

Risk preferences and HIV/AIDS: Evidence from Senegalese female sex workers

Aurélia Lépine¹ and Carole Treibich^{*2}

¹University College London

²Univ. Grenoble-Alpes, CNRS, INRA, Grenoble INP, GAEL, 38000 Grenoble, France

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Abstract

We investigate the role of preferences for risk on health and sexual behaviours of female sex workers in Senegal using primary data collected from 592 sex workers in 2017. Preferences for risk were measured using simple incentivised risk elicitation tasks as well as domain-specific risk-taking scales. Our main result indicates that risk preferences are a main predictor of sex workers' health and behaviours. We find that risk averse sex workers demand more preventive services and are less likely to engage in risky sex and, as a result, are less likely to be infected with sexually transmitted infections, including HIV/AIDS. Hence, our results confirm the role of risk preferences in the spread of HIV/AIDS epidemic.

KEY WORDS: risk aversion, risk preferences elicitation, Senegal, sex work, HIV/AIDS

JEL CODES: I1, D0, C8

^{*}Corresponding author: Carole Treibich, 1241 rue des residences 38400 Saint Martin d'Heres, tel: +33 4 76 82 78 86, email: carole.treibich@univ-grenoble-alpes.fr

1 Introduction

The HIV/AIDS burden undermines efforts to reduce poverty and inequalities and to preserve human capital. While the HIV/AIDS epidemic has harshly hit numerous Eastern and Southern African countries, such as Botswana, Lesotho or Swaziland where the prevalence of HIV/AIDS exceeded 20% in 2012, West Africa has experienced much lower rates of prevalence, current figures ranging from around 4% in Cameroon and Gabon to less than 1% in Senegal, Mauritania and Niger (UNAIDS, 2017). In Western African countries, the epidemic is concentrated among high-risk groups. For instance, female sex workers in Senegal are up to 9 times more likely to be infected with HIV/AIDS than the general population with an HIV/AIDS prevalence of 6.6% and a high prevalence of other sexually transmitted infections (STIs) (54.9% for vulvovaginitis, 10.7% for syphilis, 5.8% for trichomoniasis) (APAPS and IRESSEF, 2015). These figures are particularly alarming since the presence of any STI increases both the risk of new infections among HIV-negative people and the risk of transmission from HIV-positive people (Galvin and Cohen, 2004; Wasserheit, 1992). In addition, the nature of the work of commercial sex workers leads to high rates of transmission to the general population through clients' infection. There is evidence globally that targeting high-risk groups, such as sex workers, in low prevalent concentrated epidemics translates into HIV reduction among the general population (Vassall et al., 2014). Epidemiological models suggest that in West Africa, 75% of HIV infections among men are attributable to sexual intercourse with sex workers and that an elimination of HIV risk associated with sex work would eradicate the heterosexual HIV epidemic (Alary and Lowndes, 2004; Alary et al., 2013).

Our paper focuses on Senegal, the only African country that legalised and regulated sex work with a public health intervention. Since 1969, Senegalese female sex workers aged more than 21 years old have been compelled to register with a health centre and to attend routine health visits in order to be tested and treated for STIs and to receive free condoms (Chersich et al., 2013). An official registration card is issued (called “*carnet sanitaire*”) to keep a record of the visits made to the appointed health centre. If sex workers are tested positive for any STI, with the exception of HIV, the card is kept at the health centre during the whole course of treatment. Sex workers who fail to present an up-to-date registration card (either because they are not registered, do not comply to routine visits or are currently being treated for STI), may incur a prison sentence of between two and six months (cf. Code pénal articles 319/ 325). Despite

its legal status, prostitution is morally condemned by society members in Senegal and keeping sex work secret is a central preoccupation of Senegalese sex workers. Becoming a registered sex worker increases the probability that the sex work activity will be discovered mainly because sex workers need to carry and hide their concealed registration card while at home. The fear of becoming a social outcast acts as a main barrier to registration and explains that 80% of sex workers in Senegal (Foley and Nguer, 2010) and 57% in the capital city, Dakar, are not registered (APAPS and IRESSEF, 2015).

Although sex work regulation is effective in reducing STIs through compulsory health visits, registration does lead to an increase in risky behaviours. In a recent evaluation of the registration policy, it was found that registration made sex workers more willing to solicit clients in bars and nightclubs, which was associated with riskier clients and riskier sexual behaviours (Ito et al., 2018). Therefore, it is urgent to encourage behaviour change, which requires a better understanding of the reasons why sex workers engage in risky health and sexual behaviours.

Previous studies that have identified drivers of risky behaviours among sex workers have focused on structural drivers of HIV/AIDS. There is strong evidence that sex workers engage in riskier sex acts in order to increase sex work revenues. Several studies have estimated a large positive premium for riskier sex acts such as unprotected sex acts (Arunachalam and Manisha, 2013; Gertler et al., 2005; Rao et al., 2003). As a result, it has been documented that sex workers who experience unexpected negative income shocks are more likely to engage in unprotected sex and anal sex (Robinson and Yeh, 2011) and to have more clients (Robinson and Yeh, 2012). However, so far there is no evidence of the role of risk preferences on behaviours of populations at high-risk of HIV. The importance of stable psychological traits on risky behaviours, such as risk preferences, could explain the difficulty to change behaviours of high-risk groups, who may exhibit on average greater risk preferences than the general population. Even if hardly changeable, the identification of the role of risk preferences in the HIV/AIDS epidemic could be useful to policy-makers and NGOs working with high-risk groups that could consider this parameter when designing public health interventions. Recent evidence suggests that, for instance, the use of lottery-based financial incentives can be an effective intervention to reduce STIs in high-risk populations (Björkman Nyqvist et al., 2018).

In order to test whether risk preference is a personality trait that has a role to play in the spread

of HIV/AIDS, we collected socio-economic, psychological and biological data from female sex workers living in Dakar. Precisely, we initially conducted a survey in 2015 among 654 sex workers in order to test the validity of several measures of risk preferences. At this time, we identified several issues with the design and implementation of the experimental measures highlighted by quantitative evidence but also focus group discussions conducted after the survey. As a result, we modified survey tools and performed another survey in 2017 among 592 sex workers, which forms the main source of data used for this study. Note that among those 592 sex workers, 442 were already surveyed in 2015 and hence are surveyed twice at a two-year interval.

The primary contribution of the paper is empirical. So far, there is limited evidence of the role of risk preferences on health behaviours. One study reported that risk aversion was negatively associated with cigarette smoking, heavy drinking, obesity and seat-belt non use (Anderson and Mellor, 2008). There is also weak evidence of the role of risk preferences on sexual behaviours. Based on a laboratory experiment on 86 participants, Lejuez et al. (2002) found that risk aversion elicited using the balloon analogue risk task (BART) was negatively correlated with risky sexual behaviours. Lammers and Van Wijnbergen (2007) also showed a negative relationship between risk aversion and the perception of being infected with HIV among 163 South African students. Our study aims to contribute to the gap in knowledge in this area by looking at the role of risk preferences on health and sexual behaviours as well as health outcomes. Unlike these two previous studies, we investigate this research question by focusing on sex workers, a group whose risky behaviours with their clients and their sexual networks are the major contributor to overall HIV transmission rates in Senegal. To our knowledge, this is the first study that investigates the role of risk preferences among sex workers and in addition, this is one of the largest lab-in the field experiments measuring risk preferences using both experimental and self-reported measures in a low-income country setting.

Since our main study objective depends on the correct elicitation of risk preferences, we used a mixed-methods approach to validate risk preferences measures in our study setting. While it is often assumed that risk preferences are stable across different frames and domains in life (Stigler and Becker, 1977), there is some empirical evidence suggesting that risk aversion level differs across different domains (Dohmen et al., 2011; Galizzi et al., 2016; Schoemaker, 1990; Weber et al., 2002) and varies between contexts and elicitation methods (Binswanger, 1980; Bruhin et al., 2010; Rieger et al., 2014; Vieider et al., 2015a,b). In addition, there is evidence

that experimental economic tasks measuring risk preferences are particularly hard to implement in low-income countries given the low numeracy skills of participants as well as cultural differences (Chuang and Schechter, 2015; Coppola, 2014). Our study hence contributes to the debate on how to elicit risk preferences in a low-income country setting by testing the validity of two simple widely-used experimental economic tasks among a poor, highly stigmatised and mostly uneducated group in a Muslim dominated country, where gambling is forbidden. We conducted a total of six focus group discussions before and after the conduct and analysis of the risk preferences tasks in 2015 in order to provide further evidence regarding the validity of these tasks in our study setting.

Our main result indicates that risk preferences have a role to play in health behaviours and are a main determinant of sexual behaviours of sex workers. We found that risk averse sex workers demand more HIV prevention services, have fewer clients and are much more likely to engage in safer sex acts. As a result, the findings show a negative relationship between risk aversion and STIs, including HIV/AIDS. When focusing on the sub-sample of sex workers who were surveyed twice ($n = 442$), we find that risk preferences are fairly stable over time and mainly unaffected by major life's events. We show that the experimental measure and self-reported measures of risk preferences are correlated and that although the two measures lead to similar results, the experimental measure outperforms the self-reported measure. Our results also highlight the challenge to measure risk preferences in low-income countries and suggest that the poor understanding of the task as well as contextually irrelevant designs are important elements to consider when implementing experimental economic tasks in low-income countries.

2 Experimental set up, data and methods

2.1 Methods used to elicit risk aversion

Risk aversion was elicited using two methods: one self-assessed measure (in four different domains) and two incentive-compatible measures. Precisely, sex workers were first asked to self-report their risk preferences (SRRP) in general, in finance, with their health and with sexual behaviours using a visual scale going from 0 to 10 (see Figure 1, Dohmen et al., 2011).¹

In addition, in this study, we used two simple experimental economic tasks, incentivised with

¹Note that while the concept of risk exists and is very well understood in Senegal, there is no word for 'risk' in the local language (Wolof), hence it is the French term 'risque' that is used in Senegal and was used in the surveys.

Regarding risk attitudes, how would you rate yourself on a scale going from
0 to 10 in different domains of life?
0 meaning “not at all willing to take risks” and 10 “very willing to take risks”

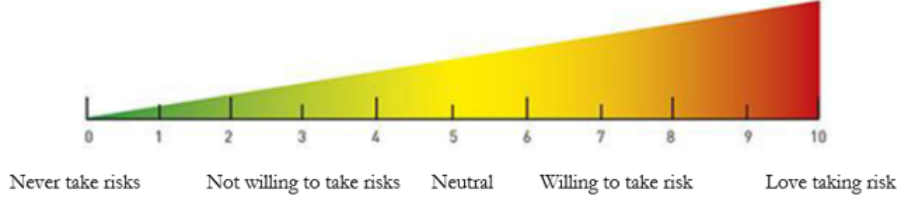


Figure 1: Visual scale used for self-reported risk aversion

real money, to elicit risk aversion: Eckel and Grossman (2008) and Gneezy and Potters (1997) tasks. Those tasks were chosen over the traditional Holt and Laury (2002) task because there was evidence in the literature that participants had a poor understanding of the Holt and Laury task in the Senegalese context (see Charness and Viceisza, 2016, where only 24.4% of participants understood the task) and that simpler tasks performed better when subjects have lower math abilities (Dave et al., 2010). It was assumed in Charness and Viceisza (2016) that participants had more difficulties with varying probabilities than with varying payoffs and that the understanding of the chosen tasks was improved since, conversely to the Holt and Laury task, probabilities of winning and losing in the two selected tasks are fixed for all alternatives and equal to 50%.

In the Eckel and Grossman task (E&G), originally proposed by Binswanger (1980, 1981), participants are asked to choose one gamble they would like to play out of six gambles. The task was designed as in Dave et al. (2010) so that the expected gain was increasing in the first five gambles and the last gamble had the same expected gain than gamble 5 but with a larger variance. Following Charness and Gneezy (2010), we used a simplified version of the Gneezy and Potters (G&P) task. Participants received a fixed amount of money of CFAF 3,000 (USD 5)² and were asked about the amount they would like to invest in a risky business and the amount they would like to keep. The business was risky because it returned 2.5 times the invested amount with a probability of 50% and the invested amount was lost with a probability of 50%) - see Appendix 1 for a detailed presentation of the two tasks.

In the first wave of the survey implemented in 2015 (Wave 1), both tasks were played but only

²1 USD=590 CFAF at the time of the 2015 survey (from June 15 to July 4) and 1 USD=554 CFAF at the time of the 2017 survey (from August 7 to August 26).

one of them was randomly chosen to be paid. The E&G task was always played first. The average amount of money that participants could win was equal in both tasks and set at CFAF 3,300 (USD 6) but participants could win up to CFAF 9,500 (USD 16).

Implied constant relative risk aversion (CRRA) ranges for each choice were computed by equalising the expected utility derived from the chosen option and the two adjacent options using the following formula: $U(x) = \frac{x^{(1-r)}}{(1-r)}$; r being the implied CRRA (Holt and Laury, 2002; Wakker, 2008).

We used the mid-point CRRA as a measure of risk aversion (Table 1). Both tasks exert large variability in the CRRA, especially the E&G task that has a CRRA ranging from 4.5 (high risk aversion) to a CRRA inferior or equal to 0 (risk-neutral and risk-loving).

Table 1: Tasks with real payments

Task inspired by Eckel and Grossman (2008) - implemented in 2015 only

Choice (50/50 Gamble)	Low payoff	High payoff	Expected return	Standard deviation	Implied CRRA range	Mid-point CRRA
Lottery 1	2,750	2,750	2,750	0	$4.5 < r$	4.5
Lottery 2	2,400	3,600	3,000	600	$1.16 < r < 4.5$	2.83
Lottery 3	2,000	4,400	3,200	1,200	$0.71 < r < 1.16$	0.93
Lottery 4	1,600	5,200	3,400	1,800	$0.50 < r < 0.71$	0.60
Lottery 5	1,200	6,000	3,600	2,400	$0 < r < 0.50$	0.25
Lottery 6	200	7,000	3,600	3,400	$r < 0$	0

Notes: For example, the implied constant relative risk aversion (CRRA) value, r , between lottery 2 and lottery 3 of the Eckel and Grossman lottery is the result of the following equation:

$$0.5 \times 2000^{(1-r)} + 0.5 \times 4400^{(1-r)} = 0.5 \times 2400^{(1-r)} + 0.5 \times 3600^{(1-r)}; r = 1.16$$

Task inspired by Gneezy and Potters (1997) - implemented in 2015 and 2017

Amount invested	Dividend	Low pay-off	High pay-off	Expected return	Standard deviation	Implied CRRA range	Mid-point CRRA
0	0	3,000	3,000	3,000	0	$2.00 < r$	2
500	1,250	2,500	3,750	3,125	625	$0.67 < r < 2.00$	1.33
1,000	2,500	2,000	4,500	3,250	1,250	$0.39 < r < 0.67$	0.53
1,500	3,750	1,500	5,250	3,375	1,875	$0.67 < r < 0.27$	0.33
2,000	5,000	1,000	6,000	3,500	2,500	$0.27 < r < 0.19$	0.23
2,500	6,250	500	6,750	3,625	3,125	$0.19 < r < 0.11$	0.15
3,000	7,500	0	7,500	3,750	3,750	$r < 0.11$	0.11

Note that since the self-reported measure capture risk preferences and experimental measures capture risk aversion, the experimental measures are expected to be negatively correlated with

the self-reported ones.

2.2 Data and tasks design

Participants were all female sex workers working in Dakar and the sample includes an equal proportion of registered and unregistered sex workers. Registered sex workers were recruited using medical records from four (out of the five) STI centres located in the suburb of Dakar (Rufisque, Pikine, Mbao, and Sebikotane) while unregistered sex workers were recruited through sex workers' group leaders and NGO staff working with unregistered sex workers. Ethical clearance was obtained from a higher education institution in the United Kingdom and from the national ethics committee in Senegal.

A first survey took place in June and July 2015. We recruited 654 female sex workers i.e. 15% of the population of sex workers in Dakar according to the last sex worker population estimation (APAPS, 2011-2012). The second survey was implemented in August 2017, i.e. roughly two years after Wave 1. We attempted to recruit all participants from Wave 1. Among the 654 sex workers who participated in Wave 1, we were able to include 442 sex workers (68%) in Wave 2, which is a low attrition rate considering the high mobility and vulnerability of sex workers. In addition, we invited another new 150 participants. Hence, we have data from 804 female sex workers of whom 442 participated in the two data rounds as shown in Figure A2b. We test whether the participants who were lost over time are different from those who remain in the survey. Table A2 in the Appendix 2 shows average characteristics for two subsets: sex workers who were lost to follow up (Wave 1 only) and those who remain in the follow up round (Waves 1 & 2). Looking at this table, we can see that sex workers who attrit did not seem to be different than the ones who were able to be recruited in Wave 2.

The different stages in the conduct of this study are presented in Figure A2a in Appendix 2. Before implementing the task in the first survey, we piloted the tasks among 50 participants and run six focus groups discussions in April 2015 that aimed at discussing the risk tasks and to assess understanding and perception of participants of those tasks. Based of those discussions, we decided to select the SRRP as well as E&G and G&P tasks for the first survey since understanding was good and no issue with the design of those tasks was raised in focus group discussions. We implemented the SRRP and E&G and G&P tasks among 654 sex workers in July 2015. Note that before playing the task with real money, all participants were asked to play a training

round and participants with poor understanding of the task had the possibility to participate to two additional training rounds. The results indicated that the self-reported understanding of the task was good since only four and two participants, for E&G and G&P tasks respectively, asked to play an additional training round. Those participants had the opportunity to play a third training round but none took this opportunity given that all participants declared to have understood the tasks.

The analysis of the data collected in Wave 1 highlighted that the experimental measures had a poor cross-validity and a poor predictive power of behaviours. Specifically, the two experimental risk aversion measures were poorly correlated ($cor = 0.035$), the CRRA from E&G task was poorly correlated with SRRP measures (correlation coefficients ranging from -0.068 to 0.029) and more worrying the CRRA from the G&P task was positively correlated with all SRRP measures (see Table A3). Indeed, we recall that CRRA is increasing with risk aversion while SRRP is decreasing with it. Therefore the experimental measures are expected to be negatively correlated with the self-reported ones. On the contrary, we found, for instance, that $cor = 0.125$ between SRRP in health and CRRA for G&P.

In order to better understand those unexpected results, we conducted additional focus group discussions with respondents in November 2015. During the discussion, we shared with participants issues with data collected in the first wave in order to obtain honest answers regarding their perception of those tasks and it is only at this stage that focus group discussions highlighted issues with the experimental tasks. Sex workers revealed that they felt uncomfortable playing to the E&G task given that gambling is considered abhorrent in Islam. Conversely, they mentioned that they liked the framing of the G&P task given that they felt empowered when asked to play the role of entrepreneurs. However, some of them mentioned that this task was more complicated to understand. Furthermore, some who considered themselves as being good in running a business assumed that their probability to win the payoff was close to one. Overall, all participants confirmed that they had difficulty to concentrate in the two tasks because they were played at the very end of the survey. Yet, they confessed that if the task was being played at the beginning of the survey, their answers to the rest of the survey would be influenced by the draw outcome.

In light of those qualitative results, we made some changes in the survey design for Wave 2.

First, we removed the E&G task and only asked participants to play the G&P task at the end of a survey, which was reduced in size. Second, in order to assess the overall understanding of the task and to identify participants who did not understand the task, we quizzed them at the end of the task. More precisely, before announcing the final amount earned, we asked participants to tell us the amount of their earning given the random draw outcome. Since the quizz was performed after the choice was made, the introduction of the quizz cannot be considered as a change in the task design and did not affect risk preferences elicited in this task.

For the above reasons, our analysis focuses on data collected in the second wave ($n = 592$). However, since there was no change in the design of the SRRP and the G&P task between Wave 1 and Wave 2, we also test the stability over time of those measure for the sample of sex workers surveyed twice at a two-year interval period ($n = 442$).

2.3 Sample description

Characteristics of sex workers interviewed in Wave 2 are presented in Table 2. Sex workers are on average 39 years old. Most of sex workers are divorced (66.7%) or have never been married (18.6%) and hence do not receive any financial support from their partner, which is consistent with the fact that 92% of sex workers report to have started selling sex because of financial reason.

Sex workers have monthly household expenditure of CFAF 353,238 (USD 638) in 2017. This corresponds to a monthly per capita expenditure of CFAF 95,640 (USD 170), which is 2.2 times higher than the level of per capita expenditure in Dakar reported in national statistics (CFAF 43,260) (ANSD, 2013). On average, sex workers reported monthly earnings from sex work of CFAF 126,551 (USD 230) in 2017.

Data also contain information on psychological traits, such as altruism, preference for the present, big five personality traits, religiosity and self-control as well as on mental health (self-efficacy, depression) and well-being. To measure altruism, participants were given CFAF 1,000 (i.e. USD 1.81 in 2017) in coins of CFAF 50 and were asked how much they would like to transfer to a recipient. The recipient in this task was a charity organisation helping street children (called “*talibés*”), a major social issue in Senegal. On average, CFAF 195 was given to the charity organisation by each participant, i.e. 20% of the amount received. Information on the preference for the present was collected in reference to finance by asking respondents if they

would prefer a sum of money today or 1.5 times this amount in one week of time and 87.7% of participants declare that they prefer receiving a lower earning immediately. Big five personality traits were measured using a 44-item inventory to which a scoring was applied in order to construct a scale for extraversion, agreeableness, conscientiousness, neuroticism and openness (John and Srivastava, 1999). Self-efficacy was constructed using a principal component analysis including a set of 11 likert scale questions aiming to capture the ability to solve problems in different domains (with police, clients, children, etc.). Finally, the patient health questionnaire PHQ-9 was used to assess whether sex workers suffer from depression. Based on this test, 9.0% of sex workers interviewed in 2017 suffered from moderately severe or severe depression (PHQ-9 score above 14).

3 Empirical specification

In order to investigate the role of risk preferences on health and sexual behaviours, we estimate the following specification:

$$S_i = \beta RA_i + \varepsilon_i$$

where S_i is one of the outcomes of interest measuring either the demand for STI/HIV prevention, or sexual behaviours with clients or STI/HIV status of sex worker i . RA_i is a measure of risk aversion of sex worker i . ε is an error term. Note that a higher CRRA means greater risk aversion while a higher SRRP means lower risk aversion. Coefficients of the RA variable were standardised. We further test the robustness of our results when controlling for a set of covariates as well as adding enumerators' fixed effects.

Table 2: Characteristics of sex workers

Variables	<i>Wave 2</i>		
	<i>Obs.</i>	Mean	SD
Socio-demographic characteristics			
Age (in years)	592	38.66	9.54
Marital status:	592		
Never married		0.186	
Married		0.054	
Divorced		0.667	
Widowed		0.093	
Household size	592	8.037	5.445
Monthly earning from sex work (CFAF) † ◇	511	126,551	111,413
Monthly household expenditures (CFAF) †	592	353,224	290,666
Expenses last 48 hours (CFAF) †	592	11,124	7,971
Not in urgent need of cash	587	0.317	0.466
Psychological and personality attributes			
Altruism (out of 1,000 CFAF) †	590	195	241
Preference for the present ±	592	0.877	0.329
Extraversion ‡	592	25.248	4.119
Agreeableness ‡	592	33.573	3.653
Counsciousness ‡	592	33.813	4.251
Openness ‡	592	28.848	5.072
Neuroticism ‡	592	21.041	4.184
Religiosity: “God protects me”	592		
Strongly disagree		0.000	
Disagree		0.014	
Agree		0.422	
Strongly agree		0.564	
Mental health			
Self-efficacy ∓	592	-0.401	0.908
Self-control *	592	0.193	0.395
Happiness	592		
Not at all happy		0.015	
Not happy		0.145	
Neither happy nor not happy		0.360	
Happy		0.367	
Very happy		0.113	
Moderately severe depression **	592	0.090	0.286

Notes: Differences in the number of observations are due to missing information.

† 1 USD = 554 FCFA in 2017. ± Prefer 1,000 CFAF now than 1,500 CFAF in a week.

◇ Out of the 592 respondents interviewed in 2017, 62 are no longer FSWs.

‡ Each index is the sum of the scores of a series of questions using a scale going from 1 to 5.

Questions are derived from the Big five personality traits questionnaire (44 items).

Extraversion and neuroticism are based on 8 items, agreeableness and consciousness on 9 items and openness on 10 items.

∓ Self-efficacy is based on a factor analysis that include 11 items that measure the ability to sort out issues with police, landlord, clients, sudden illness, make decisions regarding child education, ability to start a new business, deal with daily life problems.

* Self-control is equal to 1 if the sex worker disagrees with “I have a good self-control”.

** This variable is equal to 1 if PHQ-9 ≥ 15 and 0 otherwise.

4 Descriptive statistics

We analyse the effect of risk aversion on several outcomes capturing several dimensions of the demand for HIV/STI prevention (primary and secondary prevention activities) and sexual behaviours.

The first series of outcomes captures risk-taking in sex acts with commercial clients³ and include the intensity of sex work measured by the weekly average number of clients and the riskiness of the sex act that includes unprotected sex⁴, the perceived HIV status of the client, and the price charged assuming that a higher price means greater risk-taking during the sex act. The second set of outcomes are health related behaviours capturing the demand for STI/HIV prevention such as the affiliation to a NGO, the participation in community-based health information group meetings (*causerie*), the registration status and HIV screening. Note that the current package of services offered by NGOs working with female sex workers in Senegal only focus on health services and include information on STIs and HIV, condom distribution, STI and HIV screening and STI treatment.

The last set of outcomes analysed are related to the sex worker's health status and capture the presence of STI and HIV. The presence of STI is measured by the presence of various STI symptoms in the past month such as vaginal discharge, low abdominal pain and genital ulcer. The latter is a common symptom of STI frequently used as a proxy for its measure (Pandey et al., 2008). Information on HIV status based on biological markers is available for registered sex workers from medical record.

Descriptive statistics regarding those outcomes are reported in Table 3 and show evidence of risk-taking in commercial sex acts. On average, sex workers see about 8 clients a week in 2017. Data include information on the characteristics of the last two sexual intercourses with a client, which explains that variables that refer to sex act characteristics ('client is at risk of HIV' and 'price charged') contain many more observations. The list randomisation method (see Appendix 4) measures condom use in the last sexual intercourse. It shows that 22.0% of sex workers did not use a condom during the last commercial sex act in 2017 and this can be justified by the

³In Wave 2 we collected similar information in reference to the last two commercial sex acts.

⁴Given that several sexual behaviours (unprotected sex and anal sex) are considered socially unacceptable, their low proportion in an open interview (2.4% and 3.3%) prevent from using these measures. As a result, condom use was indirectly elicited using a list randomisation method to overcome social desirability bias (Appendix 4).

fact that sex workers evaluate that their clients have a relatively low risk of being infected with HIV (this risk was assessed to be on average 1.6 on a 10-point scale in 2017). On average, sex workers charge CFAF 16,555 (roughly USD 30) per sex act in 2017. In addition, the demand for HIV and STI prevention is high since 82.6% of sex workers were screened for HIV in the last 12 months. In addition, they are 51.4% to declare being involved in community-based HIV prevention activities.

Medical records indicate that 8.1% of registered sex workers are infected with HIV in 2017 and self-reported STI prevalence assessed through symptoms is 14.4%. At the time of the second wave of the survey, 34.1% of sex workers reported to have ever suffered from STI symptoms.

Table 3: Sexual and health behaviours and health status

Variables	<i>Wave 2</i>		
	<i>Obs.</i>	Mean	SD
Sexual behaviours			
Number of clients per week	513	8.353	8.810
Condom use during last sex act ‡	513	0.780	0.061 (SE)
Client is at risk of HIV ∓ ⊙	1,023	1.604	2.519
Price charged (CFAF) ⊙	1,024	16,555	35,009
Health behaviours			
Receive services from an NGO	583	0.249	0.432
Participate in a community-based activity ‘causerie’ †	588	0.514	0.500
Registered with authorities	512	0.498	0.500
Had a HIV test in the last 12 months	592	0.826	0.379
Health status			
Positive HIV test among registered sex workers *	173	0.081	0.274
Any symptom in last month (/3 symptoms)	589	0.144	0.352
STI symptom in last month: vaginal discharge	591	0.098	0.298
STI symptom in last month: lower abdominal pain	590	0.078	0.268
STI symptom in last month: genital ulcer	590	0.022	0.147
Ever had an STI	592	0.341	0.475

Notes: Differences in the number of observations for some variables are due to missing information.

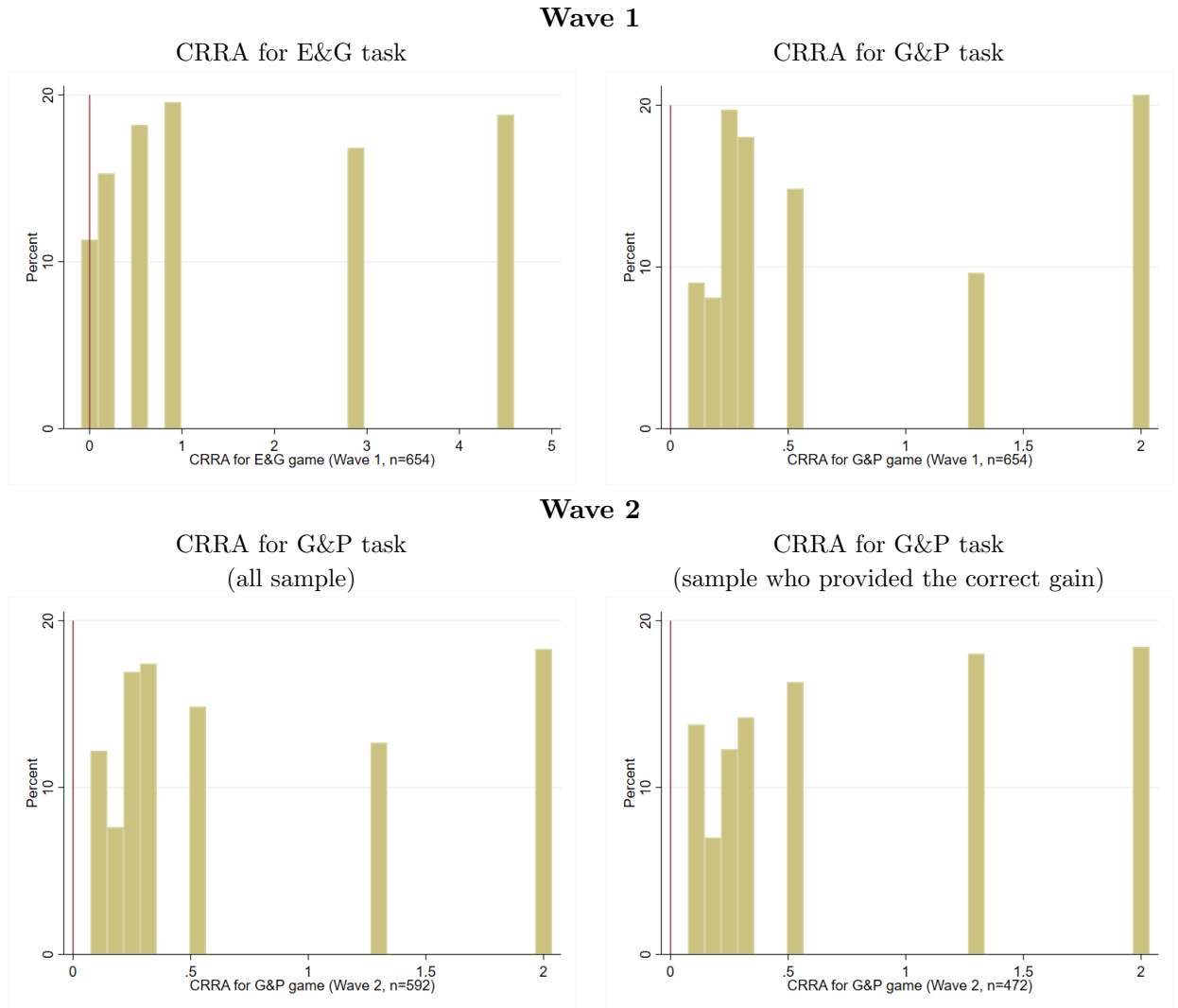
‡ Condom use is measured via the list randomisation method. These questions were asked only to active sex workers. ∓ Respondents were asked to rate the HIV riskiness of the client on a scale going from 0 to 10. ⊙ Information on the last two sex acts with a client was gathered in Wave 2.

† A causerie is a group counselling usually delivered by NGOs or sex workers’ leaders on the topic of HIV/AIDS. * Information come from available medical records of registered sex workers.

4.1 Risk aversion level depending on the method

We first look at risk aversion elicited with the two incentive-compatible measures. Figure 2 shows that 15.05% and 13.56% of sex workers are estimated to be risk neutral (CRRA close to 0) with E&G and the G&P tasks respectively. Overall, Figure 2 highlights large heterogeneity in risk aversion estimated using real payment tasks. If we compare risk aversion of sex workers in Senegal to risk aversion of other populations, one can note that our results confirm that risk aversion is higher in low-income countries than in Western societies. We find that on average sex workers invests 46.8% of the amount given in the G&P task, whereas overall investment levels range from 44.67% to 65.42% among student populations in Western societies (see Charness and Viceisza (2016) for a review of the G&P results in previous studies) and this difference is probably explained by the absence of formal risk-coping mechanism in Senegal. If we now compare those results to the ones reported on other populations in low-income countries, we can see that sex workers display on average greater risk preferences since the overall investment levels in the G&P task range from 23.08% to 50.03% in low-income countries. In addition, the CRRA based on the sample of Senegalese farmers in Charness and Viceisza (2016) indicates that 21% of farmers have a CRRA lower than 0.33 against 53% in our sample of sex workers, meaning that Senegalese sex workers are less risk averse than Senegalese farmers.

Figure 3 shows the distribution of self-reported risk aversion. The figure reveals heterogeneity in risk attitudes especially in general and for financial matters although respondents tend to be risk averse, the median for the preference for risk in general is 3 (on a scale increasing with risk preferences and ranging from 0 to 10). Looking at the distribution of subjective risk aversion across domains, one can note that sex workers declare taking more risks in finance than with their health or sexual behaviours and it is interesting to note that the distributions across the health and sexual behaviours domains have a similar pattern in the sense that they exhibit a large proportion of 0: 40% of sex workers are not at all willing to take risks in those domains.

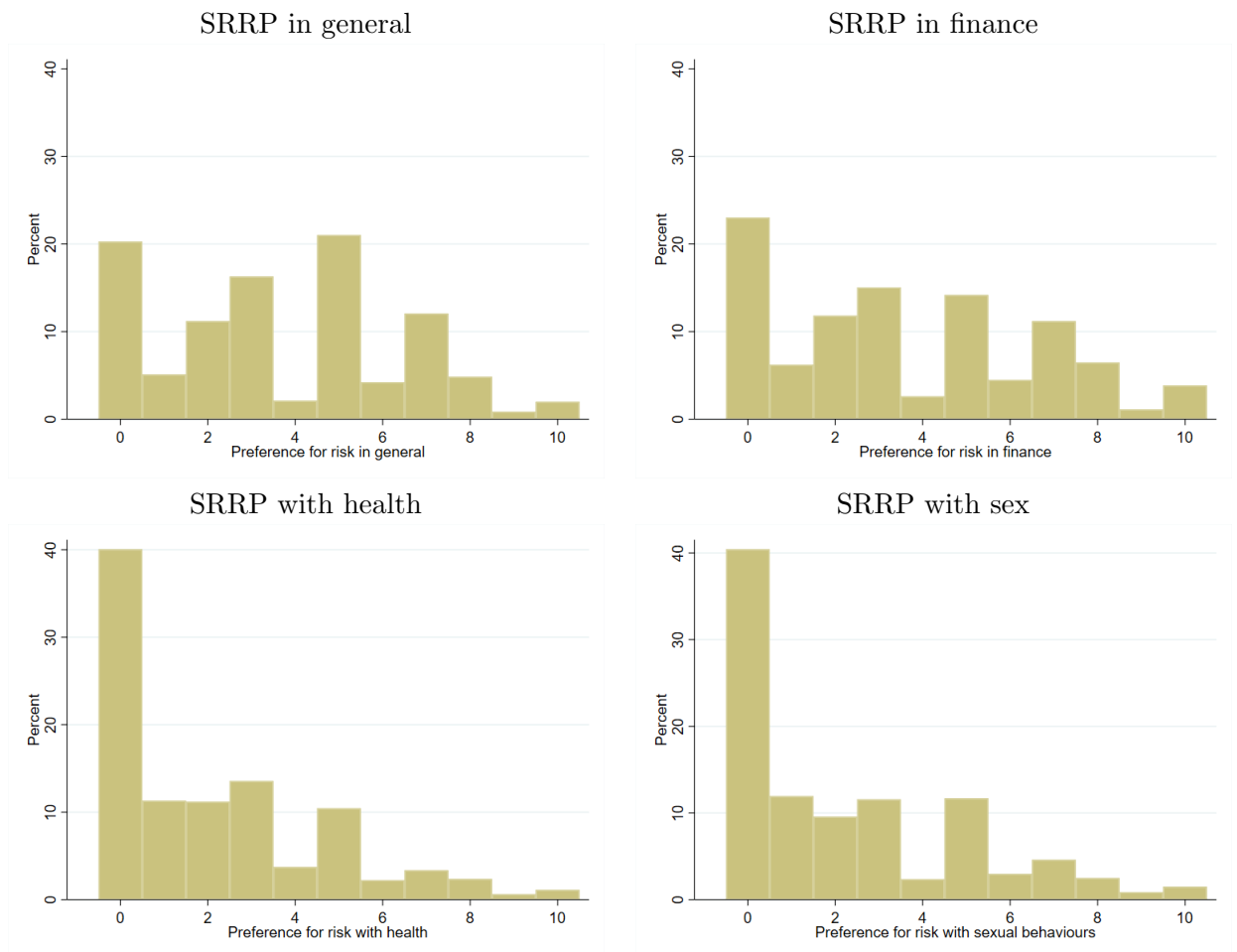


Notes: CRRA stands for constant relative risk aversion.

E&G and G&P refer to Eckel and Grossman task and Gneezy and Potters task respectively.

A CRRA inferior to 0 indicates risk-loving, a CRRA equals to 0 refers to risk-neutral individuals.

Figure 2: Distribution of risk aversion elicited with incentive-compatible measures



Notes: Out of the 804 sex workers who were surveyed over the two survey waves, data used come from 2015 for 212 respondents and for 2017 for the 592 other.

Figure 3: Distribution of self-reported risk aversion in different domains ($n = 804$)

4.2 Understanding of the task

Wave 2 data is used in order to investigate the understanding of the G&P task. The understanding of the task was good overall since almost 80% of participants were able to respond correctly to the question related to the earnings. However, as highlighted in focus groups discussions, the understanding of what a 50/50 chance to win means was poor, in fact less than half of respondents understood both the expected gain and the probability of winning this gain. We then further investigate in a robustness check how overconfidence in the probability to win may have biased our results.

Table 4: Understanding of the G&P task

Variables	<i>Obs.</i>	Mean	SD
Understand task (correct probability and gain)	592	0.486	0.500
Correct gain	592	0.797	0.402

4.3 Cross-validity and temporal-validity of risk preferences measures

Given that results based in Wave 1 questioned the quality of the risk preferences data collected, we first provide evidence regarding the validity of the tools used (by looking at cross-validity of risk preferences collected in Wave 2 and temporal stability for self-reported risk aversion measures) in Table 5.

First, it is interesting to note that, unlike results found in Wave 1, there was a significant correlation between the experimental measure and self-reported measures in Wave 2 ($cor = -0.101$, $p < 0.01$, for self-reported risk aversion in finance) and this correlation was increased when restricting the sample to those who understood the task ($cor = -0.132$, $p < 0.01$). Those correlations are generally low and of a similar magnitude of what is found in high-income countries (Galizzi et al., 2016).

If we now turn to the correlation between self-reported risk aversion measures in different domains, results show that self-reported risk aversion is highly stable across domains. But while self-reported risk aversion in general and in finance are strongly correlated ($cor = 0.776$, $p < 0.01$), self-reported risk aversion in finance is less correlated with self-reported risk aver-

sion in health ($cor = 0.492$, $p < 0.01$) and in sex ($cor = 0.497$, $p < 0.01$), which is close to the correlation of 0.45 between self-reported risk aversion in finance and in health reported by Dohmen et al. (2011). This is due to the fact that self-reported risk aversion in health and in sex exhibits lower variability than self-reported risk aversion in general and in finance. However, there is a strong correlation between self-reported risk aversion in health and sex ($cor = 0.690$, $p < 0.01$). Principal component analysis conducted using the self-reported risk aversion in the four domains shows that 73 percent of the variation in risk preferences is explained by one principal component.

Finally, we find that all risk preferences are fairly stable over time and that correlations are within the range of correlations reported in studies conducted in high-income countries (0.13 to 0.55, see Chuang and Schechter (2015)). Precisely, we find that in the total sample surveyed at a two-year interval, the correlation of answers over time for the G&P is 0.111 ($p = 0.020$) and 0.181 ($p < 0.01$) if we restrict the sample to those who were able to provide the correct gain of the payoff in the quizz. The correlation over time for self-reported risk preferences in general and in finance was of a similar magnitude ($cor = 0.127$, $p < 0.01$ and $cor = 0.110$, $p = 0.02$) while self-reported risk aversion in health ($cor = 0.305$, $p < 0.01$) and sex ($cor = 0.233$, $p < 0.01$) were found to exhibit greater stability over time. This suggests some temporal stability that is within the range reported in other studies (see Chuang and Schechter (2015) for a review).

To further explore the stability of risk aversion over time, we investigate the effect of life changing events that occurred between the two waves on risk aversion using a difference-in-differences with sex workers' fixed effects. Table A5b shows that risk preferences were mostly unaffected by those shocks. This result is in line with other studies investigating the time variant component of risk preferences in the short-term (Galizzi et al., 2016; Jung and Treibich, 2015; Sahm, 2012). In order to further explore the validity of the risk preference measures, we investigate if the outcome in the incentivised task has been influenced by exogenous factors (see Table A6). To do so, we regressed G&P CRRA on whether the participants won or lost in the real task in 2015 and during the training round in 2017 and we found no effect of these variables on the choice in the incentivised task in 2017. Then, we regressed the G&P CRRA on the enumerator's G&P CRRA (Tables A7a and A7b) in order to investigate if the answers were influenced by the enumerator. We find a significant and positive relationship (coeff= 0.28, p-value<0.01) between the participant CRRA and the enumerator CRRA, meaning that the choice of participants could have

Table 5: Pairwise correlation between risk aversion methods and stability over time

	Self-reported risk aversion (SRRP)				CRRA
	in general	in finance	with health	with sex	G&P
Correlation between risk measures					
<i>Wave 2 sample, n=592</i>					
SRRP in general	1.000				
SRRP in finance	0.776***	1.000			
SRRP with health	0.458***	0.492***	1.000		
SRRP with sex	0.437***	0.497***	0.690***	1.000	
CRRA G & P	-0.086**	-0.101**	-0.043	-0.110***	1.000
<i>Wave 2 sample who provided correct gain, n=472</i>					
SRRP in general	1.000				
SRRP in finance	0.782***	1.000			
SRRP with health	0.484***	0.498***	1.000		
SRRP with sex	0.460***	0.511***	0.690***	1.000	
CRRA G & P	-0.104**	-0.132***	-0.067	-0.129***	1.000
Stability over time ‡					
<i>All panel, n=442</i>	0.127***	0.110**	0.305***	0.233***	0.111**
<i>Panel who provided correct gain, n=345</i>	0.102*	0.117**	0.348***	0.265***	0.181***

Notes: *** p<0.01, ** p<0.05, * p<0.1.

SRRP stands for self-reported risk preferences. CRRA stands for constant relative risk aversion.

G & P refers to Gneezy & Potters task. Higher CRRA and lower SRRP mean greater risk aversion.

‡ Pairwise correlation between a risk measure collected in 2015 and in 2017 for the same individual.

been influenced by enumerator's risk preferences. In addition, when controlling for additional socio-demographic characteristics of the enumerator (age, marital status, children, experience as an enumerator) and enumerator fixed effects this relationship increases. For this reason, we further test as a robustness check if the results are affected when controlling for enumerators characteristics such as risk preferences and enumerators fixed effects. Finally, we investigate the effect of the need for cash on risk preferences to rule out that sex workers in greater need for cash would take more or less risks. To do so, we asked sex workers whether they had enough money to cover today's and tomorrow's expenditures. We find that 32% of sex workers had enough cash to face today's and tomorrow's expenditures and the correlation between this variable and income measured by the expenditures in the 48 hours was 0.09 (p-value= 0.02). We find that this variable was negatively correlated with G&P CRRA (coeff= -0.07, p-value= 0.1) while controlling for income, meaning that sex workers who had some cash when they played the task were less risk averse. It is interesting to note that such relationship was not significant for SRRP in finance, meaning that the urgent need cash encourages sex workers to be more risk averse in the incentivised task only. However, the relatively small effect and large standard

error suggest that the urgent need for cash is unlikely to have strongly distorted behaviours in the experimental task. We further provide evidence for this in a robustness check.

5 Results

5.1 Determinants of risk preferences

Table 6 reports the relationship existing between the different risk aversion measures and some socio-demographic and psychological characteristics. Note that covariates and risk aversion measures were standardised for comparison purposes. The significance of the correlations vary across risk aversion measures, yet the results allow to identify important psychological traits that are strongly correlated with risk preferences. Extraversion, conscientiousness and a good mental health status are highly positively correlated with risk aversion, while openness is negatively correlated with risk aversion. In addition, religiosity is negatively and strongly correlated with self-reported risk preferences.

Table 6: Determinants of risk aversion

Variables	(1) CRRA G&P	(2) SRRP in general	(3) SRRP in finance	(4) SRRP in health	(5) SRRP in sex
Age (in years)	-0.037 (0.043)	-0.032 (0.040)	-0.052 (0.040)	0.057 (0.044)	0.011 (0.044)
Expenses last 48 hours (CFAF, log)	-0.097** (0.040)	0.062 (0.041)	0.040 (0.040)	-0.010 (0.038)	-0.005 (0.040)
Not in urgent need of cash	-0.041 (0.048)	0.004 (0.025)	-0.023 (0.027)	-0.020 (0.036)	-0.026 (0.027)
Household size	-0.001 (0.038)	0.052 (0.038)	0.052 (0.036)	0.050 (0.037)	0.107** (0.045)
Never married	-0.001 (0.046)	0.065 (0.047)	0.002 (0.050)	0.054 (0.047)	0.076* (0.044)
Altrusim (out of 1,000 CFAF)	-0.083** (0.041)	0.034 (0.040)	0.034 (0.041)	0.032 (0.044)	0.011 (0.039)
Preference for present $\pm$	-0.004 (0.059)	0.096 (0.058)	0.069 (0.061)	0.091 (0.061)	0.146*** (0.052)
Extraversion $\ddagger$	0.159*** (0.043)	-0.059 (0.044)	-0.116*** (0.043)	-0.058 (0.039)	-0.112*** (0.038)
Agreeableness $\ddagger$	0.033 (0.046)	-0.110** (0.045)	-0.049 (0.044)	-0.082** (0.041)	-0.032 (0.040)
Conscientiousness $\ddagger$	0.104** (0.045)	-0.034 (0.046)	-0.111** (0.045)	-0.032 (0.042)	-0.126*** (0.041)
Openness $\ddagger$	-0.225*** (0.040)	0.111** (0.045)	0.164*** (0.045)	0.157*** (0.045)	0.173*** (0.046)
Neuroticism $\ddagger$	0.052 (0.043)	0.006 (0.042)	-0.021 (0.043)	0.011 (0.039)	-0.074* (0.039)
Religiosity $\diamond$	-0.034 (0.044)	-0.222*** (0.041)	-0.193*** (0.044)	-0.143*** (0.045)	-0.162*** (0.045)
Self-efficacy	-0.034 (0.043)	-0.039 (0.039)	0.017 (0.040)	-0.027 (0.039)	-0.071* (0.039)
Self-control *	-0.073* (0.041)	-0.120*** (0.042)	-0.134*** (0.043)	-0.045 (0.039)	-0.147*** (0.041)
Happiness $\diamond\diamond$	0.080* (0.044)	-0.126*** (0.046)	-0.099** (0.046)	-0.096** (0.042)	-0.095** (0.044)
Moderately severe depression **	0.001 (0.037)	0.016 (0.033)	0.041 (0.034)	0.106*** (0.034)	0.135*** (0.038)
Constant	-0.040 (0.069)	-0.070 (0.068)	-0.076 (0.071)	-0.080 (0.068)	-0.124** (0.059)
Observations	590	590	590	590	590
R-squared	0.099	0.206	0.185	0.144	0.230

Notes: All variables are standardised. Robust standard errors in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

SRRP stands for self-reported risk preferences. CRRA stands for constant relative risk aversion.

Higher CRRA means greater risk aversion while higher SRRP means lower risk aversion.

$\ddagger$ Each index is the sum of the scores of a series of questions using a scale going from 1 to 5.

Questions are derived from the Big five personality traits questionnaire (44 items).

$\pm$ Prefer 1,000 CFAF now than 1,500 CFAF in a week. $\diamond$ Respondents were asked whether they agree with the statement “God protects me”. * Self-control is equal to 1 if the sex worker agrees with “I have a poor self-control”. $\diamond\diamond$ Happiness is measured on a 5-level scale increasing with happiness.

** This variable is equal to 1 if PHQ-9 ≥ 15 and 0 otherwise.

5.2 Relationship between risk preferences and sexual and health behaviours

Table 7 presents the effect of the different measures of risk aversion on sexual behaviours. Note that each reported coefficient estimate shown in this table is based on a separate regression and coefficients are standardised for comparison purposes. Furthermore, higher CRRA means greater risk aversion while higher SRRP means lower risk aversion, therefore similar impact of risk preferences using either self-reported or elicited risk aversion would imply coefficients of opposite signs for a given outcome of interest.

The main result we can see from Table 7 is that there is an association between risk preferences measures and health and sexual behaviours. Overall, it is interesting to note that the experimental measure of risk aversion and the self-reported measure of risk preferences leads to similar conclusion. For many outcomes, the coefficient of the two types of measures are of a similar magnitude (e.g. number of client, condom use, risky client, STI and HIV status). For other outcomes (e.g. price, use of community-based health services), the experimental measure seems to outperform the self-reported measure. For two outcomes however (HIV test and registration), the two types of measure lead to coefficients with different signs.

Using the G&P CRRA, we find that risk aversion is not associated with registration but is positively associated with the affiliation to an NGO and the participation in community-based health activities. As a result, it is found that an increase in one standard deviation in risk aversion leads to an increase in the likelihood of participating in a HIV ‘causerie’ by 6.5 percentage points and the likelihood to participate in community-based health activities by 3.8 points. We also find that an increase in one standard deviation in risk aversion leads to a decrease in the likelihood of testing for HIV by 2.7 points, confirming previous negative relationship between risk aversion and the demand for screening (Goldzahl, 2017; Picone et al., 2004).

In addition, risk averse sex workers are found to have a lower average number of clients: an increase in risk aversion by one standard deviation decreases the average number of clients per week by 1.475. Furthermore, there is a clear pattern showing that risk averse sex workers are less likely to take risk during sex acts. There is a strong association between self-reported risk preferences and condom use. Precisely, an increase in one standard deviation in risk aversion increases the likelihood to use condom by 10.2 points and an increase in one standard deviation

in self-reported risk preferences decreases condom use by between 14.8 and 17.4 percentage points. Results also indicate that risk aversion is correlated with client’s characteristics since sex workers who are more risk averse are less likely to engage in sex with a risky client and on average, an increase in one standard deviation in risk aversion decreases the perceived riskiness of the client by 0.414 points (on a 10 point scale). Assuming that price captures the risk taken during sex act⁵, the result confirm that risk averse sex workers according to G&P task charge a lower price of CFAF 3,177 (or USD 5.8) on average for a one standard deviation increase in risk aversion.

While there is no significant relation between the experimental measure and HIV status, an increase in self-reported risk preferences by one standard deviation translates into a greater probability of infection by 4.3 to 5.1 percentage points. Finally, based on the experimental measure of risk aversion, we see that an increase in one standard deviation in risk aversion leads to a decrease in the likelihood of having any STI symptoms by 3.0 percentage points and to a decrease in the likelihood of having had an STI by 8.5 percentage points.

We show that our results are stable when we restrict the sample to the participants who provide the correct payoff for the task. The only difference when doing so is that we find that risk averse sex workers are found to be less likely to register, which we attribute to the risks of stigma associated with registration in case their sex work activity is discovered.

⁵This is illustrated by the existence of a high premium for unprotected sex (Arunachalam and Manisha, 2013; Rao et al., 2003).

Table 7: Association between risk preferences and health and sexual behaviours

	Clients per week (1)	Sexual behaviours Condom use (2)	Risky client (3)	Price (CFAF) (4)	Affiliated NGO (5)	Health behaviours Causerie (6)	Registered (7)	HIV test (8)	Health status HIV positive (9)	STI symptom (10)	Ever had a STI (11)
<i>All sample</i>											
SRRP in general	1.274*** (0.389)	-0.148** (0.059)	0.097 (0.077)	2,163 (2,064)	0.003 (0.019)	0.009 (0.021)	-0.014 (0.022)	-0.020 (0.015)	0.028 (0.019)	0.029** (0.015)	0.068*** (0.019)
SRRP in finance	1.301*** (0.352)	-0.161*** (0.058)	0.160** (0.071)	1,733 (1,814)	0.025 (0.019)	0.024 (0.021)	-0.012 (0.022)	-0.015 (0.015)	0.043** (0.022)	0.019 (0.015)	0.053*** (0.019)
SRRP with health	1.814*** (0.441)	-0.157** (0.062)	0.702*** (0.081)	-2,831*** (992)	0.007 (0.019)	0.036* (0.021)	-0.006 (0.023)	0.002 (0.016)	0.051** (0.025)	-0.011 (0.015)	-0.007 (0.021)
SRRP with sex	1.573*** (0.401)	-0.174*** (0.060)	0.540*** (0.082)	-1,455 (955)	0.014 (0.019)	0.015 (0.021)	-0.053*** (0.021)	-0.018 (0.016)	0.027 (0.020)	-0.013 (0.014)	-0.002 (0.020)
CRRA G&P	-1.475*** (0.364)	0.102* (0.057)	-0.414*** (0.072)	-3,177*** (898)	0.038* (0.019)	0.065*** (0.021)	-0.033 (0.023)	-0.027* (0.016)	0.021 (0.025)	-0.030** (0.014)	-0.085*** (0.019)
<i>Observations</i>	<i>513</i>	<i>513</i>	<i>1,023</i>	<i>1,024</i>	<i>583</i>	<i>588</i>	<i>512</i>	<i>592</i>	<i>173</i>	<i>589</i>	<i>592</i>
<i>Restricting to correct gain sample</i>											
CRRA G&P	-1.293*** (0.387)	0.101 (0.063)	-0.468*** (0.081)	-3,167*** (1,105)	0.040* (0.021)	0.057** (0.023)	-0.063*** (0.024)	-0.021 (0.018)	0.031 (0.026)	-0.001 (0.014)	-0.070*** (0.020)
<i>Observations</i>	<i>411</i>	<i>411</i>	<i>821</i>	<i>820</i>	<i>465</i>	<i>468</i>	<i>410</i>	<i>472</i>	<i>149</i>	<i>470</i>	<i>472</i>

Notes: This table is based on information collected in Wave 2. Risk aversion measures are standardised. Robust standard errors are reported in parentheses. Standard errors are clustered at sex worker level for sex act level analysis (Columns (3) and (4)). Each reported coefficient estimate is based on a separate OLS regression. *** p<0.01, ** p<0.05, * p<0.1. SRRP stands for self-reported risk preferences. CRRA stands for constant relative risk aversion. Higher CRRA and lower SRRP mean greater risk aversion. Columns (3) and (4) refer to the two last paid sex intercourses. Column (9) comes from medical records of registered sex workers. Differences in the number of observations in columns (5), (6) and (10) are due to missing information. Registration status information (Column (7)) is available for active FSWs only. In column (2), the reported coefficient refers to the interaction term $RA_i \times T_i$, see Appendix 4.

5.3 Robustness checks

In order to investigate the relative size of the effect of risk preferences, the outcomes of interest that have a strong relationship to risk preferences are regressed on a set of standardized socio-demographic factors. Table A7a shows that based on the full sample, risk preference is an important predictor of behaviours compared to other psychological and socio-demographic factors. The coefficient of risk aversion is similar or even greater than the ones of other covariates. For instance, risk aversion is found to be one of the main determinants of sexual behaviours (e.g. number of clients, risky clients, price) and of STI prevalence.

We conduct three additional robustness checks. First, we investigate to what extent previous wins (either in 2015 for the FSWs already interviewed or during the training round) was likely to influence the task choice and subsequent implied CRRA. We found that previous wins are not correlated with elicited risk aversion (see Table A6). We also study whether perceptions regarding the probability to win could have biased the results in the task. Answer to the quiz question on the probability to win was used to further investigate the effect of overconfidence on risk taking during the task. We find that overconfidence is positively correlated with elicited risk aversion (coeff= 0.256, $p < 0.01$). However, when including this variable in the main analysis, the impact of risk aversion on sexual and health behaviours remain identical.

Second, we investigate whether enumerators' characteristics were likely to influence the answers provided to the G&P task. While enumerators' elicited CRRA is correlated with sex workers risk preferences, the associations between risk preferences and sexual and health behaviours remain similar when controlling for enumerators' characteristics including enumerators' fixed effects. (see Table A7b).

Finally, we run the estimates by pooling the sample of Wave 1 and Wave 2 ($n = 1,264$). Indeed, one may assume that although the understanding of the task was poor in Wave 1, the understanding was good in the SRRP (see Table A8). As expected, the results show that the relationship between risk aversion elicited with the task is weaker when including the data from Wave 1. However, the results based on the SRRP lead to similar conclusion.

6 Discussion

We measured risk preferences of female sex workers in Senegal in order to investigate the role of risk preferences in HIV/AIDS transmission. Our main result suggests that risk preferences are correlated with health behaviours and are a main predictor of sexual behaviours. This might explain why despite sex work regulation, sex workers in Senegal represent a main contributor to overall transmission rates. In addition, our results reinforce the importance of targeting high-risk groups who seem to exhibit greater risk preferences than the rest of the population. This finding provides another explanation for the difficulty to limit the spread of the AIDS epidemic, especially in countries like Senegal, where the epidemic is concentrated among those groups.

We showed that experimental measures of risk aversion are poorly correlated with self-reported measures (including with the self-reported risk preferences in finance) but are fairly stable over time and not strongly influenced by shocks, which is in line with previous evidence that found that the time variant component of risk aversion is much lower than its time invariant one in the short-term (Jung and Treibich, 2015; Sahm, 2012). This finding, as well as the fact that risk preference level was strongly associated with big five personality trait, confirms that risk preference is an intrinsic characteristic. Although results obtained with self-reported measure were close to the ones obtained with the experimental measure for many outcomes, SRRP may not capture the “pure” risk preferences. The experimental measure hence is more likely to reflect an intrinsic characteristic and the results less prone to endogeneity. In addition, the strong association between the incentivised experimental risk aversion measure and health behaviours may lie in the fact that the decision to engage in risky sex acts involves significant personal health risks that are financially rewarded. This specific setting may explain why risk aversion measures in the financial domain is a relevant predictor of sexual behaviours of sex workers. Surprisingly, self-reported risk preferences in health and in sex were not more correlated with health and sexual behaviours than self-reported risk preferences in finance, which might be due to social desirability bias that led to poorer variability of those measures.

There is an emerging literature indicating that experimental measures perform poorly outside the student population found in university labs (Chuang and Schechter, 2015). In low-income countries, low level of education, poor numeracy skills and economic scarcity faced by participants can lead to bias in decision-making (Shah et al., 2012). As a result, it is crucial to design

simple tasks and to assess the understanding of the task by participants. In addition, it is crucial to make sure that the task does not interfere with local beliefs or social norms. We believe that the failure of the tasks during Wave 1 is attributable to the fact that the framing of the task (E&G) prevented participants from concentrating in the tasks. We encourage researchers who would like to use experimental measures of risk in low-income countries to run focus group discussions before and after playing incentivised task in order to ensure that the design of the task is contextually-relevant and easy to understand. Also, our results highlight the importance of quizzing participants on the understanding of the task given that we showed that simply asking participants whether they understood the task was not effective in assessing their understanding of the task.

Our results have some policy implications. In the context of Senegal, the use of a visual scale measuring SRRP could be introduced in the ion enrolment form, which would allow health providers to identify sex workers who are at a greater risk of HIV/AIDS. We showed that the SRRP was correlated with several outcomes and such addition to the registration form would be inexpensive. Our results provide some justification regarding the effectiveness of the use of lottery based financial incentives in order to reduce STIs. In Lesotho, Björkman Nyqvist et al. (2018) found that a public lottery conditional on negative test results for STIs leads to a reduction of 21.4% in HIV incidence over a two-year period, consistent with the assumption that lotteries are particularly effective to change behaviours of individuals exhibiting larger risk preferences. Other successful interventions using lottery based financial incentives to reduce the spread of infectious diseases includes the tuberculosis-screening campaign in Scotland⁶ and the HIV screening lottery launched in 2011, which enters anyone who gets an HIV test into a drawing for cash prizes up to nearly \$6,000.⁷ The effectiveness of lottery-based incentives depend on context and in countries like Senegal there are strong reasons to believe that such interventions would be ineffective given that gambling is not socially acceptable. This element has been confirmed by recent trials that showed that lottery-based rewards are less effective than fixed-amount financial incentives to change HIV related behaviours in some contexts (Kenya (Thirumurthy et al., 1999) and Malawi (Choko et al., 2017)). Overall, additional research is required in order to identify effective interventions in populations with different levels of risk preferences.

⁶<https://www.theglasgowstory.com/image/?inum=TGSE00889>

⁷<https://www.iol.co.za/news/south-africa/western-cape/zilles-hiv-campaign-gains-momentum-1189372#.UOCcQoWYvrM>

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Appendix 1 - Experimental instructions

Task #1: Eckel and Grossman (Wave 1)

READ: “We will first start by doing a training round in order to make sure that you well understood task #1. You will then randomly draw a ball among four balls places in a black bag. Two of these balls are white with a black cross and two of them are just white. It is thus as likely that you draw a white ball with a cross or a white ball.

Among the following options, which one would you choose:

- You receive 2,750 CFAF no matter which ball you draw
- You receive 2,400 CFAF if you draw the white ball with a black cross on it and 3,600 CFAF if you draw the white ball
- You receive 2,000 CFAF if you draw the white ball with a black cross on it and 4,400 CFAF if you draw the white ball
- You receive 1,600 CFAF if you draw the white ball with a black cross on it and 5,200 CFAF if you draw the white ball
- You receive 1,200 CFAF if you draw the white ball with a black cross on it and 6,000 CFAF if you draw the white ball
- You receive 200 CFAF if you draw the white ball with a black cross on it and 7,000 CFAF if you draw the white ball”

INTERVIEWER: Please use the table below to explain the different lotteries. Once the respondent made her choice please ask her what are the amounts she will earn with this choice. This in order to be sure she well understood the decision she took.

Choice	Low earning	High earning
	If white ball with a black cross	If white ball
Gamble 1	2,750 CFAF	2,750 CFAF
Gamble 2	2,400 CFAF	3,600 CFAF
Gamble 3	2,000 CFAF	4,400 CFAF
Gamble 4	1,600 CFAF	5,200 CFAF
Gamble 5	1,200 CFAF	6,000 CFAF
Gamble 6	200 CFAF	7,000 CFAF

READ: “You will now randomly draw a ball in this black bag in order to know what is the

amount you would have won if this task is drawn and if this was not a training round. You have drawn out: *White ball with a black cross on it/ White ball*

We will now proceed with the real task. Among the following options, which one would you choose:

- You receive 2,750 CFAF no matter which ball you draw
- You receive 2,400 CFAF if you draw the white ball with a black cross on it and 3,600 CFAF if you draw the white ball
- You receive 2,000 CFAF if you draw the white ball with a black cross on it and 4,400 CFAF if you draw the white ball
- You receive 1,600 CFAF if you draw the white ball with a black cross on it and 5,200 CFAF if you draw the white ball
- You receive 1,200 CFAF if you draw the white ball with a black cross on it and 6,000 CFAF if you draw the white ball
- You receive 200 CFAF if you draw the white ball with a black cross on it and 7,000 CFAF if you draw the white ball”

READ: “You will now randomly draw a ball in this black bag in order to know what is the amount you would win if this task is drawn later on. You have drawn out: *White ball with a black cross on it/ White ball*”

INTERVIEWER: note and announce how much the respondent will win if task #1 is drawn later on.”

Task #2: Gneezy and Potters (Wave 1 & 2)

READ: “In this second task, you start with an amount of 3,000 CFAF. You have to decide how many euros you want to invest in a small business (between 0 and 3,000 CFAF) where you have one chance out of two to lose the amount invested (if you draw the white ball with a black cross) and one chance out of two to win 2.5 times this amount (if you draw the white ball).

For instance, let imagine that you decide to put 1 000 FCFA in this business. Your earnings will amount to 2 000 FCFA if you lose — if you draw the white ball with the black cross (3000-1000). Your earnings will amount to 4 500 CFAF if you win — if you draw the white ball (2000 + 2500). In other words, you are sure to keep the amount of money that you won’t invest in the

small business but you may increase your earnings if you invest in this business.

The table below present the possible gains.

	Low earning	High earning
	If white ball with a black cross	If white ball
Investment		
3,000	0 CFAF	7,500 CFAF
2,500	500 CFAF	6,750 CFAF
2,000	1,000 CFAF	6,000 CFAF
1,500	1,500 CFAF	5,250 CFAF
1,000	2,000 CFAF	4,500 CFAF
500	2,500 CFAF	3,750 CFAF
0	3,000 CFAF	3,000 CFAF

We will first start by doing a training round in order to make sure that you well understood task #2. You will then randomly draw a ball among four balls places in a black bag. Two of these balls are white with a black cross and two of them are just white. It is thus as likely that you draw a white ball with a cross or a white ball.

How much money are you willing to invest in this task?"

INTERVIEWER: Once the respondent made her choice please ask her what are the amounts she will earn with this choice. This in order to be sure she well understood the decision she took.

On a scale going from 0 to 100, in your view, what is the probability that you draw a white ball?

For those who do not say 50, INTERVIEWER: Remind the participant that she is going to draw a ball in the bag and that the probability of winning the amount does not depend on her expertise in running a business but that there is a one in two chance that she wins and a chance out of two that she loses.

READ: "You will now randomly draw a ball in this black bag in order to know what is the amount you would have won if this task is drawn and if this was not a training round. You have drawn out: *White ball with a black cross on it/ White ball*

(Wave 2) INTERVIEWER : Ask the respondent which amount she would have earned if this was the real task and report the amount.

We will now proceed with the real task. How much money are you willing to invest in this task?"

(Wave 2) READ: On a scale going from 0 to 100, in your view, what is the probability that

you draw a white ball?

For those who do not say 50, INTERVIEWER: Remind the participant that she is going to draw a ball in the bag and that the probability of winning the amount does not depend on her expertise in running a business but that there is a one in two chance that she wins and a chance out of two that she loses.

READ: “You will now randomly draw a ball in this black bag in order to know what is the amount you would have won if this task is. You have drawn out: *White ball with a black cross on it/ White ball*”

(Wave 2) INTERVIEWER: Ask the respondent which amount she thinks she has earned and report the amount.

INTERVIEWER: Note and announce how much the respondent will win if task #2 is drawn later on.

Random draw

READ: “We will now draw the task which will be paid. As previously, you will randomly draw a ball. If you draw the white ball with a black cross, you will receive the amount you won in task #1, that is *gain_task1 CFAF*. If you draw the white ball, you will receive the amount you won in task #2, that is *gain_task2 CFAF*.”

You have drawn out: *White ball with a black cross on it/ White ball*”

INTERVIEWER: announce how much the respondent won.

INTERVIEWER: ask the supervisor to come and proceed with the payment.

Appendix 2 - Data collection

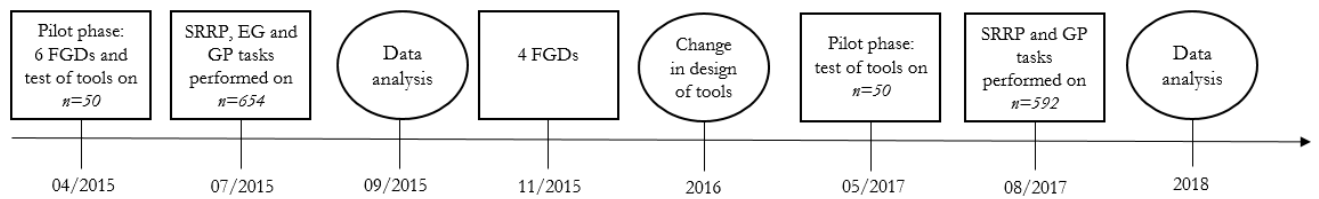
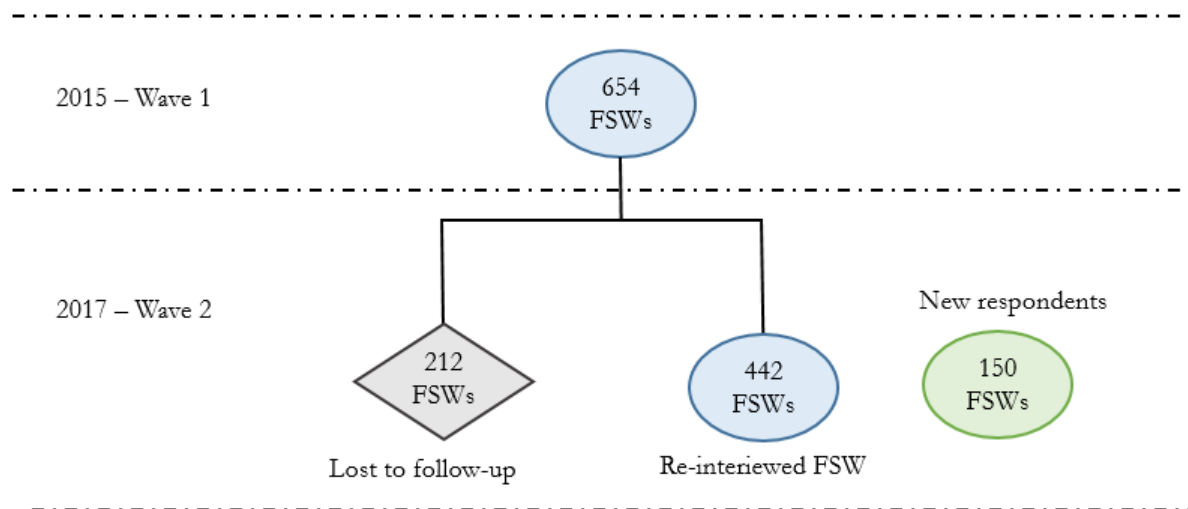


Figure A2a: Timeline of the data collection



Notes : 654 female sex workers (FSWs) were interviewed in 2015.

In 2017, 592 FSWs were interviewed among which 441 have already been interviewed in 2015.

150 additional FSWs were interviewed in 2017 and answered to both lists.

Put differently, 654 and 592 (442 + 150) FSWs were interviewed in 2015 and 2017 respectively.

In short, 804 (654 + 150) different FSWs answered at least to one survey.

Figure A2b: Sample

Attrition

Table A2: Attrition

	Mean		p-value
	<i>Wave 1 only</i>	<i>Waves 1 & 2</i>	
<i>Observations</i>	<i>212</i>	<i>442</i>	
Variables			
G&P CRRA	0.757	0.741	0.794
SRRP in general	3.665	3.810	0.531
SRRP in finance	3.684	3.914	0.345
SRRP with health	2.038	2.330	0.188
SRRP with sex	2.231	2.328	0.668
Age (in years)	33.61	36.89	0.000
Expenses last 48 hours (CFAF)	10,758	11,971	0.147
Household size	5.50	6.60	0.013
Lives alone	0.181	0.156	0.416
Never married	0.284	0.227	0.110
Altruism (out of 1,000 CFAF) †	284	269	0.482
Happiness ‡	2.953	2.971	0.844
Satisfied with sex work ◇	1.824	1.868	0.536
Registered sex worker	0.509	0.494	0.718

Notes: This table is based on information collected in Wave 1.

CRRA stands for constant relative risk aversion. G&P refers to Gneezy & Potters task.

G&P CRRA (midpoints) ranges from 0.11 to 2 (see Table 1).

SRRP stands for self-reported risk preferences and ranges between 0 and 10.

Higher CRRA and lower SRRP mean greater risk aversion.

† Participants were given CFAF 1,000 in coins of CFAF 50 and were asked how much they would like to transfer to a charity organisation helping street children.

‡ Happiness is measured on a 5-level scale increasing with happiness.

◇ Satisfaction is measured on a 4-level scale increasing with satisfaction.

Appendix 3 - Pairwise correlation between risk aversion measures in Wave 1

Table A3: Pairwise correlation between risk aversion measures in Wave 1

	Self-reported risk aversion (SRRP)				CRRA	
	in general	in finance	with health	with sex	E&G	G&P
Correlation between risk measures						
<i>Wave 1 sample, n=654</i>						
SRRP in general	1.000					
SRRP in finance	0.826***	1.000				
SRRP with health	0.540***	0.547***	1.000			
SRRP with sex	0.575***	0.561***	0.789***	1.000		
CRRA E&G	-0.068*	-0.002	0.029	0.004	1.000	
CRRA G&P	0.054	0.081**	0.125***	0.133***	0.035	1.000

Notes: *** $p < 0.01$, ** $p < 0.05$ and * $p < 0.1$. This table is based on information collected in Wave 1.

SRRP stands for self-reported risk preferences. CRRA stands for constant relative risk aversion.

E&G and G&P refer to Eckel & Grossman task and Gneezy & Potters task respectively.

Higher CRRA and lower SRRP mean greater risk aversion.

Appendix 4 - List randomisation method

The list randomisation or item count technique is an indirect questioning method implemented in order to limit dishonest answers caused by a social desirability bias. It has been applied to elicit vote preferences (Corstange, 2009; Gonzalez-Ocantos et al., 2012; Holbrook and Krosnick, 2010), illegal migration (McKenzie and Siegel, 2013), use of micro finance loans (Karlan and Zinman, 2012) as well as opinions on topics such as same sex marriage (Lax et al., 2016) and racism (Blair and Kosuke, 2012; Kuklinski et al., 1997). In health research, list randomisations have been used in order to elicit condom use under the influence of alcohol (LaBrie and Earleywine, 2000; Walsh and Braithwaite, 2008) and in two evaluations of health information interventions: an online sexual health education course in Columbia (Chong et al., 2013) and sexual information texting in Uganda (Jamison et al., 2013).

The principle of the list randomisation is to allocate respondents randomly to two different groups: a “control” and a “treatment” group. Individuals allocated to the “control” group are presented with a number of non-sensitive statements. They are not asked to say whether they agree on each of the statements but only with how many of them they agree on. The same statements are presented to the “treated” group; the difference is that a sensitive statement is added to the series of non-sensitive statements. Assuming that the two groups have a similar opinion of the non-sensitive statements, one can deduce the share of individuals in the “treated” group who agreed with the sensitive item by comparing the average number of agreed statements in each group (see Glynn, 2013; Holbrook and Krosnick, 2010; Kuklinski et al., 1997).

The effectiveness of this methodology is based on three assumptions: (i) the randomisation of the treatment, (ii) the absence of any design effect, and (iii) the absence of dishonest answers. More precisely, individuals allocated to each group must be similar in order to ensure that they agree with the same number of non-sensitive items on average. Second, the addition of the sensitive item must not change the sum of affirmative answers to the control items. Finally, as pointed out by Kuklinski et al. (1997) the choice of the non-key items needs to be such that individuals are not urged to lie.

In the survey the “control” group was presented with the following question:

I [the interviewer] will read three statements. I will then ask you with how many of these statements you agree on. You should not tell me which specific statement you agree on but the number of statements you agree on. I will give you three marbles and you have to hold them in your right hand. Keep both of your hands on your back side. For each of the statements, if you agree on it, please transfer one marble from your right hand to your left hand behind you. If you do not agree on it, please do not transfer any marble. At the end, I would like to know the total number of statements you agreed on. This number should correspond to the number of marbles you have in your left hand. I will now read the statements.

- 1. It is safer to bring a client home than going in a hotel.*
- 2. I prefer that the client pays me before the intercourse.*
- 3. Monday is the day I have the greatest number of clients.*

Participants in the “treatment” group received an additional marble and were presented the same statements plus the sensitive item that relates to condom use. Note that this sensitive item was presented in the second position of the treatment group list:

- 4. I used a condom during my last sexual intercourse with a client.*

Following Imai (2011), we can investigate the relation between condom use and respondents’ risk preferences using a simple linear regression with interaction terms:

$$Y_i = \beta T_i + \gamma RA_i + \alpha RA_i \times T_i + \varepsilon_i$$

where Y_i is the number of statements the respondent agreed with. T_i takes value 1 if the individual was in the treatment group (4 items presented). RA_i is a characteristics of individual i that may be correlated with condom use. The p-value of the coefficient α indicates if the condom use depends on the individual’s risk preferences.

Appendix 5 - Effect of major life events on risk preferences

Table A5a: Descriptive statistics of major life events in the past two years

Shocks	<i>Obs.</i>	Mean	SD
Family rupture	442	0.158	0.366
Health shock	442	0.314	0.465
Mental health shock	442	0.097	0.297
Got married	442	0.109	0.311
Negative income shock	425	0.320	0.467
Positive income shock	425	0.245	0.430
Registration ‡	380	0.079	0.270
Quit sex work	442	0.140	0.348
Jail ‡	380	0.092	0.290

Notes: ‡ Questions were asked only to active sex workers.
380 out of the 442 sex workers interviewed in both waves
are still active.

Table A5b: Effect of major life's events on risk preferences

Variables	(1) G&P CRRA	(2) SRRP in general	(3) SRRP in finance	(4) SRRP with health	(5) SRRP with sex
Family rupture	-0.029 (0.154)	0.234 (0.158)	0.268* (0.159)	0.117 (0.144)	-0.107 (0.151)
Health shock	-0.137 (0.110)	-0.079 (0.113)	-0.064 (0.114)	-0.053 (0.103)	-0.129 (0.107)
Mental health shock	0.011 (0.197)	-0.186 (0.202)	-0.032 (0.204)	0.145 (0.185)	-0.104 (0.193)
Got married	0.066 (0.186)	-0.257 (0.191)	-0.234 (0.193)	0.041 (0.175)	-0.250 (0.182)
Negative income shock	0.126 (0.109)	-0.059 (0.115)	-0.118 (0.116)	-0.049 (0.105)	0.036 (0.108)
Positive income shock	-0.421*** (0.125)	0.109 (0.131)	-0.013 (0.133)	-0.008 (0.120)	-0.090 (0.123)
Registration ‡	-0.010 (0.237)	-0.255 (0.242)	-0.079 (0.245)	0.156 (0.225)	0.000 (0.233)
Quit sex work	-0.219 (0.164)	-0.347** (0.168)	-0.566*** (0.168)	-0.226 (0.154)	-0.368** (0.160)
Jail ‡	0.159 (0.219)	0.000 (0.225)	0.000 (0.228)	0.078 (0.208)	0.182 (0.216)
<i>Observations</i>	<i>884</i>	<i>884</i>	<i>884</i>	<i>884</i>	<i>884</i>
Number of sex workers	442	442	442	442	442

Notes: Regressions include sex worker fixed effects.

Each reported coefficient is based on a separate regression.

Standard errors are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The reported coefficient is the interaction between the shock and Wave 2.

SRRP stands for self-reported risk preferences.

CRRA stands for constant relative risk aversion.

Higher CRRA and lower SRRP mean greater risk aversion.

‡ Panel of active sex workers: observations = 760, number of sex workers = 380.

Appendix 6 - Effect of exogenous factors on elicited risk preferences

Table A6: Effect of exogenous factors on risk preferences

Variables	(1) CRRRA G&P	(2) CRRRA G&P	(3) CRRRA G&P	(4) CRRRA G&P	(5) CRRRA G&P	(6) CRRRA G&P	(7) CRRRA G&P	(8) SRRP finance
<i>Previous wins</i>								
Win in 2015 †	-0.004 (0.045)							
Win in training round of G&P in 2017		0.012 (0.040)						
Overconfidence in winning the G&P game			0.256*** (0.052)					
<i>Enumerator's characteristics</i>								
CRRRA G&P enumerator				0.272*** (0.040)	0.337*** (0.059)	2.785*** (0.810)		
Enumerator age					0.227** (0.091)			
Enumerator married					0.078 (0.054)			
Enumerator has children					-0.230*** (0.069)			
Enumerator has experience in surveying sex workers					-0.048 (0.066)			
Enumerator's years of experience in survey					0.033 (0.121)			
Enumerator fixed effects				NO	NO	YES		
<i>Income constraints</i>								
Expenses last 48 hours							-0.100*** (0.037)	0.108** (0.055)
Has cash to face today's and tomorrow's expenses							-0.043 (0.050)	0.030 (0.031)
<i>Observations</i>	442	592	588	592	592	592	592	592

Notes: All variables are standardised. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

† This specification uses the panel data ($n = 442$).

Appendix 7 - Effect of risk preferences accounting for covariates

Table A7a: Association between risk preferences and health and sexual behaviours - including covariates

	Sexual behaviours				Health behaviours				Health status		
	Clients per week (1)	Condom use (2)	Risky client (3)	Price (CFAF) (4)	Affiliated NGO (5)	Causerie (6)	Registered (7)	HIV test (8)	HIV positive (9)	STI symptom (10)	Ever had a STI (11)
CRRA G&P	-1.102*** (0.359)	0.125** (0.057)	-0.255*** (0.093)	-2,653*** (946)	0.038** (0.019)	0.056** (0.022)	-0.011 (0.022)	-0.022 (0.017)	0.025 (0.025)	-0.028* (0.015)	-0.079*** (0.019)
Age (in years)	-1.337*** (0.375)	0.003 (0.034)	0.043 (0.105)	-6 (882)	0.018 (0.020)	0.051** (0.022)	-0.001 (0.023)	0.024 (0.020)	0.039 (0.028)	-0.036** (0.015)	-0.059*** (0.020)
Expenditures last 48 hours (CFAF, log)	0.579* (0.344)	0.072** (0.032)	-0.151* (0.080)	879 (1,524)	0.001 (0.018)	0.014 (0.022)	0.121*** (0.027)	0.023 (0.019)	-0.012 (0.026)	0.017 (0.012)	0.016 (0.016)
Household size	-0.093 (0.390)	0.011 (0.037)	-0.034 (0.094)	-3,455** (1,669)	0.028 (0.019)	0.021 (0.021)	-0.077*** (0.021)	-0.019 (0.017)	0.038* (0.021)	0.005 (0.015)	0.008 (0.018)
Never married	0.929* (0.478)	-0.043 (0.034)	0.140 (0.095)	1,906 (2,328)	-0.019 (0.020)	-0.041* (0.023)	0.019 (0.023)	-0.008 (0.019)	-0.001 (0.021)	0.006 (0.017)	0.032 (0.021)
Altruism (out of 1,000 CFAF)	0.065 (0.399)	0.019 (0.031)	0.093 (0.093)	678 (1,107)	0.002 (0.018)	0.042* (0.022)	0.116*** (0.020)	0.022 (0.015)	0.012 (0.021)	-0.041*** (0.012)	-0.007 (0.020)
Preference for present	0.208 (0.629)	-0.066 (0.045)	0.064 (0.096)	890 (862)	0.002 (0.027)	-0.022 (0.030)	-0.027 (0.032)	-0.017 (0.023)	0.040* (0.022)	-0.042* (0.024)	-0.018 (0.026)
Extraversion	-0.541 (0.404)	0.013 (0.034)	-0.127 (0.104)	-1,123 (1,569)	0.028 (0.020)	0.037 (0.023)	-0.024 (0.026)	-0.009 (0.019)	-0.028 (0.025)	0.016 (0.015)	0.027 (0.020)
Agreeableness	-0.005 (0.462)	-0.095*** (0.035)	-0.079 (0.113)	5,220 (3,322)	-0.018 (0.021)	0.014 (0.024)	-0.007 (0.026)	0.002 (0.019)	0.000 (0.023)	0.022 (0.016)	0.036* (0.021)
Conscientiousness	0.264 (0.444)	0.028 (0.033)	-0.011 (0.100)	-3,537* (2,008)	-0.031* (0.019)	0.031 (0.023)	0.003 (0.025)	0.029 (0.018)	-0.050* (0.027)	-0.014 (0.017)	-0.013 (0.021)
Openness	1.239** (0.496)	-0.075** (0.034)	0.484*** (0.108)	5,687* (3,394)	-0.053** (0.021)	-0.054** (0.024)	0.031 (0.025)	-0.003 (0.018)	-0.031 (0.028)	0.001 (0.014)	-0.022 (0.021)
Neuroticism	0.901** (0.446)	0.045 (0.032)	0.021 (0.101)	-2,512** (977)	-0.049** (0.020)	-0.002 (0.022)	0.005 (0.024)	0.002 (0.017)	0.033 (0.024)	0.015 (0.013)	0.038** (0.019)
Religiosity	0.420 (0.444)	0.014 (0.034)	-0.057 (0.109)	185 (927)	-0.005 (0.020)	-0.026 (0.023)	0.064*** (0.024)	0.006 (0.017)	0.011 (0.027)	-0.090*** (0.017)	-0.131*** (0.021)
Self-efficacy	0.702 (0.574)	0.041 (0.034)	0.064 (0.105)	687 (830)	0.017 (0.021)	0.024 (0.023)	0.028 (0.025)	0.006 (0.017)	0.041* (0.023)	-0.018 (0.016)	0.016 (0.021)
Self-control	-0.337 (0.385)	0.003 (0.034)	0.305*** (0.095)	606 (850)	0.003 (0.018)	-0.032 (0.022)	-0.021 (0.023)	0.014 (0.018)	0.018 (0.023)	0.022 (0.016)	0.018 (0.019)
Happiness	-1.286** (0.515)	0.095*** (0.035)	-0.411*** (0.112)	2,440* (1,443)	0.009 (0.022)	0.051** (0.025)	-0.023 (0.026)	-0.002 (0.019)	-0.015 (0.021)	-0.024 (0.017)	-0.071*** (0.021)
Moderately severe depression	-0.191 (0.241)	-0.012 (0.028)	-0.422*** (0.071)	-1,577** (639)	0.091*** (0.021)	0.052** (0.020)	-0.008 (0.021)	-0.001 (0.016)	0.014 (0.022)	-0.017 (0.015)	-0.049*** (0.018)
Observations	511	511	1,023	1,024	581	586	510	590	173	587	590
R-squared	0.131	0.296	0.134	0.082	0.094	0.082	0.137	0.027	0.137	0.106	0.159

Notes: This table is based on information collected in Wave 2. Explanatory variables are standardised. Robust standard errors are reported in parentheses. Standard errors are clustered at sex worker level for sex act level analysis (Columns (3) and (4)). *** p<0.01, ** p<0.05, * p<0.1. CRRA stands for constant relative risk aversion. Higher CRRA means greater risk aversion. In column (2), the reported coefficient refers to the interaction term $RA_i \times T_i$, see Appendix 4. See Table 6 for a detailed description of covariates.

Table A7b: Association between risk preferences and health and sexual behaviours - robustness checks

	Sexual behaviours				Health behaviours				Health status		
	Clients per week (1)	Condom use (2)	Risky client (3)	Price (CFAF) (4)	Affiliated NGO (5)	Causerie (6)	Registered (7)	HIV test (8)	HIV positive (9)	STI symptom (10)	Ever had a STI (11)
<i>All sample</i>											
CRRA G&P	-1.475*** (0.364)	0.102* (0.057)	-0.414*** (0.072)	-3,177*** (898)	0.038* (0.019)	0.065*** (0.021)	-0.033 (0.023)	-0.027* (0.016)	0.021 (0.025)	-0.030** (0.014)	-0.085*** (0.019)
<i>Including FSW's overconfidence of winning game</i>											
CRRA G&P	-1.469*** (0.382)	0.101* (0.057)	-0.406*** (0.095)	-2,887** (1,112)	0.039** (0.020)	0.051** (0.022)	-0.039* (0.023)	-0.028* (0.016)	0.020 (0.023)	-0.024* (0.014)	-0.076*** (0.019)
<i>Controlling for sex worker characteristics †</i>											
CRRA G&P	-1.102*** (0.359)	0.125** (0.057)	-0.255*** (0.093)	-2,653*** (946)	0.038** (0.019)	0.056** (0.022)	-0.011 (0.022)	-0.022 (0.017)	0.025 (0.025)	-0.028* (0.015)	-0.079*** (0.019)
<i>Including enumerator CRRA G&P</i>											
CRRA G&P	-0.931*** (0.321)	0.088 (0.056)	-0.283*** (0.097)	-2,816** (1,112)	0.023 (0.020)	0.035 (0.022)	-0.042* (0.023)	-0.022 (0.016)	0.026 (0.026)	-0.018 (0.015)	-0.049** (0.019)
<i>Including enumerator characteristics ‡</i>											
CRRA G&P	-1.448*** (0.371)	0.104* (0.055)	-0.215*** (0.083)	-2,247** (996.152)	0.004 (0.019)	0.000 (0.021)	-0.058** (0.024)	-0.031* (0.017)	0.033 (0.028)	-0.014 (0.015)	-0.049*** (0.019)
<i>Including enumerator fixed effects</i>											
CRRA G&P	-0.909** (0.340)	0.088 (0.054)	-0.025 (0.045)	-2,598** (1,053)	0.014 (0.019)	-0.018 (0.022)	-0.065*** (0.025)	-0.033* (0.017)	0.041 (0.029)	-0.006 (0.015)	-0.030 (0.020)
<i>Observations</i>	<i>513</i>	<i>513</i>	<i>1,023</i>	<i>1,024</i>	<i>583</i>	<i>588</i>	<i>512</i>	<i>592</i>	<i>173</i>	<i>589</i>	<i>592</i>

Notes: This table is based on information collected in Wave 2. Risk aversion measures are standardised. Robust standard errors are reported in parentheses. Standard errors are clustered at sex worker level for sex act level analysis (Columns (3) and (4)). Each reported coefficient estimate is based on a separate OLS regression. *** p<0.01, ** p<0.05, * p<0.1. SRRP stands for self-reported risk preferences. CRRA stands for constant relative risk aversion. Higher CRRA and lower SRRP mean greater risk aversion. Columns (3) and (4) refer to the two last paid sex intercourses.

† Sex worker characteristics are age, last days expenditures, household size, marital status, altruism, preference for present, big five personality trait, religiosity, self-efficacy, self-control, happiness and depression index (cf. Table A7a). ‡ Enumerator characteristics include CRRA G&P, age, marital status, children, experience in surveying sex workers and years of experience in surveys (cf. Table A6).

In column (2), the reported coefficient refers to the interaction term $RA_i \times T_i$, see Appendix 4.

Appendix 8 - Results on sample of Wave 1 and Wave 2

Table A8: Association between risk preferences and health and sexual behaviours - results for Waves 1 and 2

	Clients per week (1)	Sexual behaviours Condom use (2)	Risky client (3)	Price (CFAF) (4)	Health behaviours Registered (5)	HIV test (6)	HIV positive (7)	Health status STI symptom (8)	Ever had a STI (9)
<i>Waves 1 & 2</i>									
SRRP in general	0.682*** (0.234)	-0.071* (0.042)	0.022*** (0.008)	-358 (1,042)	-0.015 (0.015)	-0.021* (0.011)	0.021* (0.012)	0.037*** (0.011)	0.039*** (0.014)
SRRP in finance	0.707*** (0.222)	-0.030 (0.041)	0.031*** (0.008)	-62 (953)	-0.021 (0.015)	-0.021** (0.011)	0.017 (0.012)	0.025** (0.012)	0.021 (0.014)
SRRP with health	0.908*** (0.240)	-0.078** (0.041)	0.052*** (0.011)	-1518*** (561)	-0.028* (0.016)	-0.010 (0.011)	0.023* (0.013)	-0.000 (0.011)	-0.018 (0.014)
SRRP with sex	0.873*** (0.236)	-0.090** (0.041)	0.048*** (0.011)	-707 (553)	-0.049*** (0.015)	-0.022* (0.011)	0.009 (0.011)	-0.004 (0.011)	-0.003 (0.014)
CRRA G&P	-0.265 (0.228)	0.092*** (0.039)	0.011 (0.008)	-2,206*** (525)	-0.014 (0.015)	-0.001 (0.011)	0.014 (0.014)	-0.010 (0.011)	-0.042** (0.014)
<i>Observations</i>	<i>1,164</i>	<i>1,164</i>	<i>1,831</i>	<i>3,013</i>	<i>1,165</i>	<i>1,246</i>	<i>392</i>	<i>1,238</i>	<i>1,246</i>

Notes: This table is based on information collected in Waves 1 and 2. Risk aversion measures are standardised. Robust standard errors are reported in parentheses. Standard errors are clustered at sex worker level for all estimations.

Each reported coefficient estimate is based on a separate OLS regression. *** p<0.01, ** p<0.05, * p<0.1. SRRP stands for self-reported risk preferences. CRRA stands for constant relative risk aversion. Higher CRRA and lower SRRP mean greater risk aversion.

Risky client variable was not measured in the same way in both waves (binary variable in Wave 1 and 10-point scale in Wave 2).

Information from Wave 1 only is used here. Affiliation to NGO and participation to causerie were not collected in Wave 1.

In column (2), the reported coefficient refers to the interaction term $RA_i \times T_i$, see Appendix .