have access to effective consumption smoothing mechanisms. To examine these relationships

empirically, we will estimate fixed effects equations of the type

$$h_{it} = \beta S_{it} + \alpha_i + v_t + \varepsilon_{it} \quad (7)$$

$$e_{it} = \gamma S_{it} + \tilde{\alpha}_i + \tilde{v}_t + \tilde{\varepsilon}_{it} \quad (8)$$

where  $h_{it}$  is a measure of unprotected sex,  $e_{it}$  represents household expenditures (we did not collect consumption data), and the fixed effects  $\alpha_i$  and  $\tilde{\alpha}_i$  are meant to proxy for individual-specific variables, notably preferences and the marginal utility of lifetime wealth.  $v_t$  and  $\tilde{v}_t$  include controls for the day of the week and the month of the year.  $S_{it}$  is an indicator variable equal to 1 if the household encountered a health shock, and  $\varepsilon_{it}$  and  $\tilde{\varepsilon}_{it}$  are error terms. We cluster the standard errors at the individual level.<sup>21</sup>

An equation like (8) is often used to test for consumption smoothing. If the estimated  $\gamma$  cannot be differentiated from 0, consumption smoothing is often considered efficient and individuals are thought of as being relatively well insured from intertemporal risk. However, such an estimation does not provide any information on *how* individuals choose to cope with risk. For instance,  $\gamma$  may be close to 0 if individuals engage in costly income smoothing (Morduch, 1995), if individuals are risk averse and choose to maintain consumption in the face of income shocks by incurring costs such as reducing human capital or health investments in household members (Jacoby and Skoufias, 1997; Chetty and Looney, 2006), or if households use productive assets such as bullocks to smooth consumption (Rosenzweig and Wolpin, 1993). As we will discuss below, our own estimated  $\gamma$  is close to 0, but women incur significant (expected) health costs by increasing their supply of risky sex in response to health shocks.

## 5.2 Results

### 5.2.1 Expenditures

We first run fixed effects regressions of daily levels of various expenditure categories on the 3 types of shocks previously discussed: whether a woman is sick herself, whether a member of her household is sick, and whether a woman is suffering from an STI. Since experiencing an STI

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<sup>21</sup>As with the price regressions, we have run alternative specifications that explicitly account for serial correlation in the errors, and obtain similar standard errors and unchanged statistical significance.

often precludes supplying sex, women can only adjust their behavior after the STI has passed. To account for this, we include an indicator for the first day after having experienced an STI. All dependent variables are aggregated at the day level, so there is only one observation per woman per day. Results are presented in Table 5.

For all of the shocks, total and private expenditures<sup>22</sup> seem to be relatively insensitive to the occurrence of health shocks. For instance, private expenditures actually increase by about 11 shillings (US \$0.16) when another household member gets ill. Food expenditures do decline in response to household health shocks, but only by 14 Ksh, or 7.7% of food expenditures. Taken at face value, these results suggest that sex workers are relatively well insured against unexpected health shocks, though this result says nothing about how consumption smoothing is achieved. As the next few Tables will show, sex workers maintain consumption in large part by increasing their supply of unprotected sex and accepting significant health costs.

### 5.2.2 Participation in the Sex Sector and the Supply of Unprotected Sex

Table 6 presents fixed effects estimates of the impact of the various shock measures on labor supply. Starting with Panel A, own sickness has the expected effect for all labor supply measures: women are less likely to participate in the commercial sex market when they are sick. The more interesting result is the effect of household sickness on labor supply. Women are 2.6 percentage points more likely to see a client when a household member falls ill. This amounts to a 3.1% increase in the probability of participating in the sex sector. As can be seen in Columns 3 and 4, women increase their participation by taking on more casual clients, which is notable because women usually do not know casual clients before the transaction, so they probably can be less sure of the probability that a casual client is HIV positive than they could be of a regular client. Columns 5-7 show that women adjust their labor supply in the commercial sex sector rather than in other sectors in which they work.

Panel B presents results for experiencing the symptoms of a sexually transmitted infection (STI). As expected, experiencing an STI reduces the probability of supplying transactional sex,

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<sup>22</sup>Private expenditures include alcohol, soda, cigarettes, meals in restaurants, clothing, health and beauty products, and other privately consumed categories such as airtime for cellular phones.

and represents a sizeable income shock: total income decreases by 184 Ksh (US \$2.63) on such days. If women are unable to use risk coping mechanisms to cope with such a big income shock, they may choose to work more after recovering from the STI, and Panel B suggests that they do just this. Though not all of the responses are statistically significant at traditional levels due to the rarity of STI shocks (occurring on 3% of days), all of the coefficients in the regressions related to sex work are positive. Women see 0.274 more clients and earn an additional 230 Ksh (US \$3.29) from sex work on days after recovering from an STI.

These responses are very similar to Kochar (1995, 1999), who shows that individuals work more when their households incur negative income shocks. However, in this paper, we are ultimately interested in how the supply of unprotected sex responds to health shocks, since an increase in unprotected sex entails a significant (expected) health cost on women, especially for women that are HIV negative. If unprotected sex is indeed very sensitive to short-term health shocks, then alternative consumption smoothing mechanisms must be quite inefficient, and the provision of more effective smoothing mechanisms could have substantial benefits in reducing the spread of HIV.

Table 7 presents fixed effects regressions of unprotected sex measures on health shocks. The dependent variables are indicators for whether a woman had unprotected sex, the number of unprotected sex acts in which she engaged, and indicators for having anal, vaginal, or oral sex. All dependent variables are measured at the daily level. Panel A shows that women dramatically increase their supply of protected and unprotected sex in response to these short-term health shocks. When a household member falls sick, women are 3.0 percentage points more likely to have unprotected sex and have 0.63 more sex acts (though the latter effect is not quite statistically significant). They are also 4.2 percentage points more likely to have anal sex, and more likely to have vaginal and oral sex.<sup>23</sup> In percentage terms, these represent increases of 19.1% in the probability of having unprotected sex and 21.2% in the probability of anal sex. As will be discussed in more detail in Section 6, these increases substantially increase the likelihood of being infected with HIV.

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<sup>23</sup>These results all look very similar even when measures of participation in the sex market are included as controls (whether the woman saw a client, or the number of clients she had). This suggests an increase in risky behavior, even conditional on participation in sex work.

Panel B, which focuses on STIs, shows a similar pattern with even larger coefficients, though the coefficients do not reach statistical significance due to the rarity of STIs. In a larger sample, we expect it would be possible to find statistically significant effects. In the context of this paper, we consider the magnitude of these figures generally supportive of the figures for health shocks.

Taken together, Tables 6 and 7 suggest that the supply of sex (including unprotected sex) is very sensitive to even small, short-term shocks, likely due to the fact that women do not have access to more effective consumption smoothing mechanisms.

### **5.3 Robustness Checks**

The results of the previous section suggest that sex workers accept a significant amount of health risk to deal with short-term illness shocks, which implies that other consumption smoothing techniques have failed. In this section, we provide several robustness checks to test more closely whether our results appear consistent with a consumption smoothing explanation for the labor supply response. Ideally we would be able to check whether responses are smaller for women that have access to formal consumption smoothing mechanisms such as individual savings accounts in a bank, but the vast majority of women in this sample are unbanked and only have access to group savings accounts that heavily restrict their withdrawals. For this reason, we are unable to compare women with varying levels of access to smoothing mechanisms. Instead, we examine how the results vary by income level and by perceived HIV status.

#### **5.3.1 Results by Income Level**

If women supply more risky sex as a consumption smoothing mechanism, it should be the poorest women (those that are least able to afford medicine) who are most likely to use unprotected sex as a risk-coping technique. There exists significant heterogeneity in sex worker earnings: over the sample period, a woman at the 25th percentile of the sex worker income distribution earned 520 Ksh (US \$7.43) per day, while a woman at the 75th percentile earned 1,089 Ksh (US \$15.56) per day.

To explore whether it is poorer women that are most sensitive to the shocks, we construct



indicators for whether the sex worker’s daily income is below the daily income of the median sex worker (US \$11.10), and interact this indicator with the household health shocks. Table 8 presents fixed effects regressions of sexual behavior on health shocks and the interactions. Since we are primarily interested in the sickness indicators, we present only those results in this Table.

The results are generally consistent with a consumption smoothing explanation as the interactions are generally positive, though several coefficients are not statistically significant. Regardless, the results suggest that responses are biggest for the poorest women. It is interesting to note, however, that certain responses appear to be statistically significant and substantial in magnitude even for richer women. For instance, we estimate that women in the top half of the sex worker income distribution increase the probability that they have anal sex by 2.9 percentage points on days in which a household member falls ill. This response may underscore how the lack of savings mechanisms are a problem for women throughout the income distribution.

### 5.3.2 HIV Status and Labor Supply Responses

Sex workers are already at considerable risk of contracting HIV and so may already be HIV positive (or believe that they are likely to be HIV positive). If so, the additional health risk incurred from unprotected sex may be relatively minimal (though the risk of STI infection or pregnancy is still substantial).<sup>24</sup>

Though we cannot know if HIV positive women respond differently to shocks than do HIV negative women, since we did not test for HIV, we did ask women if they had ever been voluntarily tested for HIV and, if they had, what they thought their risk of being infected was (unfortunately, we did not ask about perceived HIV risk for women who had never been tested). Of those that were tested, 33.3% responded that they had a greater than 50% chance of being HIV positive.

To examine whether it is only women that already believe that they are already HIV positive who adjust their supply in response to health shocks, Table 9 re-runs our main specifications for the 66.7% of women who report having a risk of infection less than 50% (note that this is much

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<sup>24</sup>In addition, unprotected sex can have negative health consequences for HIV positive women because it can lead to re-infection and to an increased viral load, which tends to speed up the development of AIDS.

less than 66.7% of the sample since only 60% of the sample had been tested for HIV, and some women who had been tested did not report their perceived risk status). Given the small sample size, these results should be seen as suggestive rather than definitive.

In general, responses for women who think they are relatively unlikely to be HIV positive are substantial, though many of the coefficients are insignificant due to the reduced sample size. Such women are 2.1 percentage points more likely to see a client, 1.4 percentage points more likely to have unprotected sex, and 3.2 percentage points more likely to have anal sex on days in which a household member is sick. In our main specifications in Tables 6 and 7, these figures were 2.6, 3.0, and 4.2 percentage points, respectively. Though the estimates for the subsample of women who think they are likely negative are a bit smaller than the full sample results, they are still relatively large. While these measures of perceived HIV risk are noisy at best and are only available for a subset of the data, they do appear to suggest that even women that are likely HIV negative take on substantial health risk in response to shocks.

## 6 How Big is the Expected Health Cost?

The increase in unprotected sex that we observe among sex workers in Western Kenya imposes at least some health cost on women. But how big are these costs in real terms? In this section, we estimate the increase in the probability of becoming infected with HIV due to inadequate consumption smoothing mechanisms *over household health shocks only*. This paper has focused entirely on self-reported health shocks and has not examined the impact of larger shocks such as the death of a family member. In addition, we do not have enough power to differentiate between more and less serious illnesses. However, given that even relatively small shocks affect behavior, the larger shocks must also certainly do so. As such, the calculation in this section is a lower bound on the costs of inadequate consumption smoothing.

We conservatively do not include any costs associated with increases in the probability of becoming infected with an STI, and we do not take into account the increased risk of becoming infected with HIV while suffering from an STI (see Oster (2005) for more on this issue). We also do not include costs associated with reinfection, so this estimate is a lower bound on the true costs of unprotected sex.

With that in mind, the probability of an HIV negative woman becoming infected after a sexual act with a client<sup>25</sup> is  $p_{client}(p_{uv}t_v + p_{ua}t_a)$ , where  $p_{client}$  is the probability that the client is HIV positive,  $p_{uv}$  and  $p_{ua}$  are the probabilities that the sex worker has unprotected vaginal or anal sex with the client, and  $t_v$  and  $t_a$  are the transmission probabilities for unprotected vaginal and anal sex. Clients of sex workers are at much greater risk of HIV infection than other men: Côté et al (2004) and Lowndes et al. (2000) estimate that clients of sex workers have an HIV prevalence roughly 4-5 times that of the general population in Accra, Ghana, and Cotonou, Benin, respectively. We assume that the clients of sex workers have a 25% chance of infection (roughly 2.5 times that of the general population). We (conservatively) use 1/1000 as the transmission probability for vaginal sex (Gray et al., 2001; Magruder, 2008) and 5/1000 as the transmission probability for anal sex (Mastro and de Vicenzi, 1996).<sup>26</sup>

From Table 7, the average sex worker has unprotected sex 0.346 times per day when her household does not experience a health shock, and 0.409 times per day when her household does.<sup>27</sup> From Columns 8 and 9 of Table 7, approximately 16% of unprotected sex acts are unprotected anal sex.<sup>28</sup> From Table 2, household health shocks occur on 37% of days. Thus, a woman who was perfectly insured from these health shocks would have unprotected sex approximately  $365 * .346 \approx 126$  times per year. She would have unprotected anal sex about 20 times and unprotected vaginal sex about 106 times. By contrast, the average woman in our sample would have unprotected sex  $365 * (0.346 * 0.63 + 0.409 * 0.37) \approx 135$  times in a year. Twenty-two of these acts would be unprotected anal sex and the remaining 113 would be unprotected vaginal sex.

Assuming this woman is initially HIV negative, she is infected with probability  $1/1000 *$

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<sup>25</sup>A woman may have more than one sex act with a client in a night.

<sup>26</sup>Estimates of the transmission probability for male-to-female anal sex are hard to find, especially in an African context. We instead use the male-to-male anal sex probability, estimated in the US.

<sup>27</sup>Though the coefficient in this regression (in Table 7) is not quite significant at 10%, we use the total number of sex acts rather than the probability of having unprotected sex since women typically have multiple sex acts in a day.

<sup>28</sup>We do not directly use the coefficients for unprotected anal and vaginal sex in Table 7 themselves, since total unprotected sex differed between Rounds, perhaps due to seasonal differences in demand or other unmeasured factors.

0.25 = 0.00025 after having unprotected vaginal sex, and  $5/1000 * 0.25 = 0.00125$  after having unprotected anal sex. For simplicity, we assume that the probability of infection from protected sex is 0.

An initially HIV negative woman who is perfectly insured will be infected with probability  $1 - (1 - t_v p_{client})^{106y} (1 - t_a p_{client})^{20y}$  after  $y$  years, while the average woman in our sample will be infected with probability  $1 - (1 - t_v p_{client})^{113y} (1 - t_a p_{client})^{22y}$ . Table 10 summarizes the probability of infection after different time periods. As might be expected, the probability of infection is high even if women were perfectly able to smooth their consumption, since all of these women have a large number of unprotected sex acts. However, for women that use unprotected sex to cope with health risk, the probability of HIV infection is 0.4 percentage points higher after 1 year, 0.8 percentage points higher after 2 years, 1.6 points higher after 5 years, and 2.5 percentage points higher after 10 years. In percentage terms, these increases are on the order of 4.5-8%. Since the price premium to unprotected vaginal sex is about 38 Ksh (US \$0.54) and the premium to unprotected anal sex is about 91 Ksh (US \$1.30), this means that women accept, for instance, a 8.0% increase in the risk of HIV infection after 1 year for about  $7 * \$0.54 + 2 * \$1.30 = \$6.38$ . The relatively small compensation paid for taking these tremendous health risks strongly suggests that the provision of better smoothing mechanisms (such as savings accounts) could have substantial impacts on the health of these women, by allowing them to rely on mechanisms other than their own labor supply to smooth consumption.

## 7 Conclusion

Using panel data from a sample of 192 formal and informal sex workers in Busia, Kenya, this paper is the first to quantitatively investigate the relationship between sex work and risk. We conducted our study in rural Western Kenya, an area in which transactional sex is prevalent: we estimate that 12.5% of the adult female population aged 15-49 supplies at least some transactional sex. For this reason, our results are generalizable to a larger population of women than is true of studies of sex work in more developed countries, and our findings fit into the larger literature on risk-coping and consumption smoothing in poor countries.

Like many people in poor countries, the sex workers in our sample are subject to consid-

erable risk but lack effective formal or informal means of coping with that risk. To make up for income shortfalls caused by health shocks, these women choose to increase their supply of better compensated but more dangerous and more unpleasant sex in order to capture the price premiums associated with these activities. Given that we find sizeable responses to relatively small shocks, women must be even more vulnerable to bigger shocks.

This study suggests that in addition to helping women exit sex work, there are opportunities to reduce the health risks *within* sex work beyond HIV education and condom distribution. Focusing specifically on household illness, sex workers may be better able to reduce their risky sexual behavior if their children and dependents had better access to health services or subsidized health inputs. Public health interventions aimed at children are particularly likely to have positive externalities on the spread of HIV, and perhaps future evaluations of childhood disease interventions can monitor these effects. In addition, the provision of formal consumption smoothing or risk coping mechanisms could substantially improve sex worker welfare, and could also potentially limit the spread of HIV.

Much remains unknown about the transactional sex market in developing countries, and this study has only been able to scratch the surface by focusing on intertemporal risk and the supply of unprotected sex. Future work might focus attention on the extensive decision to enter the commercial sex market in the first place, rather than on the intensive margin as we do in this paper, especially since risk is only part of the explanation for why so many African women engage in unprotected transactional sex. More research is crucial, however, in order to understand how best to design interventions to limit the spread of HIV, a disease which remains the leading cause of death in Sub-Saharan Africa (UNAIDS, 2007).

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**Table 1. Background Characteristics**

<b>Panel A. Background Information</b>			
Age		28.43	
		(6.98)	
Educational Attainment		9.20	
		(2.69)	
Literacy		<i>Read Kiswahili</i>	<i>Write Kiswahili</i>
		0.95	0.88
Respondent is Head Of Household		0.84	
Number of Biological Children		2.06	
		(1.83)	
Total # of Dependents		2.96	
		(2.36)	
Age Began Seeing Clients		18.67	
		(5.14)	
Number of Regular Clients (at time of background survey)		2.24	
		(1.07)	
Marital Status			
	<i>Widowed</i>	0.23	
	<i>Divorced / Separated</i>	0.20	
	<i>Cohabiting</i>	0.13	
	<i>Never Married / Not Cohabiting</i>	0.44	
Has working as a CSW changed likelihood of marrying?			
	<i>Yes, made it more likely</i>	0.41	
	<i>Yes, made it less likely</i>	0.03	
	<i>No change</i>	0.57	
Tribe			
	<i>Luhya</i>	0.39	
	<i>Luo</i>	0.51	
	<i>Other</i>	0.10	
Respondent is in a peer group		0.44	
Respondent has outside job		0.84	
<b>Panel B. HIV Knowledge</b>			
Tested for HIV		0.60	
HIV Knowledge Test Score (0-1 scale)		0.94	
		(0.06)	
<b>Panel C. Access to Savings</b>			
Has Savings Account		0.37	
Savings Withdrawn in Past Month (for women with savings accounts)		72.82	
		(430.27)	
Participates in ROSCA		0.64	
Observations		192	

Notes: Monetary values in Kenyan shillings. Exchange rate was roughly 70 Kenyan shillings / \$1 US during study period. Standard deviations in parentheses.

**Table 2. Summary Statistics from Diaries: Shocks, Transfers, Expenditures, and Savings**

	(1)	(2)	
	<i>Daily Average</i>	<i>Occurred at Least Once over 3 Month Sample Period</i>	
<b>Panel A. Shocks</b>			
Someone in Household Sick (other than respondent)	0.37	0.93	
Respondent Sick	0.34	0.98	
Respondent had STI	0.03	0.34	
Observations	12481	209	
IDs	192	192	
<b>Panel B. Transfers &amp; Gifts from Clients (Daily Averages)</b>			
	(1)	(2)	(3)
	<i>Sending Out</i>	<i>Receiving From</i>	<i>Net Flow</i>
Loan and Gift Flows from Family & Friends	32.50	54.57	-22.22
	(144.36)	(204.60)	(246.07)
Gifts received from Regular Clients	94.11		
	(299.01)		
Observations	12467		
<b>Panel C. Expenditures (Daily Averages)</b>			
	(1)		
Total Expenditures	667.62		
	(703.88)		
Food Expenditures	183.40		
	(201.76)		
Observations	12521		
IDs	192		

Note: Sickness is an indicator variable equal to 1 if household or respondent reported having a cough, fever, malaria, typhoid, diarrhea, cuts or burns, or any other illness. There are more observations than IDs in Column 2 of Panel A because some women were sampled in both rounds.

All monetary values in Kenyan shillings (Ksh). The exchange rate over the data collection period was approximately 70 Ksh / \$1 US. Means are reported, with standard deviations in parentheses. Exact number of observations differ for some variables, due to reporting errors.

**Table 3. Summary Statistics from Diaries: Labor Supply and Sexual Activities**

	(1)	(2)	(3)	(4)	(5)
<b>Panel A. Averages</b>	Daily Average Entire Sample	Daily Average Round 2 Sample	Transaction Data: All Clients	Transaction Data: Regulars Only	Transaction Data: Casuals Only
Participated in the Sex Sector	0.76				
Income from Sex Work	686.84				
	(749.55)				
Total Income (All Sources)	788.26				
	(778.89)				
Number of Clients Seen	1.52				
	(1.12)				
Number of Regular Clients Seen	0.54				
	(0.66)				
Had Vaginal Sex	0.74	0.69	0.95	0.96	0.94
Had Anal Sex	0.22	0.18	0.24	0.19	0.26
Had Oral Sex	0.19	0.09	0.19	0.17	0.21
Had Unprotected Vaginal or Anal Sex	0.18	0.08	0.17	0.22	0.14
# Times Unprotected Vaginal or Anal Sex	0.42	0.12	0.27	0.41	0.20
<i>Round 2 Only</i> <sup>1</sup>					
Had Unprotected Vaginal Sex		0.07	0.07	0.10	0.05
Times Unprotected Vaginal Sex		0.10	0.08	0.11	0.05
Had Unprotected Anal Sex		0.02	0.02	0.01	0.02
Times Unprotected Anal Sex		0.02	0.02	0.01	0.02
Observations	12526	5609	19041	6754	12112
Number of Women	192	91	192	192	192
<b>Panel B. Occurred at Least Once During Sample Period</b>					
	(1)	(2)			
	Entire Sample	Round 2 Only			
Vaginal Sex	1.00	1.00			
Anal Sex	0.82	0.72			
Oral Sex	0.71	0.50			
Unprotected Vaginal or Anal Sex	0.71	0.54			
Unprotected Vaginal Sex		0.47			
Unprotected Anal Sex		0.26			
Observations	209	108			
Number of Women	192	108			

Note: Figures are calculated from self-reported daily diary data. The figures in Columns 1 and 2 are daily averages. Figures in Columns 3-5 are averages across all transactions (up to a maximum of 3 client transactions per woman per day). The number of observations in Columns 4 and 5 do not sum to the total in Column 3 due to reporting errors on client type. There are 192 total women in the sample, 108 of whom participated in Round 2.

<sup>1</sup> Data on unprotected vaginal sex and unprotected anal sex are available in Round 2 only.

**Table 4. Hedonic Price Regressions**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	----- Full Sample -----			----- Round 2 Sample Only -----			
	All Clients	Regulars	Casuals	All Clients	All Clients	All Clients	All Clients
Vaginal Sex	24.21 (25.10)	42.10 (36.33)	18.44 (24.65)	62.46 (44.83)	60.71 (44.05)	40.72 (45.36)	26.77 (55.98)
Anal Sex	77.19 (20.93)***	64.78 (25.40)**	67.81 (21.95)***	165.61 (50.80)***	159.12 (48.20)***	84.09 (42.84)*	80.33 (39.35)**
Oral Sex	23.68 (15.06)	48.38 (25.97)*	7.57 (14.36)	74.38 (24.53)***	74.49 (24.52)***	71.01 (34.38)**	97.23 (41.06)**
Massage	61.27 (14.18)***	67.40 (20.80)***	46.78 (14.28)***	54.00 (24.80)**	54.20 (24.68)**	18.04 (28.10)	16.15 (26.27)
Kissing	51.92 (12.06)***	56.65 (21.73)***	40.66 (9.93)***	50.38 (26.11)*	50.48 (26.06)*	33.40 (29.70)	40.89 (26.75)
Manual Stimulation	48.60 (15.79)***	78.27 (29.46)***	30.53 (14.42)**	86.55 (25.29)***	87.01 (25.21)***	61.53 (32.39)*	55.70 (40.99)
Company	72.07 (12.94)***	49.48 (17.94)***	61.65 (13.21)***	82.04 (23.95)***	81.97 (23.93)***	44.43 (28.84)	27.95 (23.00)
Stripping	39.78 (11.22)***	31.46 (15.97)*	34.80 (11.77)***	49.82 (19.08)**	48.60 (18.62)**	27.65 (24.22)	43.99 (25.40)*
Sex in Thighs	34.87 (15.68)**	25.06 (22.92)	46.95 (18.15)**	66.43 (35.51)*	64.44 (34.80)*	112.76 (51.55)**	70.58 (60.58)
Other Activities	58.58 (33.41)*	95.93 (57.99)*	36.70 (25.67)	24.64 (38.46)	25.89 (38.84)	50.12 (51.18)	22.61 (37.74)
Regular Client	-16.64 (14.69)			-30.14 (25.90)	-30.25 (25.88)	-13.28 (26.22)	7.56 (32.76)
Had Unprotected Sex	42.33 (16.45)**	85.90 (21.01)***	22.32 (19.60)	39.48 (30.74)		27.37 (26.19)	17.68 (34.21)
Had Unprotected Vaginal Sex					38.21 (27.91)		
Had Unprotected Anal Sex					91.11 (106.62)		
Client is Circumcised						-27.16 (20.92)	-21.63 (24.29)
Client is Very Wealthy						39.12 (46.14)	42.42 (53.17)
Client is Handsome						-83.36 (45.40)*	-109.78 (54.61)**
Sex Worker Believes Client is at High Risk of HIV / AIDS							3.09 (29.46)
Client Controls	No	No	No	No	No	Yes	Yes
Observations	18824	6731	12093	7082	7082	3856	2404
Number of women	192	192	192	108	108	108	95
R-squared	0.04	0.04	0.04	0.04	0.04	0.04	0.04

Note: All regressions are fixed effects regressions with controls for the month and the day of the week.

Clustered standard errors (at the individual level) in parentheses.

All regressions include controls for the round of data collection. The dependent variable is Kenyan shillings.

The exchange rate was approximately 70 Kenyan shillings to \$1 US during the data collection period.

Columns 6 and 7 include controls for other responses to the questions "Is the client wealthy?"

and "Is the client handsome?," but the coefficients are omitted for space.

Columns 6 and 7 also include controls for client tribe, occupation and cleanliness.

Averages prices paid by type of client: regular - 488 shillings; casual - 434 shillings; overall - 453 shillings.

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

**Table 5. Effect of Shocks on Expenditures**

	(1)	(2)	(3)	(4)	(5)	(6)
	Total Expend.	Food Expend.	# of Meals Respondent	Private Expend.	Medical Expend.	Non-Medical Shared Expend.
Mean of Dependent Variable <sup>^</sup>	588.85	181.08	2.80	65.17	13.16	431.21
<b>Panel A. Household Sickness</b>						
Somebody in Household (other than respondent) Sick	63.05 (18.086) <sup>***</sup> [0.107]	-14.08 (5.45) <sup>**</sup> [-0.078]	-0.02 (0.010) [-0.007]	10.59 (3.51) <sup>***</sup> [0.163]	18.28 (3.35) <sup>***</sup> [1.389]	84.56 (22.19) <sup>***</sup> [0.196]
Respondent Sick	52.11 (18.570) <sup>***</sup> [0.088]	-0.73 (5.390) [-0.004]	-0.02 (0.020) [-0.007]	2.43 (3.720) [0.037]	26.65 (3.14) <sup>***</sup> [2.025]	17.99 (25.150) [0.042]
Observations	12288	12270	12109	12269	12252	5463
Number of women	192	192	192	192	192	108
<b>Panel B. Sexually Transmitted Infection (STI)</b>						
STI	-10.77 (40.001) [-0.018]	-15.94 (12.610) [-0.088]	0.00 (0.040) [0.000]	-8.92 (7.430) [-0.137]	26.55 (8.88) <sup>***</sup> [2.017]	-88.57 (48.48) <sup>*</sup> [-0.205]
First Day After STI	139.80 (80.904) <sup>*</sup> [0.237]	-3.48 (14.490) [-0.019]	0.06 (0.070) [0.021]	44.28 (19.25) <sup>**</sup> [0.679]	27.46 (10.99) <sup>**</sup> [2.086]	-44.06 (93.720) [-0.102]
Observations	10391	10374	10239	10373	10359	4422
Number of women	192	192	192	192	192	108

Note: All regressions are fixed effects regressions with controls for the month and for the day of the week.

Clustered standard errors (at the individual level) in parentheses.

All regressions include controls for the round of data collection.

Private expenditures include alcohol, soda, cigarettes, meals in restaurants, clothing, health and beauty products, and other privately consumed categories such as airtime for cellular phones.

The exchange rate was approximately 70 Kenyan shillings to \$1 US during the data collection period.

<sup>^</sup>Means of dependent variables are means when all shocks are equal to 0.

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

**Table 6. Labor Supply Response to Health Shocks**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Saw Any Clients	# of Clients	# of Regular Clients	# of Casual Clients	Sex Work Income	Other Income	Total Income
Mean of Dependent Variable <sup>^</sup>	0.837	1.624	0.600	1.011	720.361	88.831	809.192
<b>Panel A. Household Sickness</b>							
Somebody in Household (other than respondent) Sick	0.026 (0.013)** [0.031]	0.077 (0.035)** [0.047]	0.002 (0.019) [0.003]	0.073 (0.029)** [0.072]	49.503 (20.034)** [0.069]	4.473 (5.910) [0.050]	53.976 (20.227)** [0.067]
Respondent Sick	-0.082 (0.018)** [-0.098]	-0.169 (0.044)** [-0.104]	-0.045 (0.023)** [-0.075]	-0.122 (0.031)** [-0.121]	-105.308 (22.612)** [-0.146]	-2.230 (4.845) [-0.025]	-107.537 (22.752)** [-0.133]
Observations	12293	12293	12293	12293	12293	12293	12293
Number of women	192	192	192	192	192	192	192
<b>Panel B. Sexually Transmitted Infection (STI)</b>							
STI	-0.226 (0.049)** [-0.270]	-0.417 (0.117)** [-0.257]	-0.077 (0.062) [-0.128]	-0.350 (0.084)** [-0.346]	-155.124 (61.423)** [-0.215]	-29.210 (8.763)** [-0.329]	-184.333 (64.838)** [-0.228]
First Day After STI	0.059 (0.042) [0.070]	0.274 (0.090)** [0.169]	0.115 (0.056)** [0.192]	0.155 (0.087)* [0.153]	229.805 (88.362)** [0.319]	-25.734 (13.271)* [-0.290]	204.072 (89.040)** [0.252]
Observations	10393	10393	10393	10393	10393	10393	10393
Number of women	192	192	192	192	192	192	192

Note: All regressions are fixed effects regressions with controls for the month and for the day of the week.

Clustered standard errors (at the individual level) in parentheses. All regressions include controls for the round of data collection. Sickness is an indicator variable equal to 1 if respondent reports a cough, fever, malaria, typhoid, diarrhea, cuts, burns, or other illnesses.

<sup>^</sup>Means of dependent variables are means when all shocks are equal to 0.

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%



**Table 7. Health Shocks and the Supply of Unprotected Sex**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	All Women					Round 2 Women Only					
	Had Unprotect. Sex	# Unprotect. Sex Acts	Had Anal Sex	Had Vag. Sex	Had Oral Sex	Had Unprotect. Sex	# Unprotect. Sex Acts	Had Unprotect. Vaginal Sex	Had Unprotect. Anal Sex	# Times Unprotect. Vaginal Sex	# Times Unprotect. Anal Sex
Mean of Dependent Variable <sup>^</sup>	0.157	0.346	0.198	0.826	0.176	0.086	0.129	0.079	0.015	0.108	0.022
<b>Panel A. Household Sickness</b>											
Somebody in Household (other than respondent) Sick	0.030 (0.013)** [0.191]	0.063 (0.042) [0.182]	0.042 (0.012)*** [0.212]	0.022 (0.013) [0.027]	0.037 (0.013)*** [0.210]	0.013 (0.012) [0.150]	0.019 (0.024) [0.147]	0.020 (0.012) [0.255]	0.006 (0.006) [0.389]	0.017 (0.020) [0.158]	0.010 (0.011) [0.462]
Respondent Sick	-0.002 (0.011) [-0.013]	-0.015 (0.030) [-0.043]	-0.016 (0.013) [-0.081]	-0.085 (0.018)** [-0.103]	-0.012 (0.012) [-0.068]	-0.005 (0.013) [-0.058]	-0.019 (0.021) [-0.147]	0.001 (0.012) [0.013]	-0.010 (0.006)* [-0.648]	-0.007 (0.019) [-0.065]	-0.011 (0.006)* [-0.508]
Observations	12293	12072	12293	12293	12293	5493	5365	5493	5493	5369	5477
Number of women	192	192	192	192	192	108	108	108	108	108	108
<b>Panel B. Sexually Transmitted Infection (STI)</b>											
STI	0.012 (0.036) [0.077]	-0.046 (0.095) [-0.133]	-0.069 (0.036)* [-0.348]	-0.233 (0.047)*** [-0.282]	-0.017 (0.031) [-0.096]	0.025 (0.044) [0.289]	0.031 (0.083) [0.240]	0.028 (0.045) [0.357]	-0.007 (0.005) [-0.454]	0.036 (0.081) [0.334]	-0.005 (0.006) [-0.231]
First Day After STI	0.087 (0.062) [0.555]	0.180 (0.134) [0.520]	-0.029 (0.053) [-0.146]	0.073 (0.043)* [0.088]	0.048 (0.045) [0.272]	0.052 (0.078) [0.602]	0.036 (0.107) [0.279]	0.060 (0.079) [0.764]	-0.011 (0.005)** [-0.713]	0.045 (0.107) [0.417]	-0.007 (0.008) [-0.323]
Observations	10393	10241	10393	10393	10393	4448	4372	4448	4448	4374	4440
Number of women	192	192	192	192	192	108	108	108	108	108	108
Sample	All	All	All	All	All	Round 2	Round 2	Round 2	Round 2	Round 2	Round 2

Note: All regressions are fixed effects regressions with controls for the month and for the day of the week.

Clustered standard errors at the individual level in parentheses. All regressions include controls for the round of data collection.

Sickness is an indicator variable equal to 1 if respondent reports a cough, fever, malaria, typhoid, diarrhea, cuts, burns, or other illnesses.

Unprotected sex includes unprotected anal and unprotected vaginal sex.

The variables in Columns 8-11 (separate indicators for unprotected anal and unprotected vaginal sex) are only available for the Round 2 diaries.

<sup>^</sup>Means of dependent variables are means when all shocks are equal to 0.

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

**Table 8. Health Shocks, Income, and Transactional Sex**

	(1)	(2)	(3)	(4)	(5)
	Saw Any	# of Clients	# of Regular	# of Casual	Sex Work
<b>Panel A. Participation in Sex Sector</b>	Clients		Clients	Clients	Income
Somebody in Household (other than respondent ) Sick	-0.004 (0.017)	-0.020 (0.047)	-0.011 (0.026)	-0.009 (0.041)	27.469 (33.777)
Somebody in Household Sick * Mean Daily Income below Median of all CSWs	0.063 (0.025)**	0.200 (0.069)***	0.027 (0.038)	0.169 (0.063)***	45.467 (41.332)
Respondent Sick	-0.083 (0.018)***	-0.170 (0.044)***	-0.045 (0.023)**	-0.123 (0.031)***	-105.615 (22.708)***
Observations	12293	12293	12293	12293	12293
Number of women	192	192	192	192	192
	(1)	(2)	(3)	(4)	(5)
<b>Panel B. Sexual Activities</b>	Had Unprotected	# Unprotected	Had Vaginal	Had Anal	Had Oral
	Sex	Sex	Sex	Sex	Sex
Somebody in Household (other than respondent ) Sick	0.016 (0.016)	0.036 (0.058)	-0.010 (0.018)	0.029 (0.017)*	0.026 (0.016)
Somebody in Household Sick * Mean Daily Income below Median of all CSWs	0.028 (0.026)	0.055 (0.086)	0.066 (0.026)**	0.028 (0.025)	0.022 (0.024)
Respondent Sick	-0.003 (0.011)	-0.015 (0.031)	-0.086 (0.018)***	-0.016 (0.013)	-0.012 (0.012)
Observations	12293	12072	12293	12293	12293
Number of women	192	192	192	192	192

Note: All regressions are fixed effects regressions with controls for the month and for the day of the week.

Clustered standard errors at the individual level in parentheses. All regressions include controls for the round of data collection.

Panels include controls for own sickness though the coefficients are not reported.

Percentile of income distribution: minimum - 162 Ksh; 25th - 520 Ksh; 50th - 777 Ksh; 75th - 1,089 Ksh; maximum - 2,340 Ksh.

The exchange rate was approximately 70 Kenyan shillings to \$1 US during the data collection period.

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

**Table 9. Health Shocks, Perceived HIV Status, and Transactional Sex**

	(1)	(2)	(3)	(4)	(5)
	Saw Any	# of Clients	# of Regular	# of Casual	Sex Work
	Clients		Clients	Clients	Income
<b>Panel A. Participation in Sex Sector</b>					
Somebody in Household (other than respondent ) Sick	0.021 (0.028)	0.115 (0.067)*	0.013 (0.038)	0.095 (0.052)*	9.107 (39.383)
Respondent Sick	-0.097 (0.034)***	-0.198 (0.076)**	-0.068 (0.043)	-0.133 (0.048)***	-114.527 (31.116)***
Observations	3981	3981	3981	3981	3981
Number of Women	68	68	68	68	68
	(1)	(2)	(3)	(4)	(5)
	Had Unprotected	# Unprotected	Had Vaginal	Had Anal	Had Oral
	Sex	Sex	Sex	Sex	Sex
<b>Panel B. Sexual Activities</b>					
Somebody in Household (other than respondent ) Sick	0.014 (0.021)	0.030 (0.052)	0.019 (0.027)	0.032 (0.023)	0.038 (0.020)*
Respondent Sick	-0.011 (0.017)	-0.038 (0.035)	-0.093 (0.034)***	-0.052 (0.020)**	-0.013 (0.015)
Observations	3981	3958	3981	3981	3981
Number of Women	68	68	68	68	68

Note: All regressions are fixed effects regressions with controls for the month and the day of the week.

In a survey, we asked respondents if they had taken an HIV test and, if yes, what they thought the chance was that they were HIV positive. This table is restricted to women who said that the probability that they were infected was less than 50%. We have beliefs for 102 women (53% of the sample). Of these, 66.7% thought they were at less than a 50% chance of being infected.

Clustered standard errors (at the individual level) in parentheses. All regressions include controls for the round of data collection. Sickness is an indicator variable equal to 1 if respondent reports a cough, fever, malaria, typhoid, diarrhea, cuts, burns, or other illnesses.

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

**Table 10. Expected Difference in the Probability of HIV Infection Over Time**

	(1) Perfect Consumption Smoothing	(2) Average Woman in Sample	(3) Difference	(4) Percentage Difference
Estimated Probability of HIV Infection after:				
1 year	0.050	0.054	0.004	0.080
2 years	0.098	0.106	0.008	0.078
3 years	0.143	0.154	0.011	0.076
4 years	0.186	0.200	0.014	0.074
5 years	0.227	0.243	0.016	0.072
10 years	0.403	0.427	0.025	0.062
20 years	0.643	0.672	0.029	0.045

Note: Calculation assumes that the average client has 0.25 probability of being infected with HIV, that the transmission probability for unprotected vaginal and anal sex are 0.001 and 0.005, respectively.

The estimated number of unprotected sex acts is taken from Table 7.

We compute that a woman that is perfectly insured from health risk would have 126 unprotected sexual encounters per year (20 anal and 106 vaginal), while the average woman in our sample would have 135 unprotected sexual encounters per year (22 anal and 113 vaginal).