Supplementary Web Appendix
Transactional Sex as a Response to Risk in Western Kenya
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1 Appendix

This document provides supplementary information for the paper "Transactional Sex as a Response to Risk." We include six Tables in this Appendix, along with some notes to describe the estimation strategy in more detail than what is discussed in the paper.

1.1 Attrition

First, Appendix Table A1 presents information on attrition from the logbooks, which is the dataset which forms the basis of our paper. The Table presents average values for all of the main summary statistics used in the paper (these statistics correspond to those reported in Table 1 of the paper). Column 1 presents information for those women that completed the project, Column 2 presents information for those that attrited, and Column 3 presents the difference between the two (along with the standard error of the difference). As can be seen, differences are relative minimal. Only 2 variables are significant (the number of regular clients at baseline and the probability of being of the Luo tribe). From this, it appears that attrition is unlikely to have a major impact on our main results.

1.2 Threats to Internal Validity and Robustness Checks

Tables A2-A5 provide evidence against several possible threats to internal validity, and provide robustness checks for our main results (corresponding to section VI in the paper). In particular, we examine (1) health shocks over a longer time period, (2) whether the most vulnerable women most strongly respond to shocks, and (3) whether HIV negative women also increase the probability of having unprotected sex in response to shocks.

1.2.1 Responses to Lagged Shocks

Tables A2 and A3 examine lagged responses to health shocks. In these regressions, we include lagged indicators for health shocks (whether the respondent was sick the day before, and whether a household member was sick the day before). If the shocks have impacts on labor supply beyond a single day, we expect these lags to be significant. As discussed in the text, we find just that.

While the estimated effects are imprecise, many of the coefficients are in the expected direction, for both participation in the market (Table A2) and the frequency of unprotected sex (Table A3).

1.2.2 Vulnerability and Response to Shocks

If women supply more risky sex in order to smooth consumption, it should be the most vulnerable women who respond most strongly to shocks. Unfortunately, it is difficult for us to test this, as we have only limited measures of vulnerability. For instance, we do not have good measures of baseline wealth, and there is little variation in our sample in access to credit or to formal savings (almost no women have access to either).

We therefore focus on heterogeneity by income level. To do this, we construct an indicator for whether the woman's daily income is below the daily income of the median sex worker (629 Ksh or US $9), and interact this indicator with the household health shocks. We present fixed effects regressions of sexual behavior on health shocks and the interactions in Web Appendix Table A4. This table focus only on illness shocks (other shocks are available on request).

As is discussed in more detail in the text, the interactions are generally positive (though insignificant), suggesting that the poorest women respond most strongly. However, it should be noted that responses are big even for relatively richer women, suggesting that lack of access to consumption smoothing mechanisms is apparently a problem throughout the income distribution.

1.2.3 Self-Reported HIV Status and Labor Supply Responses

To interpret our results, it is important to know which types of women increase their supply of unprotected sex. If the increase comes primarily from women who are already HIV positive, then the health cost to the women themselves might be relatively small (though the effects on HIV transmission might be quite large). If, however, even HIV negative women respond, then the individual costs are much higher.

To test this empirically, ideally we would have tested women for HIV. Unfortunately, we did not do that and so instead must rely on self-reported measures. In our baseline survey, we asked

women if they had ever been voluntarily tested for HIV and, if they had, what they thought their risk of being infected was (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 who believe that they are already HIV positive who adjust their labor supply in response to health shocks, Web Appendix Table A5 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 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).

Due to the reduced sample size, the results are very imprecisely estimated. However, they suggest that even HIV negative women increase their supply of unprotected sex. This suggests that women are incurring real increases in the probability of HIV infection from adjusting their labor supply, and further suggest that inadequate consumption smoothing devices appear to be a major issue. A fuller discussion of the results is included in the main text of the paper.

1.3 How Big is the Expected Health Cost?

Estimating the actual expected health cost of the increase in unprotected sex is difficult to do since we did not test women for HIV or STIs. We instead estimate the probability by combining our estimated effects with figures from the public health literature. As discussed in the text, we do not include costs of reinfection and we assume that the HIV transmission probability is unaffected by the occurrence of any STIs. We also do not attempt to capture costs of STI infection. For these reasons, the estimates in this section are lower bounds on the true costs of unprotected sex.

Given this, the probability of an HIV negative woman becoming infected after a sexual act with a client 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 woman 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 (for simplicity, we assume that the risk of infection from protected sex is 0). Clients of formal and informal 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 conservatively assume that the clients of women in our sample have a 25% chance of infection (roughly 2.5 times that of the general population). We also conservatively use 1/1000 as the transmission probability for vaginal sex (Gray et al., 2001; Magruder, 2008) and 1/200 as the transmission probability for anal sex (Mastro and de Vicenzi, 1996).[1]

From Table 7, the average woman has unprotected sex 0.346 times per day when her household does not experience a shock, and 0.409 times per day when her household does.[2] From Table 3, women have unprotected vaginal sex 0.10 times per day and unprotected anal sex 0.02 times per day (in the Round 2 data for which we have separate measures of unprotected sex), so approximately 17% of unprotected sex acts are unprotected anal sex.[3] 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 21 times and unprotected vaginal sex about 105 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-three of these acts would be unprotected anal sex and the remaining 112 would be unprotected vaginal sex.

Assuming this woman is initially HIV negative, she is infected with probability $1/1000 * 0.25 = 0.00025$ after having unprotected vaginal sex, and $5/1000 * 0.25 = 0.00125$ after having unprotected anal sex.

An initially HIV negative woman who is perfectly insured will be infected with probability $1-(1-t_v p_{client})^{105y}(1-t_a p_{client})^{21y}$ after y years, while the average woman in our sample will be infected with probability $1-(1-t_v p_{client})^{112y}(1-t_a p_{client})^{23y}$. Appendix Table A6 summarizes

[1] 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.

[2] 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.

[3] 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.

the probability of infection after different time periods. As can be seen, the increase in the risk of HIV infection from the labor supply response to shocks is substantial, which strongly suggests that these behavioral responses impose significant health costs on women.

To calculate the compensation that women receive for this behavior, Table 6 shows that income increases by 54 Ksh ($0.77) on days when shocks occur. Since shocks occur on 37% of days, this works out to $0.37 * 365 * 0.77 = \$104$ per year. From Table 3, average income is 788 Ksh per day, which works out to around $4,000 per year. Thus, if a woman were perfectly insured, she would make about $3,900 per year rather than $4,000, so the percentage increase in income is about $100/$3,900, or roughly 2.6%.

A fuller interpretation of the results is discussed in Section VII of the paper.

Appendix Table A1. Attrition

	In Final Sample	Attrited	Difference
	(1)	(2)	(3)
Age	28.43	28.29	0.14
	(6.98)	(6.73)	(1.11)
Education Grades Completed	9.20	9.86	-0.66
	(2.69)	(2.97)	(0.44)
Can Read Swahili	0.95	0.98	-0.03
	(0.21)	(0.14)	(0.03)
Can Write Swahili	0.88	0.84	0.04
	(0.33)	(0.37)	(0.05)
Respondent is Head Of Household	0.84	0.86	-0.01
	(0.37)	(0.35)	(0.06)
Number of Biological Children	2.06	1.86	0.20
	(1.83)	(1.50)	(0.28)
Total Number of Dependents	2.96	2.63	0.32
	(2.36)	(2.14)	(0.37)
Respondent Lives with Other Working Age Adult[a]	0.29	0.35	-0.06
	(0.46)	(0.48)	(0.07)
Number of Other Working Age Adults in Household	0.50	0.63	-0.14
	(0.93)	(0.97)	(0.15)
Widowed	0.23	0.18	0.05
	(0.43)	(0.39)	(0.07)
Divorced / Separated	0.20	0.27	-0.06
	(0.40)	(0.45)	(0.07)
Cohabitating	0.13	0.06	0.07
	(0.34)	(0.24)	(0.05)
Never Married / Not Cohabitating	0.44	0.49	-0.05
	(0.50)	(0.51)	(0.08)
Number of Regular Clients (at time of	2.24	2.62	-0.38
background survey)	(1.07)	(1.39)	(0.19)**
Respondent worked with client at home in last week	0.09	0.10	-0.01
	(0.29)	(0.31)	(0.05)
Number of times working at home in last week	2.06	1.80	0.26
(for those who worked at home at least once)	(1.21)	(0.84)	(0.58)
Tribe = Luhya	0.39	0.54	-0.15
	(0.49)	(0.50)	(0.08)*
Tribe = Luo	0.51	0.33	0.17
	(0.50)	(0.48)	(0.08)**
Respondent is in a Peer Group	0.44	0.41	0.03
	(0.50)	(0.50)	(0.08)
Respondent has Outside Job	0.84	0.92	-0.08
	(0.37)	(0.28)	(0.06)
Has Been Tested for HIV	0.60	0.68	-0.09
	(0.49)	(0.47)	(0.08)
Observations	192	49	241

Notes: In Columns 1 and 2, means are presented, with standard deviations in parentheses.
In Column 3, standard errors are in parentheses.
[a]We define as working age any adult between the ages of 18 and 55.
* significant at 10%; ** significant at 5%; *** significant at 1%

Appendix Table A2. Labor Supply Response to Lagged Health Shocks

	(1) Saw Any Clients	(2) # of Clients	(3) # of Regular Clients	(4) # of Casual Clients	(5) Sex Work Income	(6) Other Income	(7) Total Income
Mean of Dependent Variable[a]	0.84	1.62	0.60	1.01	720.36	88.83	809.19
Panel A. Household Sickness							
Somebody in Household	0.044	0.067	0.046	0.014	31.98	8.61	40.59
(other than respondent) Sick Today	(0.018)**	(0.047)	(0.026)*	(0.039)	(28.28)	(6.38)	(28.37)
Somebody in Household	0.036	0.051	0.006	0.036	32.85	2.78	35.63
(other than respondent) Sick Yesterday	(0.016)**	(0.041)	(0.027)	(0.035)	(26.68)	(5.98)	(27.77)
Respondent Sick Today	-0.058	-0.088	0.007	-0.094	-83.02	0.98	-82.04
	(0.020)***	(0.050)*	(0.029)	(0.038)**	(25.20)***	(6.81)	(26.57)***
Respondent Sick Yesterday	0.001	0.040	0.075	-0.034	28.01	-2.36	25.65
	(0.015)	(0.038)	(0.024)***	(0.034)	(23.97)	(6.04)	(24.69)
Interactions							
Somebody in HH Sick Today *	-0.049	-0.034	-0.061	0.040	-8.83	-7.92	-16.74
Somebody in HH Sick Yesterday	(0.021)**	(0.063)	(0.038)	(0.057)	(39.59)	(11.03)	(40.16)
Respondent Sick Today	-0.039	-0.138	-0.116	-0.020	-46.85	-4.76	-51.61
* Respondent Sick Yesterday	(0.020)**	(0.058)**	(0.036)***	(0.053)	(36.58)	(8.82)	(39.63)
Observations	11265	11265	11265	11265	11265	11265	11265
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 a control 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.

[a]Means of dependent variables are means when all shocks are equal to 0.

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

Appendix Table A3. Lagged Health Shocks and the Supply of Unprotected Sex

	(1) Had Unprotect. Sex	(2) # Unprotect. Sex Acts	(3) Had Anal Sex	(4) Had Vag. Sex	(5) Had Oral Sex
Mean of Dependent Variable[a]	0.16	0.35	0.20	0.83	0.18
Panel A. Household Sickness					
Somebody in Household	0.030	0.107	0.039	0.039	0.027
(other than respondent) Sick Today	(0.015)*	(0.049)**	(0.017)**	(0.019)**	(0.015)*
Somebody in Household	0.005	0.005	0.038	0.033	0.016
(other than respondent) Sick yesterday	(0.016)	(0.041)	(0.015)**	(0.016)**	(0.015)
Respondent Sick Today	0.008	0.019	-0.013	-0.062	-0.013
	(0.013)	(0.039)	(0.014)	(0.021)***	(0.013)
Respondent Sick Yesterday	0.020	0.043	0.002	0.001	-0.003
	(0.013)	(0.034)	(0.012)	(0.015)	(0.012)
Interactions					
Somebody in HH Sick Today *	-0.006	-0.071	-0.031	-0.048	-0.004
Somebody in HH Sick Yesterday	(0.021)	(0.060)	(0.025)	(0.024)**	(0.024)
Respondent Sick Today	-0.026	-0.075	-0.003	-0.037	0.002
* Respondent Sick Yesterday	(0.020)	(0.060)	(0.021)	(0.020)*	(0.019)
Observations	11265	11070	11265	11265	11265
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 a control 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.

[a]Means of dependent variables are means when all shocks are equal to 0.

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

Appendix Table A4. Health Shocks, Income, and Transactional Sex

Panel A. Participation in Transactional Sex Market	(1) Saw Any Clients	(2) # of Clients	(3) # of Regular Clients	(4) # of Casual Clients	(5) Sex Work Income
Somebody in Household (other than respondent) Sick	0.013	0.037	-0.010	0.046	41.48
	(0.018)	(0.053)	(0.029)	(0.047)	(33.54)
Somebody in Household Sick * Mean Daily Income	0.028	0.082	0.024	0.055	16.43
Below Median for all Women	(0.026)	(0.071)	(0.039)	(0.064)	(40.64)
Respondent Sick	-0.082	-0.168	-0.045	-0.121	-105.17
	(0.018)***	(0.044)***	(0.023)*	(0.031)***	(22.53)***
Observations	12293	12293	12293	12293	12293
Number of women	192	192	192	192	192

Panel B. Sexual Activities	(1) Had Unprotected Sex	(2) # Unprotected Sex	(3) Had Vaginal Sex	(4) Had Anal Sex	(5) Had Oral Sex
Somebody in Household (Other than Respondent) Sick	0.023	0.056	0.009	0.026	0.026
	(0.016)	(0.058)	(0.019)	(0.017)	(0.016)
Somebody in Household Sick * Mean Daily Income	0.015	0.015	0.027	0.033	0.022
Below Median for all Women	(0.026)	(0.086)	(0.026)	(0.025)	(0.023)
Respondent Sick	-0.002	-0.015	-0.085	-0.016	-0.012
	(0.011)	(0.030)	(0.018)***	(0.013)	(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 a control for the round of data collection.
Percentiles of income distribution: minimum - 120 Ksh; 25th - 412 Ksh; 50th - 629 Ksh; 75th - 949 Ksh; maximum - 2,036 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%

Appendix Table A5. Health Shocks and Transactional Sex for Women who Perceive Themselves at Low Risk of HIV/AIDS

Panel A. Participation in Transactional Sex Market	(1) Saw Any Clients	(2) # of Clients	(3) # of Regular Clients	(4) # of Casual Clients	(5) Sex Work Income
Somebody in Household (other than respondent) Sick	0.021	0.115	0.013	0.095	9.11
	(0.028)	(0.067)*	(0.038)	(0.052)*	(39.38)
Respondent Sick	-0.097	-0.198	-0.068	-0.133	-114.53
	(0.034)***	(0.076)**	(0.043)	(0.048)***	(31.12)***
Observations	3981	3981	3981	3981	3981
Number of Women	68	68	68	68	68

Panel B. Sexual Activities	(1) Had Unprotected Sex	(2) # Unprotected Sex	(3) Had Vaginal Sex	(4) Had Anal Sex	(5) Had Oral Sex
Somebody in Household (other than respondent) Sick	0.014	0.030	0.019	0.032	0.038
	(0.021)	(0.052)	(0.027)	(0.023)	(0.020)*
Respondent Sick	-0.011	-0.038	-0.093	-0.052	-0.013
	(0.017)	(0.035)	(0.034)***	(0.020)**	(0.015)
Observations	3981	3958	3981	3981	3981
Number of Women	68	68	68	68	68

Note: In a baseline 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%. In our sample, 109 women had been tested. We have beliefs for 102 of these women. Of these, 66.7% thought they were at less than a 50% chance of being infected.

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. 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%

Appendix Table A6. Expected Difference in the Probability of HIV Infection Over Time

	(1) Woman Who Could Fully Smooth Over Health Shocks	(2) Average Woman in Sample	(3) Difference	(4) Percentage Difference
Estimated Probability of HIV Infection after:				
1 year	0.051	0.055	0.004	0.079
2 years	0.100	0.107	0.008	0.076
3 years	0.146	0.157	0.011	0.074
4 years	0.189	0.203	0.014	0.072
5 years	0.231	0.247	0.016	0.070
10 years	0.409	0.433	0.025	0.060
20 years	0.650	0.679	0.029	0.044

Note: Calculation assumes that the average client is infected with HIV with probability 0.25, and that the transmission probabilities 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 (21 anal and 105 vaginal), while the average woman in our sample would have 135 unprotected sexual encounters per year (23 anal and 112 vaginal).