

UNIVERSITY OF CAPE TOWN



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## Correlates of Sexual Concurrency:

Findings from a survey of the student population at the  
University of Cape Town

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# 1 Introduction

Given the gravitas of HIV/AIDS it is not surprising that much economic literature has explored the topic. In this research, the role of concurrent sexual partnerships is increasingly recognized as important for the transmission of sexually transmitted infections, particularly in Africa (Mah and Halperin, 2008). However, a thorough analysis of the correlates of concurrency itself has remained overlooked. This analysis is especially central in South Africa where high levels of concurrency are coupled with high levels of HIV/AIDS. By one account, one in five adults in the country has HIV/AIDS, and one of every three adults engages in concurrent sexual relationships (Nattrass and Gonsalves 2009; Colvin *et al.*, 1998). This paper attempts to fill this gap in the literature by identifying correlates of sexual concurrency. This is done by using a dataset compiled from responses to a survey specifically designed for this purpose, involving students at the University of Cape Town.

In South Africa concurrency is prevalent, with the link to HIV transmission proven. A 1995 survey in KwaZulu Natal found that 40% of sexually active men reported having more than one sexual partner during the preceding three months, with this finding being mirrored in other Sub-Saharan African countries (Caraël, 1995; Colvin *et al.*, 1998; Voeten *et al.*, 2004; James and Matikanya, 2006; Mattson *et al.*, 2007). Empirically HIV prevalence is far higher in regions with higher concurrency rates; cursory evidence that concurrency is a key driver of the epidemic (Mah and Halpern, 2010a). Although some evidence exists to challenge this hypothesis, the majority of evidence, and the most convincing evidence, does allude to a strong link between concurrency and HIV/AIDS rates (Lagarde *et al.*, 2001; Mah and Halpern, 2010a, 2010b; Epstein, 2010; Morris, 2010). Evidence on the spread of Sexually Transmitted Infections (STIs) in general, has added weight to this belief. For example, a study in the United States regarding the transmission of a certain STI, found that one's partners concurrency is significantly associated with the likelihood of having a sexually transmitted infection (Potterat *et al.*, 1999). Mathematical models confirm this point; compared to a model with serial monogamy, concurrency in 50% of partnerships makes the HIV/AIDS epidemic about ten times as large (Morris and Ketzschmar, 1997, 2000).

In the most concerning of results, Johnson *et al.* (2009) use mathematical models to analyze the epidemiology of the disease in South Africa, to find that concurrency has accounted for roughly three-quarters of new HIV infections between 1990 and 2000. Using their model they predict that “almost 80% of all HIV transmissions in 2010 will occur in non-spousal or commercial sex relationships” (Johnson *et al.*, 2009: 317). Given this recent evidence on the role of concurrency in the transmission of HIV, it becomes a worthy task to address the correlates of concurrency in South Africa.

This paper is organized into five sections. We begin with a brief introduction, after which we present Fair's (1978) seminal model of concurrency, and discuss ways in which more

recent models of concurrent sexual relationships differ and compare. Further, evidence on this variety of models is analyzed in this context in order to better understand the depth and history of previous research on sexual concurrency. Third, we present data gathered for the purpose of identifying correlates of concurrency. Fourth, the empirical model is presented and the findings discussed. The fifth section concludes.

## 2 Interdisciplinary Models of Sexual Concurrency

The topic has been examined by theorists and empiricists in an array of fields. Perhaps the most seminal of models is Fair’s (1978) economic model of infidelity, which spawned models by Buss (1989), Cameron (2002), Cox (2008), Elmslie and Tebaldi (2008), among others. This section begins with the comprehensive presentation of Fair’s (1978) model, before moving to more recent variants.

In what appears to be the first published attempt at modeling sexual concurrency from an economic standpoint, Fair (1978) uses a time allocation approach, where the individual can choose how much leisure time<sup>1</sup> to allocate between a spouse, and a *paramour*<sup>2</sup>. He postulates a model very similar to Becker’s (1973) pioneering work on marriage, with the exception that Fair differentiates the preferences of the household members. In this way the one partner can prefer to enter a concurrent sexual relationship, even when the other does not. If we were to assume that there exists some degree of information asymmetry in that one spouse was not aware of the other spouses actions, then the model allows for adulterous behaviour.

Fair (1978) allows agents to partake in three kinds of activities; time spent with spouse ( $t_s$ ), time spent with paramour ( $t_p$ ), and time spent working ( $t_w$ ). Let  $U_s$  and  $U_p$  denote the utility that  $i$  derives from the spouse and paramour respectively. For simplicity we assume that there is only one paramour, one spouse and one type of good from which agents derive utility.  $U_s$  is now postulated to be a function of the time spent with spouse ( $t_s$ ), of the number of units of the good consumed in the relationship ( $x_s$ ), and of a vector of other variables ( $E_s$ ) that affect  $U_s$ , other than  $t_s$  and  $x_s$ :

$$U_s = f(t_s, x_s, E_s) \tag{1}$$

Similarly, the utility derived from the affair ( $U_p$ ), can be postulated to be a function of the time spent with the paramour ( $t_p$ ), of the number of units of the good consumed in the affair ( $x_p$ ), and of a vector of other variables ( $E_p$ ) that affect  $U_p$ , other than  $t_p$  and

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<sup>1</sup>Leisure time is defined as nonmarket activities

<sup>2</sup>The word paramour is archaic french and can be loosely translated to mean an illicit lover

$x_p$ :

$$U_p = g(t_p, x_p, E_p) \quad (2)$$

The total utility of agent  $i$  is thus the sum of the utility from the marriage and the affair:

$$U = U_s + U_p \quad (3)$$

The variable  $x_s$  consists of the units of the good supplied by  $i$  ( $x_{si}$ ) and of units of the good supplied by the spouse ( $x_{ss}$ ):

$$x_s = x_{si} + x_{ss} \quad (4)$$

Similarly, the variable  $x_p$  consists of the units of the good supplied by  $i$  ( $x_{pi}$ ) and of units of the good supplied by the paramour ( $x_{pp}$ ):

$$x_p = x_{pi} + x_{pp} \quad (5)$$

Since the agent can only choose between three ways of spending his time, the total available time must equal the sum of the time spent in each of those activities:

$$T = t_s + t_p + t_w \quad (6)$$

The decision problem for agent  $i$  is to choose  $t_s$ ,  $t_p$ ,  $x_{si}$  and  $x_{pi}$  so as to maximise  $U$ , subject to the budget constraint:

$$w(T - t_s - t_p) + V = p(x_{si} + x_{pi}), \quad (7)$$

where  $p$  is the price of the good,  $w$  is  $i$ 's wage rate, and  $V$  is  $i$ 's nonlabour income. One simplistic interpretation of this decision is that the agent  $i$  must choose how much time ( $t_s$  and  $t_p$ ) and how much effort ( $x_{si}$  and  $x_{pi}$ ) he must spend on each the spouse and paramour in order to maximise utility. Note that the price of good  $x_{si}$  and  $x_{pi}$  are assumed to be the same, for simplicity sake.

For this problem to be well behaved we impose certain restrictions. Variables exogenous to the model are  $x_{ss}$ ,  $x_{pp}$ ,  $p$ ,  $w$ ,  $V$ ,  $E_s$ , and  $E_p$ . Also,  $t_s$ ,  $t_p$ ,  $x_{si}$  and  $x_{pi}$  are all assumed to be non-negative, so as to avoid a corner solution. Note that the treatment of  $x_{ss}$  and  $x_{pp}$  as exogenous means that  $i$ 's decisions do not affect the decisions of the spouse and paramour. This is an unrealistic assumption, but a necessary simplification for our purposes. Relaxing this assumption may be of interest in further work, and will likely require a game theoretic approach given its strategic nature. Further, as Fair alludes, this specification can be

modified very slightly to more accurately model a situation in which the paramour is a prostitute.<sup>3</sup> This too may be of interest in further work.

To solve  $i$ 's decision problem we set up the standard Lagrangian,

$$L = U + \lambda[w(T - t_s - t_p) + V - p(x_{si} + x_{pi})], \quad (8)$$

and differentiate with respect to each of the decision variables to derive the first-order conditions. With the aid of the assumption that the solution is an interior one ( $t_p$  is greater than zero), the variables have the expected effects on the time spent with a paramour. The model makes the following predictions:

- As  $i$ 's nonlabour income increases,  $i$  works less and spends more time with both the spouse and the paramour.
- As the spouse spends more time in the relationship,  $i$  derives more utility from the relationship, and hence decreases the amount of time he spends with the paramour.
- Similarly, as the paramour spends more time in the affair,  $i$  derives more utility from the affair, and hence decreases the amount of time he spends with the spouse.
- As the amount of the good supplied by the spouse to the relationship increases,  $i$  chooses to spend more time with the spouse.
- Similarly, as the amount of the good supplied by the paramour to the affair increases,  $i$  chooses to spend more time with the paramour.

These postulations are in and of themselves not particularly useful, but they do make sure the model aligns with ones preconceived notion of concurrency.

Fair (1978) tests his original model by using data collected from two magazine surveys, and finds weak evidence to support it. The evidence is weak due to the inadequacy of the data, and due to the complete lack of diagnostic testing. The author himself admits that the data is nonrandom and likely the victim of bias. Pagan and Vella (1989) and Wells (2003) re-estimate the model using a subset of the data and run various diagnostic tests. They find weak evidence of omitted variables as well as heteroscedasticity, but conclude that the model is satisfactory.

In his original paper Fair proposes four other ways to model concurrency. The first is similar to Becker's (1968) model of crime in which the individual makes the decision to commit a crime or not based on the expected costs if caught, the probability of being caught and the expected benefits. This amounts to a simple cost-benefit analysis. The second is a multiperiod optimisation problem, which will be able to account for the present as well as expected future events. The third is a game theoretic approach in which the

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<sup>3</sup>The budget constraint would in this case be  $w_i(T - t_s - t_p) + V = p(x_{si} + x_{pi}) + w_p t_p$

individuals interact strategically with feedback and Bayesian updating of beliefs. Lastly, an approach which is similar to the job-search literature in which individuals seek concurrent sexual relationships in order to search for an alternate spouse (Fair, 1978).

The cost-benefit analysis approach is presented by Cameron (2002) and Elmslie and Tebaldi (2008). Cameron uses a basic utility model where sexual and non-sexual services of the spouse and paramour enter the individuals utility function. The model also explicitly accounts for two additional factors: the *exit capital* of the individual, and the rate of depreciation of the marriage. The former is a positive externality of being in the relationship, and can be seen as relationship skills learned or an increased self value in the partnership market. Cameron posits that one cannot simply end a relationship with no exit capital as this has repercussions on the ability to enter into future relationships. For example, one cannot end a relationship on socially unacceptable grounds, such as a sudden weight gain in one's partner. Instead the agent professes that the break-up was due to irreconcilable differences in order to exit with an increased value in the partnership market.

When making the decision to engage in concurrent relationships, the agent weighs the benefits and costs of doing so, and while the benefits of the concurrent relationship are fairly easy to quantify, the costs are often more opaque and require the data to be very specific. Elmslie and Tebaldi (2008) extend Fair and Cameron's models to include both the costs of the concurrent relationship as well as the probability of being caught (assuming that the agent's partner is unaware of the extra-partner relationship). Furthermore, they test whether evolutionary biology theory can be used to explain the high prevalence of concurrency in most societies. They hypothesize various influences that the parameters have on the probability of engaging in concurrent sexual relations, and test the model using data from the US General Social Survey. They find that both biological instincts and economic theory have a role to play in understanding the prevalence of concurrency. This further justifies the discussion of infidelity in the economic sphere of academia.

Academics in other disciplines have also explored theories of concurrent sexual relationships. In *On the Origin of the Species*, Charles Darwin (1859) shows interest as to why, in nature, the female of the species is often the "choosy" sex, and the male is often the more competitive sex. It would take over a century for Trivers (1972) to propose the theory of what biologists today call *sexual selection*. Trivers believed that the answer lay in the theory of parental investment, where the sex that invests more in the offspring than the other would be the most fastidious in terms of partner selection. In the case of humans a nine-month long investment is the minimum obligatory investment for a female to produce a child, whereas for the males the act of sex itself is sufficient to parent the same child. Evolutionary forces therefore penalise females who are not careful in selecting the best partners. A female who chooses wisely is afforded the protection of the male, along with his resources, and is thus given the best chance of passing on her genes through her offspring. Conversely, the males who typically, although not always, invest less in the childbearing process should

be more competitive with each other for access to the high-investing females. In this way evolutionary biology suggests that the lower-investing sex should be more likely to have concurrent sexual relationships as they tend to make many small investments, rather than just one costly investment, as the higher-investing sex does.

Cox (2008) elaborates and argues that evolutionary biology predicts that we should all have some hard-coding inherent in us all, as a vestige of our very distant past, that influences our actions. This coding is a direct result of the evolutionary upbringing the human race has undergone, as discussed above. Cox (2008) presents evidence that does appear, at least on the surface, to confirm this coding in us all. His conclusions are clouded however by the possibility that these traits may only be the obvious responses to interplay between evolutionary forces, societal norms and economic incentives. He illustrates this point well with an example, “A woman working to make partner in her law firm decides to have sex with a man whom she finds attractive, but diligently adheres to her oral contraception regimen since it is not an opportune time for her to have a child” (Cox, 2008: 22-23). Although evolutionary forces are at work here, the economic incentives have overshadowed them for the moment. Hence, evolutionary biology does not obviate deliberate choices. Rather, choices are the outcome of a complex interplay between constraints and preferences. In this way microeconomics, with its theory of rational choices and cost-benefit analyses, has much to add in terms of analysing these choices.

Buss (1989) and Buss *et al.* (1990) conduct a mammoth cross-cultural study to determine whether the predictions made by evolutionary psychology and biology hold for a variety of cultures across the globe. Their study involves 10 047 participants on six continents and five islands. They find compelling evidence to suggest that the qualities humans find desirable in a mate do not differ substantially across cultures, and that these qualities are exactly those predicted by evolutionary psychology and biology. Characteristics that are putatively attractive are essentially predictors of fertility and reproductive value. For example, males that have high value are reliable, have an interest in long-term relationships, can provide resources, are intelligent, healthy and kind. Similarly, women with known signs of fertility such as full lips, lustrous hair, clear eyes and clear skin are preferred. This is evidence of the hard-coding discussed earlier.

Although a good amount of literature is available on concurrency, it is incomplete in two senses. First, models that have been constructed to explain concurrency have been tested with sub-optimal data. Second, although evolutionary biology and psychology have contributed to the literature, they focus mainly on explaining sex differences, rather than more general correlates of concurrency. This research will attempt to use more suitable data, and attempt to identify a range of correlates.

## 3 Data Gathering

### 3.1 Survey Administration

One conclusion that can be drawn from previous research is that empirical evidence seeking clarity on the correlates of concurrency is weak, largely due to the inadequacy of data available. The type of data required is highly personal and is often the victim of misrepresentations on the part of the respondent. Data on sexual behaviour has traditionally been captured from face-to-face interviews, but such interviews have been shown to elicit significantly lower numbers of sexual partners in comparison to more impersonal and anonymous interviews (Johnson, *et al.*, 2009; Ghanem, *et al.*, 2005; Kissinger, *et al.*, 1999; Meekers *et al.*, 2005; Mensch, *et al.*, 2003). In this specific context, the stigma associated with admitting to having concurrent sexual partners is thought to cause most misrepresentations, in terms of a social desirability bias. Further, the data used to test the above models have not been garnered using surveys specifically constructed for this purpose, as such they typically rely on the concatenation of two or more data points in order to determine whether the respondent has engaged in concurrent sexual relationships.

For these reasons, data presented in this paper has been collected using an impersonal online survey for the specific testing of the correlates of concurrency (see appendix B for the survey). Students at the University of Cape Town were surveyed to gather data on their demographics, sexual experiences, and feelings and attitudes towards concurrency, with a view to identifying correlates of concurrency in the student population.<sup>4</sup> The survey itself was hosted on the Vula portal - a communication tool available to all students at the University of Cape Town - which allowed it to be completely anonymous. Using the University mailing list available to students and staff, an email was sent to over 20 000 students inviting them to take part in this research. The response rate was decent with 1 039 students choosing to begin the survey. Due to the length and personal nature of the survey however, only 551 respondents completed the entire form and submitted it.

### 3.2 Survey Construction

The survey used to derive the data has been carefully designed to avoid biases such as social desirability bias and framing bias, among others. In order to gather as many accurate responses as possible, two surveys were administered: one for those currently in a sexual relationship, and one for those who are not currently in a relationship, but have been in the past.<sup>5</sup> The only difference between the two surveys is the phrasing of the questions.

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<sup>4</sup>Permission was sought from and granted by the Commerce Ethics in Research Committee.

<sup>5</sup>A sexual relationship is defined, for these purposes, as a relationship in which partners have engaged in penetrative sex.

The models presented by Fair (1978), Cameron (2002) and Elmslie and Tebaldi (2008) hypothesize and test for many correlates of concurrency, but neglect potentially key correlates too. We expect this is because the data did not allow for the testing of these hypotheses. The data collected for the purposes of this paper however can be used to test these other correlates, and will in this way add to the body of research on the topic. Each of these will be discussed, in turn, below.

### **3.2.1 Sexual desire**

It is hypothesized that those with higher sexual desires are more prone to concurrency. Spector, Carey and Steinberg (1996) construct a self-administered survey to measure sexual desire. They find that sexual desire is multidimensional and comprises two distinct desires: i) dyadic sexual desire (desire to engage in sex with a partner) and ii) solitary sexual desire (desire to engage in sex by one's self). The former including both the physical and emotional desire to engage in sexual activities, the latter only including the physical desire. They also find that merely asking the respondent how many times they have been involved in, or would like to have been involved in sexual activities in the past period, is not an accurate measure of sexual desire. For this reason we follow their proven approach and derive a measure of desire that can be segmented into dyadic and solitary sexual desire.

The measure of solitary desire is the concatenation of two questions that test the respondent's frequency and importance of sexual activities with himself. The measure of dyadic sexual desire is the concatenation of three questions that test for the frequency of sexual activities with a partner, the frequency of sexual thoughts about a partner, and the importance of sexual activities with a partner. The total measure of sexual desire is simply the addition of the two.

An alternate measure of sexual desire is the utility a respondent derives from having a variety of sexual partners. Two proxies for this desire are the number of sexual partners they have had so far in their lifetime, and how many they *would have liked* to have had so far. The respondent also reveals his age at first penetrative sexual experience, and his current age. By using these four questions we can determine how many partners the respondent has had, and would like to have had, per year of being sexually active. These two variables will proxy as another measure of sexual desire.

### **3.2.2 Risk aversion in the context of sexual activities**

Partaking in adulterous behaviour is a risky act, hence the risk aversion of the respondent is thus of obvious interest. Dohmen *et al.* (2005) investigate individuals' attitudes toward risk. They test various methods of measuring risk preferences, including context-specific

questions, general questions and the oft used “lottery example” (Becker *et al.*, 1964). They find that the best measure of specific risk behaviour is context specific, and the best overall measure of risk preference is best set in a more general context. They find that the lottery example is not as valuable a measure of risk preference as previously thought. We use four related questions to test for the relation between concurrency and risk preference in a general context, and also specifically in the context of sexual activities. In the context of sexual risk-taking, a person who does not practice safe sex, has never been tested for sexually transmitted infections, and who’s age at first sex is very low, is assumed to be the most risky. The general measure of risk is a score out of 10, based on the respondent’s reported willingness to fully undertake risky activities.

### **3.2.3 Religiosity**

Religiosity is a self-reported measure, in which respondents detail the degree to which they are religious on a scale of one to ten. In the past it has been hypothesized that this should be strongly related to the propensity to partake in concurrency sexual relationships. This, however, only applies to more Western regions and not to Africa where many cultures or religions do not prohibit concurrent sexual relationships (Lesthaeghe, 1989). In any event, empirics do not support this religion-concurrency link (Fair, 1978; Cameron, 2002; Wells, 2003; Elmslie and Tebaldi, 2009). We include it merely as a control factor to determine if this research finds differently.

### **3.2.4 Sexual and emotional satisfaction**

People that are satisfied with the quality of their relationship are less inclined to partake in concurrent sexual relationships (Cameron, 2002; Lawrence and Byers, 1995; Elmslie and Tebaldi, 2008). Since Hamilton’s (1929) classic study, much social science research has focussed on how to measure relationship quality (Adams, 1960; Bernard, 1933; Burgess, 1939; Hicks *et al.*, 1970; Inselburg, 1964; Locke, 1951, 1952; Locke and Wallace, 1959). The oldest measure of relationship quality, the Dyadic Adjustment Scale, has been replaced by the more often used Relationship Assessment Scale (RAS) (Spanier, 1976). The RAS uses a 7-item Likert scale to derive a generic relationship satisfaction measure. The survey used in this paper does not ask precisely the same questions, but does use a similar structure, and mirrors the underlying methodology. For example, one question in the RAS is “In general, how satisfied are you with your relationship?”. In this survey, however, we split satisfaction into sexual satisfaction and emotional satisfaction. In this way we can dig down to reveal whether concurrency is driven mainly by the purely sexual desire to have sex, a purely emotional desire to have sex or a combination of the two, and whether this differs across sexes. This type of dyadic measurement follows the research of Paik (2010).

We have also included questions related to the sexual and emotional attraction of the respondent to the paramour, should he or she have engaged in concurrent sexual relations. We hypothesize that this is likely to be linked to the probability of having sex outside the relationship.

### 3.2.5 Partner response to concurrency

If information asymmetry does initially exist between partners, repercussions may occur if both partners are made aware of the extra-partner relationship. These “costs” will likely enter into the decision makers mind. If he believes that these repercussions are trivial then he may be more incline to partake in concurrent sexual relationships. The final question in the survey reveals what repercussions the respondent expects if his or her partner was made aware of any adulterous behavior.

## 4 Results

We begin with an interrogation of the data collected by analyzing the descriptive statistics, before moving to a discussion of the pooled multivariate results.

### 4.1 Descriptive statistics

Table 1 presents the descriptive statistics of the data. From this we can see that in terms of demographics, the sample seems to be well representative of the student population at the University of Cape Town (UCT). In the sample there are about as many females and males and almost as many African persons as white persons (University of Cape Town, 2010). This roughly approximates the UCT population in general, and lends some support that our sample captures the student population well. Further we notice that there is a decent distribution of responses across the six faculties on campus, with the exception of the Law faculty. This inhibits any meaningful conclusions about this population subgroup, given that there are so few datapoints.

The age at sexual debut in South Africa has been estimated at around 18 years of age (Bakilana, 2005). This is mirrored in our data with the average age at first sex being reported as 18.02 years.

The World Health Organization and others, estimate that in South Africa between 50% and 60% of people between the ages of 15 and 24 used some sort of protection at last sex (Cullinan, 2003; Eaton *et al.*, 2003). This is similar to the reported regularity of safe sex in our data, with around 75% of the sample practicing safe sex at least regularly.

Table 1:  
*Descriptive Statistics*

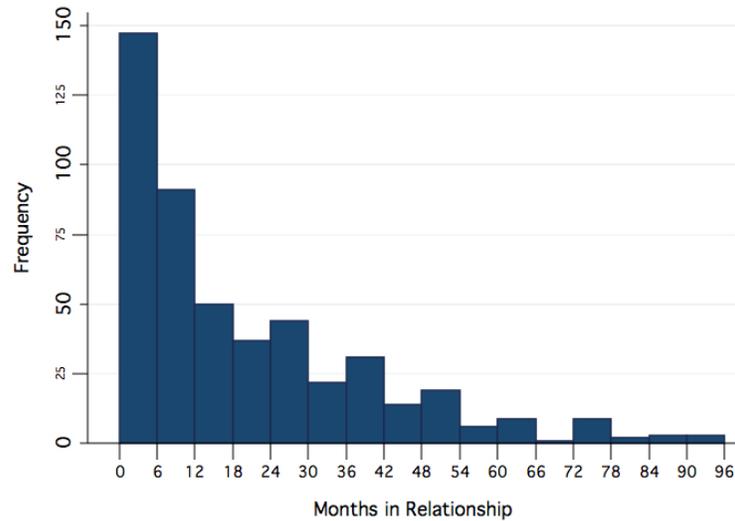
Variable	n	Prop. / Mean	SD
<i>Demographics</i>			
Age	500	23.47	6.17
Personal income per month	500	3 222.28	2949.81
Gender			
Male	228	45.5%	-
Female	273	54.5%	-
Faculty			
Commerce	101	20.16%	-
Humanities	151	30.24%	-
Engineering and the Built Environment	87	17.37%	-
Law	19	3.80%	-
Science	88	17.56%	-
Health Sciences	55	10.98%	-
Sexual preference			
Heterosexual	438	89.39%	-
Homosexual	52	10.61%	-
Race			
African	165	33.00%	-
White	220	44.00%	-
Coloured	63	12.60%	-
Other	52	10.40%	-
<i>Risk and Religion</i>			
Religiosity (1 - 10)	500	4.58	2.67
General risk appetite (1 - 10)	502	5.70	2.06
Age at first sex	493	18.02	2.62
Regularity of safe sex			
Always	231	46.86%	-
Regularly	147	29.82%	-
Sometimes	79	16.02%	-
Never	36	7.30%	-

Variable	n	Prop. / Mean	SD
<i>Regularity of STI test</i>			
Never	109	21.84%	-
Once	61	12.22%	-
Twice	90	18.04%	-
Three times	109	21.83%	-
Four, or more times	130	26.05%	-
<i>Sexual desire</i>			
Sexual desire (1 - 32)	491	15.51	5.52
Sexual partners per year	451	1.38	1.32
Sexual partners wanted per year	441	1.64	3.02
<i>Relationship</i>			
Relationship length (months)	495	21.48	28.74
<i>Relationship satisfaction (1 - 10)</i>			
Sexual satisfaction	495	7.59	2.06
Nonsexual satisfaction	498	7.65	2.35
Sexual attraction	495	8.18	1.85
Nonsexual attraction	498	8.06	2.13
Partner concurrency rate	498	18.51%	-
Own concurrency rate	496	28.11%	-
Acceptability of own concurrency (1 - 10)	500	1.87	1.89
Own reaction to partner concurrency (1 - 10)	496	7.90	2.25
Partner reaction to own concurrency (1 - 10)	496	8.12	2.04

We find that around one fifth of respondents have never been tested for STIs, but also that almost half of the respondents have been tested three or more times. Hence, of those respondents that have been tested, it is likely they have been tested three or more times. Data on the rates of STI testing in South Africa vary widely depending on the source of the data, and are not comparable to the data we present here given different measures of regularity (Cullinan, 2003, Eaton *et al.*, 2003; Peltzer *et al.*, 2009; Government of South Africa, 2010, 2007; AVERT, 2010).

Surveys about the length of relationships in Africa have found that the most reported non-spousal relationships have average durations of between three and 12 months (Ferry *et al.*, 2001; Jewkes *et al.* 2001; Nnko *et al.*, 2004). As can be seen from Figure 1 our data mirrors this finding.

Figure 1: Relationship Length



Source: Author's estimates.

The two concurrency variables seem to indicate that there exists some degree of information asymmetry between partners. The data show that 18% of partners have engaged in concurrent sexual relationships, whereas 28% of respondents themselves have engaged in concurrency. Hence, respondents report more concurrency about themselves than they report of their partners. It is likely that this is because the respondent is more aware of his own concurrency, than the concurrency of his partner.

The last three descriptive statistics measure how respondents feel about having multiple sexual partners when in a committed sexual relationship. We can see that most respondents feel that concurrent sexual relationships is not acceptable, and that most respondents believe that there will be a strong negative reaction from their partner if they were to engage in concurrency.

Given the focus of previous research on gender differences, it may be of interest to analyze the data segmented by gender. We ran t-tests to determine whether any of the data differed significantly between genders. Significant factors are presented in Table 2.

From Table 2 we can see that males in our sample have a significantly greater risk appetite than females. Men also report having more sexual partners per year of sexual activity than women, however this is not to be taken on face value. In previous research it has been found that young women underreport sexual experience, and that young men slightly exaggerate their sexual experience (Mensch *et al.*, 2003; Hewett *et al.*, 2004; Turner *et al.*, 1998). Hence, this finding may be the result of biased reporting.

Table 2:  
*Gender Segmented Descriptive Statistics*

Variable	Male		Female		Significance Level
	n	Mean	n	Mean	
General risk appetite	228	6.12	273	5.34	1%
Sexual partners per year of activity	207	1.53	243	1.25	5%
Sexual partners wanted per year of activity	198	2.57	242	0.89	1%
Partner partaken in concurrency	226	0.18	270	0.19	NS
Respondent partaken in concurrency	225	0.32	272	0.25	10%
Acceptability of own concurrency	226	2.12	273	1.66	1%
Nonsexual satisfaction	225	7.36	272	7.90	1%
Nonsexual attraction	225	7.77	272	8.28	1%

*Notes:* The last column reports the significance level of mean-comparison test between the male and female sample, against the two-sided alternative.

We find that both genders report partner concurrency to be roughly as likely. However, men themselves report to being engaged in more concurrent relationships than women. It seems then that men are thus more likely to engage in concurrent sexual relationships than women. Again we notice that the differences between reported partner concurrency, and the concurrency of the respondent can be attributed to information asymmetry.

Finally, the data suggests that men find concurrent sexual relationships more acceptable than women, and that men report having lower levels of nonsexual attraction to their partners and nonsexual satisfaction with their partners, than their female counterparts.

In summary then, the data seems to well-representative of the UCT population, and it reveals many of the relationships found in previous research. Gender differences do occur, especially in variables related risk aversion, sexual desire and relationship specific factors.

## 4.2 Pooled Multivariate Results

Before we can estimate an empirical model of concurrency we need address whether we can pool the data derived from the two different surveys.

The two surveys used, although very similar, were administered to different groups; one to respondents currently in a sexual relationship, and the other to those not currently in a sexual relationship. Although this is useful in deriving a greater sample size, there may exist a bias such that the data generated from the second group is statistically different from the first group. To test whether the data from the two surveys can be pooled we

run a full regression, and also include a variable to indicate whether the data was derived from the first group or the second, as well as interaction terms for each variable. This will allow us to test whether one group of respondents has a different average propensity to engage in concurrent relationships, as well as whether the behaviour of the groups towards concurrency responds differently to the set of variables. We run a Wald test for joint significance of the indicator variable, along with all the interaction variables and find that there is not enough evidence to conclude that the data needs to be separated.<sup>6</sup> We can therefore pool the data derived from the two surveys as originally hoped.

Given that the data can be pooled we present Table 3, which summarizes the multivariate results of a selection of models. The table shows that the empirical model is developed in four stages; first only demographic factors are included, then we add in turn, risk appetite and religiosity factors, sexual desire factors and relationship factors.

Model 1 is a basic estimation on which we build more interesting models. Immediately it is apparent that the faculty variables, and the race variables are significant. Commerce students, the omitted category, are more likely to be engaged in concurrency than those in Humanities, Science and Engineering. Pairwise tests conclude that students in Humanities, Science, Health Sciences, Engineering or Law are not significantly more likely to engage in concurrency than each other.

Further, Africans and coloreds are more likely to partake in concurrency than their white counterparts by roughly 25% and 16% respectively. In many Sub-Saharan African cultures having concurrent sexual relationships is not taboo, and is actively and openly practiced (Lesthaeghe *et al*, 1989). These statistics may reflect this cultural norm present in the African populace, but not in the white populace. A Wald test confirms that Africans are not however more likely to engage in concurrent sexual relationships than coloreds. Lastly, the gender variable is significant at the 10% level.

Model 2 includes risk factors and a measure of religiosity. The measure of religiosity is not significant at even the 10% level in any estimation of the model, leading to us to conclude that religiosity is not significantly associated with concurrency. If there was however a degree of association we would say that more religious respondents are less likely to engage in concurrency. Both of these findings are consistent with previous research (Fair, 1978; Cameron, 2002; Elmslie and Telaldi, 2009). Two risk factors, the risk appetite of the respondent and the age at first sex, show high significance. However, when further variables are included in the estimation they lose significance. One could assume therefore that these factors are only significant in model 2 due to some pairwise correlation with other factors yet to be included in the model.

Interestingly, once we account for these risk factors, the gender variable is no longer significant. As we noticed from the descriptive statistics, men have a greater risk appetite,

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<sup>6</sup>The Wald Test yields an F-statistic of 1.28, and a p-value of 0.1722, against the two-sided alternative.

Table 3:  
Multivariate OLS and Probit Results

Explanatory variable	(1)		(2)		(3)		(4)	
	Probit	LPM	Probit	LPM	Probit	LPM	Probit	LPM
Age	0.001	0.001	0.004	0.003	0.006	0.006	-0.019**	-0.012**
Male	0.079*	0.080*	0.039	0.043	-0.031	-0.020	-0.052	-0.019
Humanities	-0.101*	-0.109*	-0.131*	-0.137**	-0.147**	-0.153**	-0.171***	-0.136**
Science	-0.124**	-0.137**	-0.113*	-0.121*	-0.154**	-0.162**	-0.203***	-0.179***
Health Sciences	-0.101	-0.113	-0.105	-0.114	-0.126*	-0.134*	-0.171**	-0.17**
Engineering	-0.128**	-0.126**	-0.138**	-0.157**	-0.151**	-0.167**	-0.137**	-0.131**
Law	-0.011	0.012	0.002	-0.003	-0.112	-0.12	-0.085	-0.08
African	0.251***	0.241***	0.284***	0.265***	0.319***	0.287***	0.317***	0.235***
Colored	0.155**	0.129**	0.188**	0.155**	0.229***	0.182***	0.2**	0.133**
Other	0.106	0.086	0.126	0.103	0.164*	0.129*	0.117	0.072
Religiosity			-0.014	-0.014*	-0.012	-0.012	-0.019	-0.011
Risk appetite			0.031***	0.03	0.022*	0.02*	0.019	0.016
Regularity of safe sex			0.027	0.028	0.02	0.021	0.018	0.019
Age at first sex			-0.02**	-0.018**	-0.023**	-0.02**	-0.01	-0.006
Regularity of STI test			0.017	0.016	0.000	0.001	-0.001	0.000
Sexual Desire					0.008*	0.007	0.011**	0.007*
Number of partners					0.023	0.023	0.024	0.021
Number of partners wanted					0.012	0.011	0.005	0.004
Relationship length							0.004***	0.004***
Relationship satisfaction							-0.008**	-0.007**
Acceptability of concurrency							0.076***	0.061***
Partner concurrency							0.212***	0.162***
Reaction to partner concurrency							-0.021*	-0.021**
Partner reaction to own concurrency							0.000	0.003
Adjusted $R^2$ or Pseudo $R^2$	0.07	0.07	0.11	0.13	0.13	0.15	0.29	0.30
$n$	492	492	475	475	414	414	402	402

Notes: This table presents the marginal effects from a Probit estimation, and the coefficients from a Linear Probability Model (LPM). The omitted categories are 'Commerce' for the faculty dummies and 'White' for the race dummies. All models have been tested and corrected for heteroskedasticity.

\* Denotes significance at the 10 percent level, \*\* at the 5 percent level and \*\*\* at the 1 percent level.

hence as we add risk-related factors to the model the contribution of the gender variable to model declines. Part of the significance of the gender dummy is therefore associated with the different risk appetites of each gender. Previous research does not include risk factors such as the ones presented in this paper, and has not been able to accurately account for the underlying reason why the gender variable is often so significant. It is likely therefore that previous research has overestimated the effect of being male on ones propensity to engage in concurrency as they failed to account for risk-related factors.

In model 3 factors related to the sexual desire of the respondent are included. These variables, as a whole, show very little significance; only the measure of sexual desire is significant, and only at the 10% level. From this one would tentatively conclude that sexual desire is not a robust correlate of concurrency. If however, there was a significant link between sexual desire and concurrency, the data shows that it would be positive in nature: the greater ones sexual desire, the more likely one is to engage in concurrent sexual relationships.

The full, final model is presented as model 4 where relationship specific factors are included along with all other variables. The faculty and race variables remain significant, however the age variable, which has until not been significant becomes very significant in both the LPM and Probit models. According this model older persons are less likely to engage in concurrent relationships, with each additional year decreasing the likelihood by around 2%. One might believe this age effect is a nonlinear one, however the squared age of the respondent is insignificant when added to the model. This is evidence that the effect is linear in nature.

In this full estimation the gender dummy variable is not significant while the risk factors, which were once significant, have become significant only at the 14% level. The reasons for this is unclear, but perhaps there exists some pairwise relationship between the risk factors and factors such as number of sexual partners per year of sexual activity. In any case, the important finding is not whether risk factors affect concurrency, but that when we account for risk factors the gender dummy is not significant. Hence the propensity to engage in concurrent sexual relationships has been overstated in previous research, which ignored differences in risk appetite between genders.

The most remarkable findings from this research are left for last. When the relationship factors are included in the model we see that they are strongly correlated with concurrency. The relationship length is highly significant and indicates that the longer the relationship the more likely one is to engage in concurrency, when controlling for a variety of factors. This variable might best be estimated in log form, given the wide disbursement of responses. When using this log-form estimation the variable remains significant, but the interpretation of the coefficient is clouded; we lose the ability to correctly determine the magnitude of the marginal effects as we are including a marginal effect of a percentage change in relationship length. In order to avoid this we maintain the original level form.

One hypothesis is that agents that are more liberal in terms of concurrency would be more likely to engage in concurrent relationships. The estimation mirrors this belief entirely, as respondents who are more accepting of concurrency are more likely to engage in concurrency. Further, one would predict that relationship satisfaction is strongly related to decision to engage in concurrency. One can conclude that, given the estimation, as the quality of the relationship increases, the likelihood of engaging in concurrency decreases.

Further, if the respondents partner has been involved in concurrency, then he is 21% more likely to engage in concurrency himself. This might indicate that there is some level of retribution against ones partner, where a partner would react to the other partners choice to enter into an extra-partner relationship by entering a concurrent relationship himself.

Lastly, we notice one seemingly paradoxical effect. The reaction the respondent will have to his partners concurrency is significant, while the perceived reaction that the partner will have to the respondents concurrency is not. In terms of previous research the decision to engage in concurrency should be related to the perceived costs of the action (Cameron, 2002; Elmslie and Tebaldi, 2009). However, in this model the perceived costs (the reaction of the partner) are not related to the decision to engage in extra-partner sexual relations. This is somewhat counterintuitive. One may believe that these two variables are highly correlated and thus multicollinearity may cause the latter variable to lose significance. However, the correlation between the two is not particularly high at 35%, and would indicate that multicollinearity is not a concern. We suggest that when the respondent decides whether to enter a concurrent relationship, he does not weigh the costs in terms of the reaction of his partner, but rather he weighs the cost as how *he would feel* if his partner engaged in extra-partner sexual relations. This may be interpreted as some sort of guilt he may feel after the fact. Hence the true cost of entering a concurrent relationship in this model is quite different from how it is included in models suggested in other literature. The respondent is not acting solely self-interested when he chooses not to engage in concurrency, rather he weighs the costs as the emotional harm he would feel if his partner engaged in concurrency.

In summary, we find that race and faculty are correlated with concurrency. Age also significantly affects the decision in engage in concurrent sexual relationships, with older persons less likely to have multiple partners at the same time. Overwhelmingly however, we find that the model is driven by relationship specific factors, such as relationship satisfaction. The results show, therefore, that the decision to enter a concurrent sexual relationship depends partly on the agent himself, but also on the relationship that agent finds himself in.

### 4.3 Gender Segmented Multivariate Results

Something we have until now avoided is whether we should pool the male and female data as we have done above. Literature from evolutionary biology and psychology, as well as economic models of concurrency, predict that the behavior of men and women in relation to having concurrent sexual partners differs significantly (Trivers, 1972; Buss, 1989; Cameron, 2002; Cox, 2008; Elmslie and Tebaldi, 2009). If this is true in our data, we could draw some meaningful conclusions from estimating separate models for each gender.

In the descriptive statistics we noted that men have a much higher propensity to engage in concurrency than women, however we must be careful of these postulations as descriptive statistics can be misleading. To examine whether it is worthwhile estimating separate models we use two different approaches, following the methodology of Fair (1978) and Elmslie and Tebaldi (2009). First, by including a gender dummy in the full estimation we can statistically test for whether males and females have different “average propensities” to engage in concurrency. In other words, we test if one gender is more likely to engage in concurrent sexual relations, even after controlling for a variety of factors. Second, we run a Wald test as we did in the previous section, to determine whether the behavior of men and women toward concurrent sexual relationships responds differently to a set of controls included in the model.

The results of the first test show that the gender dummy is not significant in our full model (for results see model 4 in Table 3). Hence we can conclude that men and women do not have different average propensities to engage in concurrency, after controlling for a variety of factors, including risk appetite, religiosity, sexual desire and various relationship-specific factors. This finding is mirrored by Fair (1978) using his original data, but is different to the results of Cameron (2002) and Elmslie and Tebaldi (2009). As discussed above in the pooled multivariate results, all three of these previous estimations fail to take into account risk-related factors, and hence overestimate the gender effect.

Similarly to the Wald test conducted in the pooled multivariate section above, we test for the joint significance of the gender dummy, and a full set of interaction terms in the full model. By doing so we find robust evidence that at least one of the interaction terms is significantly different from zero.<sup>7</sup> Hence we conclude that it is worthwhile estimating one empirical model for each gender. Given this we present Table 4, a summary of the gender segmented multivariate results.

From Table 4 we can see that the slope estimates for each gender differ in quite a few cases. To start off with, we see that the age of the respondent is significant in the female estimation, whereas in the male estimation it is not significant. From this we can say that, for females, the likelihood of being involved in concurrent sexual relationships decreases as

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<sup>7</sup>The Wald test yields an F-statistic of 2.28, and a p-value of 0.001, against the two-sided alternative.

Table 4:  
*Gender Segmented Multivariate Results*

Explanatory variable	Male		Female	
	Probit	LPM	Probit	LPM
Age	-0.010	-0.007	-0.036***	-0.020**
Humanities	-0.189*	-0.122	-0.144*	-0.148*
Science	-0.214**	-0.093	-0.196**	-0.213**
Health Sciences	-0.191	-0.079	-0.165**	-0.225**
Engineering	-0.182*	-0.097	-0.048	-0.074
Law	-0.217***	-0.496**	0.157	0.046
African	0.641***	0.433***	0.138	0.095
Colored	0.101	0.063	0.239**	0.162*
Other	-0.194	-0.068	0.153	0.119
Religiosity	-0.020	-0.024**	-0.003	-0.002
Risk appetite	0.027	0.016	0.016	0.015
Regularity of safe sex	0.040	0.029	-0.006	0.019
Age at first sex	-0.002	0.001	-0.023	-0.013
Regularity of STI test	0.038	0.017	-0.032	-0.026
Sexual Desire	0.018**	0.007	0.014**	0.009
Number of partners	0.070**	0.043**	-0.028	-0.026
Number of partners wanted	0.007	0.004	0.011	0.006
Relationship length	0.011***	0.005***	0.003*	0.002
Relationship satisfaction	-0.020***	-0.007*	-0.011**	-0.009**
Acceptability of concurrency	0.087***	0.049***	0.073***	0.063***
Partner concurrency	0.327**	0.217***	0.258***	0.176**
Reaction to partner concurrency	0.007	0.006	-0.043***	-0.037**
Partner reaction to own concurrency	-0.014	-0.018	0.015	0.019
Adjusted $R^2$ or Pseudo $R^2$	0.57	0.45	0.28	0.40
$n$	180	180	222	222

*Notes:* This table presents the marginal effects from a Probit estimation, and the coefficients from a Linear Probability Model. All models have been tested and corrected for heteroskedasticity. The omitted categories are ‘Commerce’ for the faculty dummies and ‘White’ for the race dummies. \* Denotes significance at the 10 percent level, \*\* at the 5 percent level and \*\*\* at the 1 percent level.

the respondent gets older. For males, the association between age and concurrency is not significant, but at the direction of the effect is nevertheless the same.

Similarly to the pooled estimation results, Commerce students, the omitted category, are still significantly more likely to engage in concurrency than their Humanities, Science and Health Science counterparts. Engineering students however, are as likely to engage in concurrency as Commerce students, regardless of gender. As discussed earlier, there are very few observations from Law students, hence we should avoid drawing conclusions about this group. However, if we were to draw any conclusion it would be that male Law students are significantly more likely to engage in concurrent sexual relationships than male Commerce students. While the difference between female Law students and female Commerce students is not significant.

Interestingly, the African male group is significantly more likely to engage in concurrent sexual relations than white males. Further tests conclude that the African males are also more likely to engage in concurrency than colored males. For men of all race groups therefore, African males are the most likely to engage in concurrency. As discussed earlier, this is expected given that many Sub-Saharan African cultures still practice polygyny, where one man has many wives (Lesthaeghe, 1989). For females however, there is no significant difference between the African and white groups. This shows that the African culture is truly polygynous rather than polygamous: African men show an increased likelihood of having multiple sexual partners at the same time, whereas African females do not.

As in the pooled estimation, religiosity shows no robustly significant effect, but does show that, if anything, an increase in religiosity would lead to a decreased likelihood of engaging in concurrency. The factors related to the risk appetite of the respondent show no sign of significance across the estimations, and do not have a consistent effect on the likelihood of engaging in concurrent sexual relationships.

In this model we use three measures of sexual desire. First, a measure of desire derived from the responses to a variety of questions. Second, the number of partners the respondent has had per year of being sexually active. And third, the number of sexual partners the respondent would ideally like to have had per year of being sexually active. In this segmented estimation, we see that two of these measures are significantly correlated with concurrency for males, but only one of them is significant for females. For both sexes the higher the respondent's sexual desire, the more likely they are to engage in concurrency. However, the number of sexual partners the respondent has had per year of sexual activity is only significant in the male estimation. It seems then that sexual desire as a whole is more of an influence on the decision to engage in concurrent sexual relations for males, than for females. By pooling the data, we lost the ability to see this subtle difference, and concluded that sexual desire was not a significant correlate of concurrency. Now, however we can conclude that for males, sexual desire is an important correlate of concurrency. This is less true for females.

This more fine-grained estimation allows us to identify another effect hidden in the pooled estimation. For men, the length of the relationship is significantly correlated with having concurrent sexual relations, whereas for women this is not the case. The practical significance of this variable indicates that for men, one month longer in a relationship raises the likelihood of entering a concurrent sexual relationship by around 1%. Given the nature of this variable we may expect that the likelihood of concurrency is a nonlinear function of the relationship length. However, as in the pooled estimation, the squared length of the relationship is not significant in the model.

As in the pooled estimation, relationship factors stand out as being very significant in both the male and female models. What can be noted from the segmented models however, is that the size of the coefficients in the male estimation are generally larger than those in the female estimation. For example, if a man's partner has engaged in concurrent sexual relationships he is 33% more likely to enter concurrency himself. However, if a woman's partner engages in concurrency, she is only 26% more likely to enter concurrency. It appears from this that men are more sensitive to relationship specific factors than women.

In both models the reaction that the partner will have to the respondents concurrency is not significant. In the pooled estimation we postulated that this was because the true cost of having concurrent sexual relations is a feeling of guilt which is derived from the respondent knowing how he would feel given *his partners* concurrency. We see from Table 4 that the reaction the respondent will have to his partners concurrency is not significant in the male estimation, but very significant in the female estimation. Hence, the postulation we made earlier relates only to females. We conclude then that when females engage in concurrency, the cost they face is a feeling of guilt they derive from knowing how it would hurt them, if their partner were to enter concurrent sexual relations.

In summary then, we note that once the risk appetite of the respondent is taken into account, men and women are equally likely to engage in concurrent sexual relationships. However, as predicted by evolutionary biology and psychology, the behavior of men and women in relation to concurrency responds differently to certain factors. Specifically we find that for males, the African group is the most likely to engage in concurrency. This is largely due to cultural differences between race groups. Sexual desire is an important correlate of concurrency for men more than women, and in general men are more sensitive to the relationship specific factors. Also, for women, the cost of engaging in concurrent sexual partners is related to a feeling of guilt derived from knowing how she would feel if her partner had concurrent sexual partners. Men however, do not place as much weight on this feeling.

Overall though, both models show that relationship specific factors are highly correlated with concurrency. Hence we again conclude that the decision to enter concurrency depends partly on the agent, but also on the relationship that agent finds himself in.

#### 4.4 Partner-Paramour Comparisons

With the type of data gathered for this research we can test whether, in the eyes of the respondent, the paramour and partner are significantly different. Table 5 summarizes the data on partner-paramour comparisons.

Table 5:  
*Partner-Paramour Comparisons*

Variable	Partner		Paramour		Significance Level
	Mean	SD	Mean	SD	
Age	23.33	4.73	23.10	4.31%	NS
Sexual attraction (1 - 10)	8.14	1.56	6.70	2.67%	1%
Nonsexual attraction (1 - 10)	7.58	2.11	5.6	2.84%	1%

*Notes:* The last column reports the significance level of mean-comparison test between the partner and paramour sample, against the two-sided alternative.

From Table 5 we notice that the average age of the partner and the paramour are very similar. A mean-comparison test confirms that they are not significantly different, hence we conclude that in most cases there is no significant difference between the age of the partner and the age of the paramour.

More interesting however, is that the level of attraction the respondent feels toward his partner and paramour are very different. It has been hypothesized that in order for the respondent to engage in concurrency, the paramour should, in the eyes of the respondent, be more attractive in some way than his partner.. Hence one might expect that the sexual and nonsexual attraction the respondent feels toward the paramour would be greater than that of the partner. This however, is not the case here. The attraction the respondent feels toward the partner is significantly greater than the attraction he feels toward the paramour. This alludes to the conclusion the paramour-specific factors are not the driver of concurrent sexual relationships. Given this finding, and the findings above, we could tentatively conclude that the decision to enter concurrent sexual relationships depends more on relationship-specific factors, than agent-specific and paramour-specific factors.

## 5 Conclusion

In HIV/AIDS research the role of sexual concurrency is increasingly recognized as being important. In South Africa, concurrency is prevalent with the link to HIV transmission proven. To highlight its effect on the HIV/AIDS epidemic, research suggests that in South Africa almost 80% of HIV transmissions in 2010 will occur in extra-partner sexual relationships. An analysis of the correlates of sexual concurrency is therefore worthwhile.

Although some research address sexual concurrency, it is incomplete. The data used is often the victim of misrepresentations in the form of social desirability bias, and has been gathered by using inappropriate techniques. Data used in this paper has been gathered by using impersonal online surveys specifically designed to avoid this bias. Descriptive statistics of this data show that it is well-representative of the student population at the University of Cape Town. We also find that gender differences do occur, specifically in terms of risk aversion, sexual desire and relationship specific factors.

Interestingly, we find that once the risk appetite of the agent is taken into account, men and women are equally likely to engage in concurrency. This contradicts previous literature, which failed to account for differences in risk aversion. However, we find that the behavior of men and women toward concurrency responds differently to a set of controls in the model. This accords well with theories of concurrency from evolutionary biology and psychology. By estimating a model for each gender we can conclude that of all men, the African group is the most likely to have multiple sexual partners at the same time. We postulate that this is the result of certain Sub-Saharan African cultures, in which polygyny is still prevalent. Of all students, younger persons and those enrolled in the Commerce faculty are the most likely to engage in concurrent sexual relations.

Relationship length, although not as significant for both genders, is linked to having concurrent sexual relations, with the likelihood of concurrency increasing with the length of the relationship. Our estimations also reveal that sexual desire is an important correlate of concurrency for men more than women, and that one's partner's concurrency is strongly linked to one's own concurrency. Further, men are in general more sensitive to relationship specific factors.

Overwhelmingly however, we find that all models are significantly responsive to relationship specific factors, such as relationship satisfaction, relationship length and partner concurrency. The results therefore strongly suggest that the decision to engage in concurrency depends partly on the agent himself, but also on the relationship he finds himself in.

## Bibliography

- Adams, C. (1960). Marital Happiness Prediction Inventory. University Park, Pennsylvania: Division of Marriage and Family Service. *Working paper*.
- Bakilana, A. (2005). Age at Sexual Debut in South Africa. *African Journal of AIDS Research*, 4(1), 1-5.
- Becker, G. (1968). Crime and Punishment: An Economic Approach. *Journal of the Political Economy*, 76(2), 169-217.
- Becker, G. (1973). A Theory of Marriage: Part I. *Journal of the Political Economy*, 81(4), 813-46.
- Bernard, J. (1933). An instrument for measurement of success in marriage. *American Sociological Society*, 27, 94-106.
- Burgess, E. and Leonard C. (1939). *Predicting Success or Failure in Marriage*. New York: Prentice Hall.
- Buss, D. (2007). The Evolution of Human Mating. *Acta Psychologica Sinica*, 39(3), 502-512.
- Buss, D. and Schmitt, D. (1993). Sexual Strategies Theory: An Evolutionary Perspective on Human Mating. *Psychological Review*, 100(2), 204-32.
- Buss, D., Shackelford, T., Kirkpatrick, L., Choe, J., Lim, H. and Hasegawa, M. (1999). Jealousy and the Nature of Beliefs About Infidelity: Tests of Competing Hypotheses About Sex Differences in the United States, Korea, and Japan. *Personal Relationships*, 6(1), 125-150.
- Carter, M., Kraft, J, Koppenhaver, T., Galavotti, C., Roels, T. and Kilmarx, P. (2007). 'A bull cannot be contained in a single kraal': Concurrent sexual partnerships in Botswana. *AIDS and Behavior*, 11(6), 822-30.
- Cameron, S. (2002). The Economics of Partner Out Trading in Sexual Markets. *Journal of Bioeconomics*, 4, 195-222.
- Caraël, M., Ali, M. and Cleland, J. (2001). Nuptiality and risk behaviour in Lusaka and Kampala. *African Journal of Reproductive Health*, 5(1), 83-9.
- Colvin, M., Abdool Karim, S., Connolly, C., Hoosen, A. and Ntuli, N. (1998). HIV infection and asymptomatic sexually transmitted infections in a rural South African community. *International Journal of STD and AIDS*, 9(9), 54850.
- Cox, D. (2008). The Evolutionary Biology and Economics of Sexual Behavior and Infidelity. Department of Economics, Boston College. *Working Paper*.

- Cullinan, K. (2003). In South Africa HIV infection is decreasing, safe sex increasing. *Bullitin of the World Health Organization*, 81(1), 72.
- Darwin, C. (1859). *Origin of The Species*. London: Murray.
- Eaton, L., Flisher, A. and Aaro, L. (2003). Unsafe sexual behaviour in South African youth. *Social Science and Medicine*, 56(1), 149-65.
- Elmslie, B. and Tebaldi, E. (2008). So, Where Did You Sleep Last Night? The Economics of Infidelity. *Kyklos*, 61(3), 391-410.
- Epstein, H. (2010). The Mathematics of Concurrent Partnerships and HIV: A Commentary on Lurie and Rosenthal, 2009. *AIDS and Behaviour*, 14, 29-30.
- Fair, R. (1978). A Theory of Extramarital Affairs. *Journal of Political Economy*, 86(1), 45-61.
- Ghanem, K., Hutton, H., Zenilman, J., Zimba, R. and Erbelding, E. (2005). Audio computer assisted self interview and face to face interview models in assessing the response bias among STD clinic patients. *Sexually Transmitted Infections*, 81(5), 421-25.
- Government of South Africa (2007). HIV & AIDS and STI Strategic Plan for South Africa 2007-2011. [Online] Available at: <http://www.info.gov.za/otherdocs/2007/aidsplan2007/index.html>. [2010, 18 September].
- Government of South Africa (2010). Key facts of the National Communication Survey on HIV/AIDS, 2009. [Online] Available at: [http://www.info.gov.za/issues/hiv/survey\\_2009.htm](http://www.info.gov.za/issues/hiv/survey_2009.htm). [2010, 18 September].
- Gregson, S., Zhuwau, T., Ndlovu, J. and Nyamukapa, C. (2002). Methods to reduce social desirability bias in sex surveys in low-development settings: experience in Zimbabwe. *Sexually Transmitted Diseases*, 29(10), 568-75.
- Hamilton, G. (1929). *A Research in Marriage*. New York: Boni.
- Hendrick, S. (1988). A generic measure of relationship satisfaction. *Journal of Marriage and Family*, 50, 93-8.
- Hendrick, S., Dicke, A. and Hendrick, C. (1998). The relationship assessment scale. *Journal of Social and Personal Relationships* 15, 137-42.
- Hewitt, P., Mensch, B. and Erulkar, A. (2004). Consistency in reporting of sexual behaviour by adolescent girls in Kenya: a comparison of interviewing methods. *Sexually Transmitted Infections*, 80(2), 43-8.
- Hicks, M. and Marilyn, P. (1970). Marital happiness and stability: a review of the research in the 60's. *Journal of Marriage and the Family*, 32 (11), 553-74.

- Inselburg, R. (1964). The sentence completion technique in the measure of marital satisfaction. *Journal of Marriage and the Family*, 26 (8), 339-41.
- James, V. and Matikanya, R. (2006). *Protective factors: A case study for Ngudzeni ADP (Swaziland)*. World Vision Australia/ Swaziland.
- Johnson, L., Dorrington, R., Bradshaw, D., Pillay-Van Wyk, V. and Rehle, T. (2009). Sexual behaviour patterns in South Africa and their association with the spread of HIV: Insights from a mathematical model. *Journal of Demographic Research*, 21(11), 289-340.
- Kissinger, P., Rice, J., Farley, T., Trim, S., Jewitt, K., Margavio, V. and Martin, D. (1999). Application of computer-assisted interviews to sexual behaviour research. *American Journal of Epidemiology*, 149(10), 950-4.
- Lagarde, E., Auvert, B., Caraël, M., Laourou, M., Ferry, B. and Akam, E. (2001). Concurrent sexual partnerships and HIV prevalence in five urban communities of Sub-Saharan Africa. *AIDS*, 15(7), 877-84.
- Lawrence, K. and Byers, E. (1995). Sexual satisfaction in long-term heterosexual relationships: The interpersonal exchange model of sexual satisfaction. *Personal Relationships*, 2, 267-85.
- Lesthaeghe, R., Kaufmann, G. and Meekers, D. (1989). The Nuptiality Regimes in Sub-Saharan Africa. In *Reproduction and Social Organization in Sub-Saharan Africa*, Berkeley: University of California Press.
- Locke, H. (1951). *Predicting Adjustment in Marriage: a Comparison of a Divorced and a Happily Married Group*. New York: Henry Holt and Company.
- Locke, J. and Karlsson, G. (1952). Marital adjustment and prediction in Sweden and the US. *American Sociological Review*, 19 (Feb), 10-7.
- Locke, H. and Wallace, K. (1959). Short marital adjustment and prediction tests: their reliability and validity. *Marriage and Family Living*, 21(8), 251-5.
- Mah, T. and Halperin, D. (2010a). Concurrent sexual partnerships and the HIV epidemics in Africa: Evidence to move forward. *AIDS and Behavior*, 14, 11-6.
- Mah, T. and Halperin, D. (2010b). The Evidence for a Role of Concurrent Partnership in Africa's HIV Epidemics: A Response to Lurie and Rosenthal. *AIDS and Behavior*, 14, 25-8.
- Mattson, C., Bailey, R., Agot, K., Ndinya-Achola, J. and Moses, S. (2007). A nested case-control study of sexual practices and risk factors for prevalent HIV-1 infection among young men in Kisumu, Kenya. *Journal of Sexually Transmitted Diseases*, 34(10), 731-6.

- Meekers, D. and Van Rossem, R. (2005). Explaining inconsistencies between data on condom use and condom sales. *BMC Health Services Research*, 5(1), 5.
- Mensch, B., Hewett, P. and Erulkar, A. (2003). Reporting sensitive behaviour by adolescents: a methodological experiment in Kenya. *Demography*, 40(2), 1-22.
- Mialon, H. (2009). The Economics of Faking Ecstasy. Department of Economics, Emory University. *Working paper*.
- Morris, M. (2010). Barking up the Wrong Evidence Tree. Comment on Lurie & Rosenthal, "Concurrent Partnerships as a Driver of the HIV Epidemic in Sub-Saharan Africa? The Evidence is Limited". *AIDS and Behaviour*, 14(1), 31-3.
- Morris, M. and Kretzschmar, M. (1997). Concurrent partnerships and the spread of HIV. *AIDS (London, England)*, 11(5), 641-8.
- Morris, M. and Kretzschmar, M. (2000). A microsimulation study of the effect of concurrent partnerships on the spread of HIV in Uganda. *Mathematical Population Studies*, 8(2), 109.
- Nachabr, J. (1997). Prediction, Optimization, and Learning in Repeated Games. *Econometrica: Journal of the Econometric Society*, 64, 275-309.
- Nattrass, N. and Gonsalves, G. (2009). Economics and the Backlash against AIDS-Specific Funding. Paper for the WHO and World Bank and UNAIDS Economics Reference Group.
- Pagan, A. and Vella, F. (1989). Diagnostic Tests for Models Based on Individual Data: A Survey. *Journal of Applied Econometrics*, 4, S29 - S59.
- Paik, A. (2010). "Hookups, dating, and relationship quality: Does the type of sexual involvement matter?" *Journal of Social Science Research*, 39, 739-53.
- Peltzer, K., Matseke, G., Mzolo, T. and Mmapaseka, M. (2009). Determinants of knowledge of HIV status in South Africa: results from a population-based HIV survey. *BMC Public Health*, 9, 174-82.
- Potterat, J., Zimmerman-Rogers, H., Muth, S., Rothenberg, R., Green, D. and Taylor, J. (1999). Chlamydia transmission: concurrency, reproduction number, and the epidemic trajectory. *American Journal of Epidemiology*, 150(12), 13319.
- Pongou, R. (2009). An Economic Theory of Fidelity in Network Formation. Department of Economics, Brown University. *Working paper*.
- Reis, I., Anderson, R. and Sponaugle, G. (1980). A Multivariate Model of the Determinants of Extramarital Sexual Permissiveness. *Journal of Marriage and Family*, 42(2), 395-411.

- Schroeder, K. and Rojas, F. (2002). A Game Theoretic Analysis of Sexually Transmitted Disease Epidemics. *Rationality and Society*, 14(3), 353-383.
- Spanier, G. (1976). Measuring dyadic adjustment: New scales for assessing the quality of marriage and similar dyads. *Journal of Marriage and the Family* 38, 15-28.
- Treas, J. and Giesen, D. (2000). Sexual Infidelity Among Married and Cohabiting Americans. *Journal of Marriage and Family*, 62, 28-60.
- Turner, C., Ku, J., Rogers, S., Lindberg, L., Pleck, J. and Sononsteing, F. (1998). Adolescent sexual behaviour, drug use, and violence: Increased reporting with computer survey technology. *Science*, 280(5365), 867-73.
- University of Cape Town (2010). *Our history*. [Online] Available at: <http://www.uct.ac.za/about/intro/history/>. [2010, 18 September].
- Voeten, H., Egesah, O. and Habbema, J. (2004). Sexual behavior is more risky in rural than in urban areas among young women in Nyanza Province, Kenya. *Journal of Sexually Transmitted Diseases*, 31(8), 481-7.
- Wells, C. (2003). Retesting Fairs (1978) Model of Infidelity. *Journal of Applied Econometrics*, 18(2), 237-239.

## Appendixes

### Appendix A

Table A1:  
*Partner-Paramour Comparisons for the Male Population*

Variable	Partner		Paramour		Significance Level
	Mean	SD	Mean	SD	
Age	23.26	5.24	23.03	4.92	NS
Sexual attraction (1-10)	7.79	1.66	7.04	2.49	5%
Nonsexual attraction (1-10)	7.07	2.11	5.14	2.80	1%

*Notes:* The last column reports the significance level of mean-comparison test between the partner and paramour sample, against the two-sided alternative.

Table A2:  
*Partner-Paramour Comparisons for the Female Population*

Variable	Partner		Paramour		Significance Level
	Mean	SD	Mean	SD	
Age	23.39	4.20	23.23	3.61	NS%
Sexual attraction (1-10)	8.29	1.43	6.28	2.80	1%
Nonsexual attraction (1-10)	8.08	1.88	6.03	2.80	1%

*Notes:* The last column reports the significance level of mean-comparison test between the partner and paramour sample, against the two-sided alternative.

### Appendix B

What follows is a copy of the survey administered to UCT students on the Vula site.

## Correlates of Concurrency Research Survey:

### Section 1: About you:

Are you a student at UCT or a staff member at UCT?  
(Student / Staff / Not registered at UCT as either)

In which faculty are you currently registered?  
(Commerce / Humanities / Engineering and the Built Environment / Law / Science / Health Sciences)

What is your age?  
(Integers)

What is your biological sex?  
(Male / Female)

What is your race ethnicity?  
(African / Indian / Asian / White / Coloured / Other)

What is your home language?  
(Afrikaans / English / IsiNdebele / IsiXhosa / IsiZulu / Sepedi / Sesotho / Setswana / SiSwati / Tshivenda / Xitsonga / Other)

What is your monthly income from all sources (allowance, work, etc)?  
(Integers)

Which of the following best describes your sexual preference?  
(Heterosexual / Bisexual / Homosexual)

During the last month, how often would you have liked to engage in sexual activity with a partner?  
(None / Once a month / Once every two weeks / Once a week / Twice a week / 3 to 4 times a week / Once a day / More than once a day)

In the last month, how often have you had sexual thoughts involving a partner?  
(Once or twice a month / Once a week / Twice a week / 3 to 4 times a week / Once a day / A couple of times a day / Many times a day)

During the last month, how often would you have liked to engage in sexual activity with yourself?  
(None / Once a month / Once every two weeks / Once a week / Twice a week / 3 to 4 times a week / Once a day / More than once a day)

How important is it for you to fulfill your desires to behave sexually with a partner?  
(scale of 1 - 7)

How important is it for you to fulfill your desires to behave sexually by yourself?  
(scale of 1 - 7)

How many sexual partners have you had in your lifetime?  
(Integer numbers)

How many sexual partners would you have liked to have had so far?  
(Integer numbers)

For the purposes of this survey, *safe sex* is defined as sex where participants take precautions to protect themselves against sexually transmitted diseases such as AIDS.

When you do have sex, how often do you practice safe sex?  
(Never / Sometimes / Regularly / Always)

At what age did you first have full penetrative sex?  
(Integers)

How many times have you been tested for Sexually Transmitted Infections?  
(Never / Once / Twice / Three times / Four, or more times)

Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks? On a scale of 1 – 10, please rate your attitude to risks below (1 being unwilling to take risks, 10 being fully prepared to take risk)

How religious do you consider yourself to be?  
(scale of 1-10; 1 being not religious at all, 10 being very religious)

## Section 2: About your relationships with others:

Are you committed to having sexual relations with only this partner? i.e. Are you in a monogamous relationship?  
(Yes / No)

How long have you and your sexual partner been together?  
(Time in years and months)

Over the life of your relationship, how satisfied have you been with the sexual component of your relationship with your partner?  
(scale of 1 – 10; 1 being very dissatisfied, 10 being very satisfied)

Over the life of your relationship, how satisfied have you been with the non-sexual component of your relationship with your partner?  
(scale of 1 – 10; 1 being very dissatisfied, 10 being very satisfied)

How sexually attracted are you to your partner?  
(scale of 1 – 10; 1 being no attraction at all, 10 being extremely attracted)

How attracted are you to your partner non-sexually?  
(scale of 1 – 10; 1 being no attraction at all, 10 being extremely attracted)

What is your partner's age?  
(Integers)

What is your partner's race ethnicity?  
(African / Indian / Asian / White / Coloured / Other)

For the purposes of this survey, 'cheating' is defined as sexual relations with someone who is not the person you are currently in a committed sexual relationship with. These

sexual relations may include kissing, oral stimulation, manual stimulation, sexual intercourse, etc.

How acceptable is cheating on your partner?  
(scale of 1 – 10; 1 being completely unacceptable, 10 being completely acceptable)

To the best of your knowledge has your current sexual partner cheated on you?  
(Yes / No)

Have you ever cheated on your current sexual partner?  
(Yes / No)

If yes to question Y above, please answer questions X – XX, below.

Referring now to the person who you cheated on your partner with: How sexually attracted were you to them prior to having sexual relations?  
(scale of 1 – 10; 1 being no attraction at all, 10 being extremely attracted)

Referring again to the person who you cheated on your partner with: How attracted (other than sexually) were you to them prior to having sexual relations?  
(scale of 1 – 10; 1 being no attraction at all, 10 being extremely attracted)

What is this person's age? (who you cheated on your partner with)  
(Integers)

What is this person's biological sex?  
(Male / Female)

What is this person's race ethnicity?  
(African / Indian / Asian / White / Coloured / Other)

Imagine that your partner cheated on you, and you found out, what do you think your reaction would be?  
(scale 1 – 10, 1 being no reaction at all and continue relationship as it was, 10 being an extreme negative reaction and definitely break up)

Imagine that you cheated on your partner and he/she found out, what do you think his/her reaction would be?  
(scale 1 – 10, 1 being no reaction at all and continue relationship as it was, 10 being an extreme negative reaction and definitely break up)