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Intra-Household Bargaining Power and HIV Prevention: Empirical Evidence from Married Couples in Rural Malawi[1]

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Abstract

This paper studies the dynamics between intra-household bargaining power and HIV prevention from a systemic perspective, using a panel data set of 500 married couples in rural Malawi from 2004-2008. All information has been matched at the couple level, which allows to directly assess the effect of a relative increase in bargaining power, as measured by economic, social and relationship variables, on both spouses' attitudes towards HIV prevention, while controlling for HIV status. I employ a fixed effects linear probability model with national and region-specific time trends in order to capture both unobserved heterogeneity at the individual level as well as differences in HIV prevalence and intensity of HIV campaigns in the three regions that are studied. The results show that factors that are associated with a relative increase in female bargaining power, such as own earnings and attendance of women at local political meetings, are related to improved acceptance of HIV prevention.

Keywords

HIV/AIDS, gender, intra-household bargaining, spousal communication, condom use, Sub-Saharan Africa, Malawi.

JEL Classification

I14, J16, O15.

1 INTRODUCTION

This paper aims at a better understanding of the interplay between bargaining power and HIV prevention among married couples in rural Malawi. Most HIV infections in Sub-Saharan Africa occur during heterosexual intercourse between persons in couple relationships, which is contrary to the nature of the disease in many Western countries, where key populations at higher risk include injecting drug users, men who have sex with men (MSM), and sex workers, i.e., groups that are less likely to be living in stable relationships (UNAIDS, 2010, p. 30; Painter, 2001). HIV prevention among couples is insofar different from the prevention needs of single individuals as the use of condoms might not always be practical in long-term relationships, particularly if a couple desires children. On a more general note, there are always important interaction effects between individual HIV prevention efforts and one's partner's behavior. In order to fight the spread of HIV, it is therefore highly relevant to understand how couples decide on HIV prevention methods.

The present analysis focuses on the role that intra-household bargaining power plays for this decision since gender inequality has been identified by UNAIDS as a key driver of the HIV epidemic (2012b, pp. 12 & 70): The marginalization of women in many societies, particularly in developing countries, creates considerable barriers with respect to access to HIV prevention, treatment and care services (Conrad and Doss, 2008). Further, women are biologically twice more likely to become infected with HIV through unprotected heterosexual intercourse than men (Türmen, 2003). As a consequence of these two reasons, in Sub-Saharan Africa, where two-thirds of all HIV-infected people live, women account for 59 percent of all HIV-infected individuals (UNAIDS, 2012a). Women's leverage in bargaining for safe sex is crucially affected by the economic and social situation of both themselves as well as their partners, which makes it worthwhile to study HIV prevention from a systemic perspective, i.e., based on data from both partners.

This paper provides an empirical study of intra-household bargaining power and HIV prevention, using a matched couple panel data set from the Malawi Diffusion and Ideational Change Project MDICP. The present analysis is unique in its approach to match all couples' information from 2004 - 2008, which enables to directly assess the effect of an increase in female bargaining power on her own or her husband's attitudes towards HIV prevention, while controlling for the bargaining situation and HIV status of both partners. In addition, the data allows not only to link women to their husbands, but also to use information on their husband's additional wives in the case of polygamous relationships, which make up close to 18 percent of the sample.

The HIV prevention methods that I study are situated in the context of the ABC strategy "Abstain,

Be faithful, use Condoms". Given that I am studying married couples, I focus on the two latter elements of this strategy, i.e., condom use and fidelity, rather than abstinence. Attitudes towards condom use and HIV prevention in general are measured (i) directly with a survey item on the acceptance of condom use within marriage and (ii) indirectly with a variable that indicates whether participants have talked about the risk of HIV with their spouse. Qualitative evidence from Zulu and Chepngeno (2003) shows that these discussions often cover fidelity, condom use with extramarital partners and/or other risk-reduction strategies. (iii) Fidelity is measured with a survey item on self-reported extramarital affairs.

When assessing the determinants of these three HIV prevention strategies, I use data on both spouses' economic situation, their status inside the relationship and in the society in general, in order to reflect bargaining power inside the relationship as well as partners' outside options - which will ultimately define their threat point - from a systemic and multidimensional perspective (Doepke and Tertilt, 2011; Gutiérrez et al., 2000). In addition, the panel dimension of the MDICP provides a rich set of controls. Since the same individuals have been interviewed repeatedly, this allows the use of individual-specific fixed effects in order to capture time-invariant unobserved heterogeneity. The estimation equation further contains village- and region-specific fixed effects in order to take into account the influence of a participant's social network on individual attitudes related to HIV prevention. The impact of HIV awareness campaigns and increases in HIV prevalence on prevention behavior is captured with a time trend. Besides a national, a region-specific time trend is used in order to address differing effects and prevalence levels across survey regions over time.

The hypotheses assessed in the course of the analysis are the following: (i) Women's empowerment, and the increase in bargaining power associated with it, promotes HIV-related spousal communication among married couples, (ii) the perception of condoms as an appropriate method for HIV prevention among married couples becomes more prevalent as women's bargaining power increases, and (iii) behavior that is associated with increased risk for HIV infection, such as extramarital infidelities, decreases as women become more empowered.

Overall, the results from a fixed effects linear probability model with time trends show that attitudes towards HIV prevention are significantly affected by intra-household bargaining power. In particular, factors that are associated with an increase in female bargaining power are also found to correlate with higher acceptance of HIV prevention. Namely, own earnings and attendance of women at local political meetings significantly increase the propensity for HIV-related spousal communication. For the acceptance of condom use within marriage, the number of co-wives appears to be play a dominant role. However, when looking at the subsample of most empowered women, higher female earnings are also significantly related to higher acceptance of condom use within marriage. Regarding the determinants of self-reported infidelity, the data

fails to detect a significant association with any of the bargaining power variables.

The results are robust to various modifications in the estimation equation. In order to also use information on junior wives in the case of polygamous relationships, I perform the estimations using average, minimum or maximum values across all spouses, which leads to highly similar estimates. Further, the potential for variation in the impact of income on prevention behavior at different levels of income is assessed by re-estimating the equation using earnings in groups instead of logged income values, and the results remain comparable. Although the main interest of this analysis lies in the individual contribution of each of the bargaining power variables, I also employ a bargaining power index derived from factor analysis in order to assess the joint impact of the variables, which, in line with the baseline model, suggests that higher relative female bargaining power improves attitudes towards HIV prevention among married couples in rural Malawi. Finally, in order to assess whether the results depend on the functional form of the model, I estimate a conditional logit instead of a fixed effects linear probability model, and the results remain robust across all model choices.

The contributions of this research to the existing literature - discussed in more detail in Section 2 - are twofold. First, I take a systemic perspective by employing matched couple data together with multidimensional empowerment measures. Second, I address issues stemming from unobserved heterogeneity by using panel data methods. Previous empirical studies of this subject using couple data from Sub-Saharan Africa can be found in two streams of literature. The first one employs cross-sectional data in order to analyze the association between various dimensions of partners' bargaining power and HIV prevention or risk (Bishai and Grossbard, 2010; Lepine et al., 2013; Ntshebe, 2011; Van der Straten et al., 1998; Zulu and Chepngeno, 2003). While being highly informative regarding HIV prevention behavior among couples, by relying on cross-sectional data these studies might be facing potential issues with respect to unobserved heterogeneity.

The second stream of literature focuses on the identification of a causal relationship between female economic bargaining power and HIV prevention and/or HIV risk in couple datasets (Orfei, 2012; Kohler and Thornton, 2011; De Walque et al., 2012; Dworkin and Blankenship, 2009). While economic independence is a crucial element in increasing female intra-household bargaining power, social empowerment might be just as important, especially with respect to intimate decisions (Duflo, 2012, pp. 1060-1064; Kim et al., 2008). Gerritzen (2012) contributes to the literature on female bargaining power and HIV prevention by using a multi-dimensional empowerment definition in a panel dataset from the MDICP. However, the analysis is based on a sample of married women, i.e., without capturing the systemic components of household and relationship factors. To the best of my knowledge, there is no previous study that follows a systemic approach based on matched couple data in order to assess the impact of intra-household bargaining power

on attitudes towards HIV prevention (and risky behavior) that goes beyond economic empowerment and still finds a credible way to deal with unobserved heterogeneity.

The paper proceeds as follows: Section 2 presents theoretical considerations and previous empirical contributions to the study of intra-household bargaining in the context of HIV prevention. An introduction to the MDICP data set, together with descriptive statistics is provided in Section 3. Section 4 shows the empirical strategy and main results, followed by robustness checks. Open issues and potential extensions are discussed in Section 5. Section 6 concludes.

2 Literature review

This section provides an overview of previous literature on the role that intra-household bargaining power plays for HIV prevention. The first part describes theoretical contributions, whereas the second part presents empirical analyses based on couple data from Sub-Saharan Africa.

2.1 Theoretical considerations

2.1.1 Economic contributions to HIV research

From a theoretical perspective, it seems puzzling that individuals do not use protection against a disease that is well-known to be deadly, particularly since condoms are neither expensive nor difficult to use. This question is even more pressing for women, who are biologically twice more likely to become infected with HIV through unprotected heterosexual intercourse than men. Philipson and Posner (1993) argue that the failure to use condoms as protection against HIV is not necessarily irrational, but rather depends on the expected utility associated with unprotected sex. Engaging in unprotected sex can be a rational decision if the cost associated with using protection (e.g., financial cost, discomfort of condoms, stigma) exceeds the benefit from doing so (e.g., avoiding an infection with HIV). The decision to use protection is taken under uncertainty, namely regarding the HIV status of oneself and one's partner, as well as the actual transmission probability of HIV.

In this line of thinking, the expected utility associated with unprotected sex is different for men and women since the discomfort associated with condoms is negligible for women, but also because of gender-specific differences in fertility preferences and HIV infection risk (Philipson and Posner, 1993, pp. 32-42, 76-81, 114-116, 208). However, women might still engage in unprotected sex if they were to receive sufficient compensation for the experienced disutility, up to the point where the expected utility of unprotected sex

would be zero or positive. Compensation could either be pecuniary or "embedded in a relationship involving an exchange of multiple services" (Philipson and Posner, 1993, p. 34).

Critics of the Philipson-Posner framework have challenged their use of rather simplistic epidemiological models, and even more so the strong focus on private choices of perfectly rational individuals and the abstraction from constraints induced by cultural and societal structures and realities (Conrad and Doss, 2008; Gaffeo, 2003). The model largely ignores the importance of extra-economic coercion due to social and cultural inequalities as well as the inability of some partners to enforce contracts or to exit the market in the absence of outside options (Christensen, 1998, p.12). As Eskridge and Weimer (1994, p. 735) put it, "most events that transmit HIV are not the result of well-informed, voluntary decisions by mature decision makers" and thus, the resulting level of HIV prevalence within gender-related inequitable structures can hardly be considered to be optimal and utility-maximizing.

The Philipson-Posner (1993, p. 32) model incorporates cultural dimensions to the extent that it accounts for the increases in costs of condom use for members of a culture where this is associated with stigma (e.g., it is seen as a signal of HIV risk) or not in line with expected behavior. In rural Malawi, as well as in many other traditional, rural societies in Sub-Saharan Africa, the use of condoms is strongly associated with extramarital relationships and not considered acceptable among married couples - thus increasing the cost of condom use in the marital setting (Chimbiri, 2007).

It is therefore important to reflect on approaches to decrease the cultural cost in traditional societies associated with behaviors that reduce the risk of HIV infection. In the presence of cultural barriers, an increase in women's bargaining power can be expected to improve and promote HIV prevention efforts. As women become more empowered, they realize that their health status is not determined by others or by fate, but rather that it lies within their own hands to protect themselves (Gutiérrez et al., 2000).

2.1.2 Intra-household bargaining models

In Becker's (1965; 1976; 1981) original model, the household is interpreted as a unit with a unitary preference structure where an altruistic household head allocates pooled resources in order to maximize household utility derived from consumption and production. In the context of HIV prevention, the household head would decide in favor of HIV protection if doing so maximizes overall household utility, though not necessarily individual utility. Based on Becker's framework, a number of bargaining models have emerged that challenge the view of the household as a unitary entity and introduce conflicts of interest in combination with gendered social behavior norms (Chiappori and Donni, 2009; Doepke and Tertilt, 2011). The resulting arrangements can be either cooperative or non-cooperative, whereupon an individual's bargaining power

determines his or her share from the entire payoff. In these models, household members decide for a co-operative arrangement if the resulting payoff makes each of the partners better off than the share that they receive under non-cooperation, and vice versa. Leaving the relationship represents a non-cooperative solution and thus, bargaining power and an individual's threat point are also determined by an individual's options outside the relationship (Agarwal, 1997; Conrad and Doss, 2008).

Concealability of HIV prevention

A number of applications of bargaining power theory on fertility decisions analyze situations where perceptions of ideal family size differ among men and women (e.g., Rasul, 2008). For example, experimental evidence from Ashraf et al. (2013) shows that women who were informed about contraceptives in the absence of their husband were more likely to use contraceptives and they were also more likely to decide for concealable forms of contraception. It is important to note that fertility decisions are conceptually different from HIV prevention decisions. Numerous methods of birth control are concealable, e.g., women could use contraceptive shots or birth control pills without the husband noticing it, whereas HIV prevention typically involves barrier methods of contraception (such as male or female condoms) which are not concealable and therefore require the cooperation of the male partner.

Limitations for married couples

There is a conceptual difference between marital and extramarital sex that needs to be taken into account when studying the link between female bargaining power and HIV prevention. Namely, the widely promoted ABC approach "Abstain, Be faithful, use Condoms" might not necessarily suit the reality of married couples: The first element of ABC campaigns, abstinence, cannot be considered to be a practicable prevention method in the context of married individuals. The second element recommends fidelity in order to avoid HIV risk. This is particularly relevant in the context of married couples, as longitudinal research has shown that the biggest HIV infection risk for married women is their husbands' extramarital activities (O'Leary, 2000; de Zoysa et al., 1996). When it comes to the third element of the ABC strategy, condoms, it has been mentioned above that condom use is not well accepted among married couples in rural Malawi due to its strong cultural association with infidelity (Chimbiri, 2007; Zulu and Chepngeno, 2003). Furthermore, using condoms is also impracticable for married couples that plan to conceive. With respect to HIV prevention, condom use with partners outside the marital relationship appears to be even more important. It is therefore not surprising that discussions on condom use with extramarital partners, as well as on fidelity, constitute a central element of HIV-related spousal communication, as qualitative studies of couple data have shown (Zulu and Chepngeno, 2003).

Thus, an effective HIV prevention strategy for married couples would be if spouses are either faithful

to each other or if they use condoms with extramarital partners. Using the terminology of the bargaining approach, both methods represent cooperative solutions as they cannot be enforced unilaterally and require the consent of both partners.[1] The need for cooperative bargaining solutions makes HIV-related spousal communication an important element of HIV prevention strategies (Noar et al., 2006). The only feasible non-cooperative solution for women would be to leave a partner who is unfaithful or unwilling to use HIV protection.[2] Indeed, calling for a divorce in order to respond to an increase in HIV infection risk through their husband's behavior appears to be an increasingly common reaction by women, also in rural Malawi (Reniers, 2008).

2.2 Empirical contributions

Previous empirical studies of intra-household bargaining power and HIV prevention using couple data from Sub-Saharan Africa can be found in two streams of literature. The first one employs cross-sectional data in order to analyze the association between various dimensions of partners' bargaining power and HIV prevention or risk. Based on cross-sectional household data from Uganda, Bishai and Grossbard (2010) study the prevalence of extramarital relationships, which constitutes an important risk factor for HIV infection. The authors show that bridewealth payment is associated with a decrease in extramarital behavior for women, but not for men. A study of Lepine et al. (2013) on the determinants of HIV testing among Nigerian couples reveals that routine testing appears to be particularly effective to increase HIV testing among women, whereas education, wealth and perceived risk are important predictors for both men and women alike. Ntshebe (2011) studies contraceptive uptake among couples who participated in the 2001 wave of the MDICP and investigates whether couples' propensity to use any traditional or modern form of birth control is associated with differences in age and education - both of which are meant to reflect bargaining power - and perception of HIV risk. However, since the analysis does not distinguish between different forms of contraception, it is not possible to say whether couples use contraceptives that also protect them against HIV, i.e., barrier methods, or not. Dunkle et al. (2004) and Van der Straten et al. (1998) analyze couple data from South Africa and Rwanda and find that HIV prevalence is higher for women who are subject to sexual coercion and physical violence in intimate relationships. Zulu and Chepngeno (2003) study HIV-related spousal communication among married couples using data from the 1998 wave of the MDICP and find that for women, more informal social contacts and greater exposure to HIV program sources (such as messages from radios, health clinics, and community based health workers) are associated with better HIV protection.

All of the aforementioned studies rely on cross-sectional data and thus might be facing potential issues

with respect to unobserved heterogeneity. Namely, if individual-specific unobservable factors, e.g., attitudes such as carefulness and diligence, simultaneously affect the bargaining power variables as well as HIV prevention behavior, this could lead to omitted variable bias. Lepine et al. (2013) try to capture unobserved heterogeneity at the village and state level by using a three-level random-intercept logistic model. Even though unobservable local variation in beliefs and attitudes can be expected to play an important role with respect to HIV prevention, unobserved variation at the individual level cannot be captured in such a set-up. I add to this literature by using panel data and fixed effects estimation methods in order to deal with individual-specific unobserved heterogeneity in this regard.[3]

The second stream of literature focuses on the identification of a causal relationship between female economic bargaining power and HIV prevention and/or HIV risk in couple datasets. Orfei (2012) studies the effect of exogenous shocks to female bargaining power on male extramarital behavior in West Africa. He uses exogenous variation in kin support resulting from the death of a younger sibling and finds that this increases the propensity for male infidelities. The differing impact of conditional cash transfer programs for HIV prevention uptake on married men and women has been analyzed by e.g., Kohler and Thornton (2011) as well as De Walque et al. (2012). However, even though a large number of the participants in these studies are married, spousal data has not been linked, so it remains unclear what the impact on the bargaining situation at the couple level would look like. Furthermore, there is a growing microfinance literature, for which a research agenda has been laid out in Dworkin and Blankenship (2009), that links HIV and microfinance programs since "two of the most commonly identified structural determinants of HIV/AIDS are poverty and gender inequality". Indeed, access to finance is a crucial element in increasing female intra-household bargaining power, but social empowerment might be just as important as economic empowerment, especially with respect to intimate decisions (Duflo, 2012, pp. 1060-1064; Kim et al., 2008).

Gerritzen (2012) contributes to the literature on female bargaining power and HIV prevention by using a multi-dimensional empowerment definition when analyzing a panel dataset of over 1,200 married women from the MDICP data set from 1998-2008. Using panel data methods, the analysis shows that women's empowerment promotes the acceptance of adequate HIV prevention strategies. However, the study assesses these effects in a sample of women, i.e., not from a systemic point of view.[4]

The present study is thus unique in its approach to link data at the couple level over several years when analyzing HIV prevention among married couples, a perspective which is further enriched by employing a multidimensional empowerment definition that goes beyond economic empowerment and by using panel data methods to avoid omitted variable bias due to unobserved heterogeneity.

3 Data and descriptive statistics

3.1 The MDICP dataset

The dataset is based on panel data of spouses who participated in the 2004, 2006 and 2008 waves of the Malawi Diffusion and Ideational Change Project MDICP. The MDICP is an ongoing longitudinal survey by the University of Pennsylvania and the Malawi College of Medicine that has been carried out since 1998 and follows approximately 3,000 randomly selected individuals in rural Malawi. The study is conducted in 120 villages that cover all three regions of the country: Rumphi (north), Mchinji (central) and Balaka (south). The survey response rate is consistently above 65 percent in all waves, with an atttrition rate of less than 25 percent, which is mainly due to migration. Furthermore, new participants have been added to the sample in 2004.[5]

One of the main interests of the MDICP is to study the role that informal networks play in the context of contraceptive decision-making and HIV prevention strategies, mainly through their effect on fertility preferences and diffusion of HIV-relevant knowledge (Watkins et al., 2003). The survey questionnaires used for this analysis collect information on socio-demographic characteristics and fertility preferences. In addition, the data also includes HIV biomarkers from voluntary HIV tests that have been carried out in 2004, 2006 and 2008. The tests were free of charge and included a randomized financial incentive for participation. Therefore, self-selection of low-risk individuals into HIV screening activities is not an issue in this setting. Namely, the share of respondents who agreed to get tested for HIV was consistently over 90 percent (Anglewicz et al., 2009; Thornton, 2008).

The individual-level data from the MDICP captures behavioral and socio-economic information on both wives and husbands which allows for a comprehensive approach towards studying HIV prevention. This implies that the analysis can directly compare the effect of an increase in female bargaining power on her own or her husband's behavior, while controlling for the bargaining situation of both partners as captured by economic, social and relationship variables. In addition, the data allows not only to link women to their husbands, but also to use information on their husband's additional wives in the case of polygamous relationships, which make up close to 18 percent of the sample. I thus expect to gain a thorough understanding of the impact of women's empowerment on bargaining processes in the context of HIV prevention, also in the case of concurrent partnerships.

Regarding external validity, Malawi proves to be a useful case to study the impact of intra-household bargaining power on HIV prevention. With respect to social and economic characteristics as well as regarding the national HIV prevalence of 11 percent, Malawi is highly comparable to other countries in Southern

Africa that are similarly affected by the epidemic (UNAIDS, 2010, pp. 22-30). The sampling strategy of the MDICP was not explicitely designed to be representative of the national population, however, in 1998 the sample characteristics closely matched those found by the 1996 Demographic and Health Survey DHS for rural Malawi (Watkins et al., 2003). Although the level of HIV prevalence among the MDICP population is slightly lower than the values found by the DHS, the MDICP can nevertheless be considered as representative for the rural Malawian population (Anglewicz et al., 2009; Thornton, 2008).

Another reason for the sample choice is that, in contrast to urban areas, HIV prevalence in rural areas of Malawi has been increasing over the past years, which makes it even more relevant to study a survey population such as the one from the MDICP. In this regard, it also has to be kept in mind that in 1994 the government of Malawi implemented a national population policy, which promoted the use and availability of contraceptives, in order to reduce maternal and infant mortality by lengthening birth intervals, but also in response to the HIV/AIDS crisis (Chimbiri, 2007, p. 1103). In other words, we can assume that a large majority of the population knows how HIV is contracted and how an infection with HIV can be avoided. Thus, lack of information on effective HIV prevention does not seem to be the issue, rather there appear to be other reasons that impede condom use. This is also reflected by the survey items in the MDICP that assess knowledge on prevention.

3.2 Descriptive statistics

Descriptive statistics are provided in Table 1 for male and female survey respondents, separately. The MDICP is being conducted in a rural, traditional society where the daily lives of men and women are profoundly different. The importance of cultural expectations in shaping gendered realities is also reflected by the results from the t-tests provided in Table 1 which show significant differences between male and female survey participants. An overview on the variables included in the analysis is given in the appendix in Table A.1, together with graphical representations of summary statistics over time (Figure B.1 - B.12).

(Insert Table 1 here)

3.2.1 Dependent variables

Three dependent variables are included in the analysis in order to assess the three hypotheses on spousal communication, acceptance of condom use within marriage and self-reported extramarital behavior.

Spousal communication

This dummy variable measures if spouses have - at any point in the relationship - talked with each other about the risk of HIV and what they can do as a couple in order to protect each other from getting infected. As aforementioned, these discussions often cover fidelity and/or condom use with extramarital partners (Zulu and Chepngeno, 2003). The descriptive statistics in Table 1 show that over 87 percent of the MDICP participants have had such a conversation with their spouse. Although the difference is relatively small, husbands are significantly more likely to have had this type of conversation than their (first) wives (see Table 1). This is due to the fact that polygamous men in the sample could have had this conversation not only with their first wife (whose data is included in the table), but also with one of their other wives.[6] However, over-reporting due to social desirability could also play a role in this regard. In the analysis, I therefore use the spousal communication variable as reported by both, husband and first wife, in order to study the determinants of both partners separately.

Acceptance of condom use within marriage

Acceptance of condom use within marriage is reflected by a dummy variable that takes the value one if the respondent considers condoms as an acceptable prevention method for married couples. Over 37 percent of the female respondents are in favor of using condoms, where as the share among male proponents is 29.8 percent and thus significantly lower (see also t-tests in Table 1). This is in line with the higher implied cost of condom use for men, as suggested by Philipson and Posner (1993). In the following analysis, I study the determinants of acceptance of condom use of both partners, by using the reported values with respect to this variable for husband and first wife.

Extramarital Behavior

The third dependent variable in the analysis is infidelity, as measured by self-reported male extramarital relationships. In the survey item that is used for the present analysis, participants were asked about the number of sexual partners that they had during the last year (after being reminded about the confidentiality of their answers). I focus on male extramarital activities, which has been shown to be an important HIV risk factor for married women. The focus on male rather than female self-reported infidelities is also common in the literature as men's self-reported behavior in this regard tends to be more reliable than women's (Orfei, 2012; de Paula et al., 2013). This holds particularly in traditional societies where promiscuous behavior is generally not acceptable for women, but tends to be more accepted and to a certain degree even expected from men.[7] Based on the number of wives, it can be derived whether the participant was unfaithful during the last year. In other words, if a participant is polygamous, this is not seen as an infidelity. I then use this information to construct a dummy variable that takes the value one if the respondent (implicitly) reports an infidelity. This is the case for 10 percent of the married men in the MDICP data, but only for 1.7

percent of the women. As mentioned above, particularly in traditional societies, self-reported extramarital behavior tends to be less reliable for women than for men, and is therefore not going to be used for this analysis.[8]

3.2.2 Measures of intra-household bargaining situation

For the empirical analysis, I use a multidimensional measure of bargaining power that captures economic aspects, both partners' status inside the relationship and in society in general.

Economic Situation

The variables in this section describe both the actual economic situation of survey participants, measured by own earnings, and their economic potential, as represented by their education (see also Table 1). The large majority of MDICP respondents makes a living from subsistence farming. Some of their products will be sold on local markets, though. The yearly income that respondents make in this way and that they can use at their own discretion is measured with the earnings variable. Provided that the analysis controls for family wealth and land ownership (see below), the earnings measure can be interpreted as an important component of an individual's economic situation. Education is measured as years of formal schooling that the participant has attended.

There are large and statistically significant gender-specific differences with respect to the economic variables (see also t-tests in Table 1): Male respondents generate an average yearly income of 28,888 Malawi Kwacha (67 USD), which is significantly higher than the average earnings among female respondents (15,681 Malawi Kwacha or 37 USD). Generally speaking, for both men and women alike, earnings appear to be very low. However, to put these figures into perspective, one has to take into account that nominal GDP per capita in Malawi was 253 USD in 2012 and that, given the importance of subsistence farming in rural Malawi, not all business activities might involve monetary compensation. The level of education is low among all MDICP participants, and it is again lower among women who have on average followed three years of formal education, compared to four years among the male survey population.

Relationship

The next group of variables includes proxies for factors that can be expected to affect bargaining power inside the couple relationship. Due to the widespread prevalence of polygamy, particularly in Northern Malawi, I control for the number of women that the husband is married to. As aforementioned, polygamous couples make up close to 18 percent of the sample. On average, men in the survey have 1.2 wives, with the maximum number of wives being four. I also control for the awareness of options outside of marriage with

a dummy variable based on a survey item that asked if the respondent considers it to be acceptable for a wife to leave her husband if he beats her. 78.6 percent of the women agreed with this, whereas the share of men agreeing with this statement was 70.2 percent and thus significantly lower (see also t-tests in Table 1).

Society

The social status of both spouses is captured with a variable measuring the number of local political meetings that respondents have attended during the last year. On average, men report significantly higher attendance at political meetings (2.3 times a year compared to 1.2 times a year as reported by the women) and therefore appear to be better integrated in the processes that shape and define the local society.

3.2.3 Demographic characteristics and further controls

The last set of variables includes standard demographic controls. In 2004, 2006, and 2008, HIV tests were conducted among the MDICP survey population (see also Section 3.1). In the MDICP subsample that is used for this analysis, 3.6 percent of the women and 4.6 percent of the husbands are HIV-positive (average values from 2004, 2006, and 2008). Contrary to what one would expect, the difference in HIV prevalence between men and women is not statistically significant. It has to be taken into account, though, that the summary statistics in Table 1 are for husbands and their first wives only. Typically, HIV prevalence is higher among junior wives, which partly stems from the larger share of AIDS widows among second wives due to the institution of wife inheritance (Reniers and Tfaily, 2008). As depicted in Table A.2, besides the over 500 first wives that are studied in the main analysis, there is also information available on approximately 100 junior wives. Among these junior wives, average HIV prevalence is 6.2 percent. Furthermore, it has to be kept in mind that the MDICP subsample that is used for the following analysis is also unique insofar as it contains information on couples where both partners consistently participated in the MDICP survey during at least two waves and also remained married over this time period. It is therefore not surprising to see that with 3.1 percent in 2004 and 5.4 percent in 2008, HIV prevalence in the subsample of husbands and first wives is also lower than in the full MDICP survey population (6.4 percent in 2004 and 8.9 percent in 2008). Against the backdrop of the potential selectivity of the subsample that is used for this study, it becomes even more important to control for individual HIV status and for unobserved heterogeneity using individual-specific fixed effects in the analysis.[9]

The effects of participants' age and family size on prevention behavior is controlled for by a birth cohort measure and the number of living children. The difference in the average number of children as reported by husband and first wife in Table 1 stems from the fact that in polygamous relationships, the husband often also has children with his other wives. In addition, I also control for family wealth and land ownership in

order to ensure that the income variable described above reflects personal income and not family income.

Furthermore, I control for the region of residence because there are important cultural and ethnical differences between the three regions included in the MDICP. Whereas inheritance and residence are predominantly matrilinear in the Southern region, they typically follow a patrilinear pattern in the Northern part of the country. In the Central region, both matri- and patrilinearity can be observed. While there are large differences across regions with respect to ethnicity, religion, and customs, within themselves the regions are rather homogenous. The dominant ethnicity in the North are the Tumbuka, in the Central region the Chewa, and in the South the Lomwe and Yao. In the North, the majority of the population is Protestant, whereas in the Central region Catholicism and Protestantism are equally important. The South is predominantly Muslim (Helleringer and Kohler, 2005, pp. 267-271; Watkins et al., 2003, p. 6).

4 Empirical strategy and results

4.1 Estimation strategy

In order to analyze the three hypotheses stated in Section 1, I use panel data estimation methods in a sample of married couples from rural Malawi who participated in the 2004, 2006 and 2008 waves of the MDICP.

4.1.1 Estimation equation

I estimate a fixed effects linear probability model in order to understand the effect of intra-household bargaining and women's empowerment on HIV prevention inside and outside the marital relationship:

$$y_{it} = \mathbf{x}'_{it,pt}\beta + \eta_i + \eta_j + \eta_k + \lambda_t + \lambda_{tk} + \varepsilon_{it} \tag{1}$$

The left-hand side variable is an indicator variable measuring attitudes towards HIV prevention (i.e., HIV-related spousal communication and acceptance of condom use within marriage) and risky behavior (i.e., self-reported male infidelity), whereas the right-hand side variables are meant to model factors that affect a couple's HIV prevention decisions such as intra-household bargaining power and both partners' HIV status. Namely, the vector $\mathbf{x}'_{it,pt}$ includes information on individual i and partner p. Since data on both spouses has been linked, I can study for example how the wife's income is associated with her husband's attitude towards condom use within marriage. This allows for a systemic and comprehensive perspective on HIV prevention, taking into account both partners' characteristics.

Heteroskedasticity-consistent and cluster-robust standard errors are used since (i) the dependent variables are binary, and (ii) errors are serially correlated over time due to the panel nature of the data (Angrist and Pischke, 2009, pp. 45-48; Arellano, 2003; Wooldridge, 2002, pp. 256-280).

4.1.2 Unobserved heterogeneity and time trends

Taking advantage of the panel dimension of the MDICP data, fixed effects and time dummies are used in order to capture individual-specific unobserved heterogeneity and time trends in a way which is not possible in cross-sectional analysis.

Individual-specific fixed effects η_i are employed because unobservable factors such as attitudes or socio-cultural norms are likely to affect HIV risk and prevention strategies. For example, if a person is very diligent and careful, this is likely to influence both her efforts in school or at work (i.e., the empowerment variables), and her protection decision, therefore leading to omitted variable bias. By using fixed effects estimation, one can control for such individual-specific unobservable factors as long as they are time-constant (Arellano, 2003, pp. 11-20; Cameron and Trivedi, 2005, pp. 700-707). Considering that I study a four-year time period (from 2004 until 2008), it seems reasonable to assume that individual-specific attitudes and characteristics such as diligence or carefulness are not very likely to change over such a short time horizon. In order to also capture the influence of a respondent's social network on individual attitudes, the estimation equation further contains village- and region-specific fixed effects η_j and η_k, respectively.

In addition, nation-wide and region-specific time dummies λ_t and λ_{tk}, respectively, are used in order to control for the potential effect of HIV information campaigns or other events that took place during a particular wave. For example, in 2004, HIV tests were conducted for the first time with the entire MDICP population. If the (unobservable) effect of this first testing campaign was similar among all participants, it will be sufficiently captured by this time trend. Furthermore, a region-specific time trend is meant to pick up regional variation over time with respect to increases in HIV prevalence and HIV information campaigns as, e.g., the South with its historically higher HIV rates has been targeted earlier with prevention campaigns.

To the extent that individual-specific attitudes and prevention campaigns have had an effect on HIV prevention behavior in the past, this should also be reflected in individual HIV status. As the estimation controls for HIV status of both husband and wife, this effect should adequately be captured and not bias the estimates.

4.1.3 Pooled data vs. panel data estimation methods

Throughout the analysis, panel data estimation methods are used rather than following a pooled estimation approach. This is supported by the fact that across all specifications (except for the model with infidelity as the dependent variable), a poolability test, based on the F-statistic resulting from a Wald test, rejects the null hypothesis that all fixed effects are zero. I therefore conclude that using fixed effects is more appropriate than pooling the data. The Breusch-Pagan Lagrange multiplier test yields similar results and strongly suggests the use of a random effects specification instead of pooled OLS (again, except for the model with infidelity as the dependent variable). In other words, there are significant differences across units and using pooled OLS would not be appropriate (Breusch and Pagan, 1980). Overall, panel data estimation methods are appropriate in this setting.

In order to assess whether a fixed effects specification is preferable to a random effects approach, I conduct a Hausman (1978) test which suggests that fixed effects are preferable to random effects when the estimation is conducted using HIV-related spousal communication as the dependent variable. Even though the Hausman test does not reject using random effects for the other two dependent variables, I use fixed effects as this model provides consistent estimates, even in a situation where random effects estimation would be more efficient. In addition, random effects require relatively strong assumptions, namely that the correlation between the individual-specific unobserved heterogeneity term η_i and the other covariates be zero, whereas a fixed effects specification does not require any assumptions on this correlation (Wooldridge, 2002, pp. 252-275). Overall, the results from both models are qualitatively very similar, with the coefficients from the random effects estimation being even larger and and - as expected - featuring smaller standard errors than the ones from the fixed effects model. Based on the aforementioned considerations, my preferred specification is a fixed effects linear probability model with national and region-specific time trends.

4.1.4 Estimation based on levels vs. relative differences

For each dependent variable, I estimate two different models. First, I study the associations between prevention behavior and the level of the bargaining variables (for both husbands and wives). Second, I look at the relative differences between husbands and wives. In the case of political participation, for example, I first - simultaneously - look at the number of local political events that both spouses have attended during the last year. Then, I deduct the number of events that the wife has attended from the number that her husband has attended and only use this variable as a regressor. Similarly, for earnings I use the relative difference between the husbands and the wife's income, as a share of the average income of the couple

during the last year.

4.2 Main results

This section presents the results for the determinants of couples' attitudes towards HIV prevention. The first part describes the estimation results when regressors are expressed in levels (Table 2), the second part uses relative differences between husband and first wife as regressors (Table 3). Each table contains estimates with respect to HIV-related spousal communication (columns 1 and 2 for husband and wife's reported values, respectively), acceptance of condom use (columns 3 and 4 for husband and wife's perception, respectively), and self-reported male infidelity (column 5).

Overall, the results show that attitudes towards HIV prevention are affected by a range of systemic variables shaping the life situation of both spouses. It is particularly interesting to see that factors that are associated with an increase in female bargaining power, such as attendance of political meetings or higher earnings, are also found to correlate with improved attitudes towards HIV prevention.

4.2.1 Estimation based on levels

The first group of variables in columns 1 and 2 in Table 2 studies the relationship between the economic situation of the couple and the propensity for HIV-related spousal communication. The estimation is based on data from the 2004 and 2006 wave, as the 2008 questionnaire did not contain the item on spousal communication. Spousal communication is negatively associated with higher earnings of the husband, potentially reflecting that relatively higher male income could make it more difficult for women to approach their husbands and address issues related to HIV prevention. This result holds for both the reported values of the husband (column 1) and the wife (column 2). The coefficient measuring the impact of education on prevention behavior is omitted because there is too little variation over time. Since I am studying a sample of adults, there are very few changes in education over time, which is why the impact of education will be attributed to the individual-specific, time-constant fixed effect.

When it comes to the relationship variables, the analysis detects a significant and negative coefficient on women's perception of outside options. As aforementioned, this is measured by a survey item asking whether it is adequate for a wife to leave her husband if he is beating her. I find that women who agree with this statement are significantly less likely to talk to their spouse about the risk of HIV. This could reflect that women who are very aware of their options outside of marriage are more inclined to leaving a potentially risky relationship. In other words, when faced with an increase in (perceived) HIV risk, women

could either voice their concern or leave the relationship (Hirschman, 1970). This is in line with results by, e.g., Reniers (2008) who finds that women in rural Malawi see divorce as a way to mitigate HIV risk.

With respect to the society variables, the number of local political events that the husband has attended during the past year is associated with a significantly lower propensity for HIV-related spousal communication, as reported by the husband.

Columns 3 and 4 in Table 2 report the determinants of acceptance of condom use within marriage, for husband and wife, respectively, based on data from 2006 and 2008. The only variable that appears to play an important role in this regard is the number of wives that a man is married to. Provided that HIV risk is higher for polygamous couples, it is not surprising that women and men living in a polygamous relationship are also more inclined to using condoms within marriage (Reniers and Tfaily, 2008).

Column 5 in Table 2 displays estimates from regressing self-reported male extramarital behavior on bargaining power variables and other controls, using data from 2006 and 2008. The bargaining power variables fail to be significant at any conventional level. As this might reflect reverse causality between infidelity and the number of wives (namely, if previous infidelities become a junior wife), I re-estimate the equation, this time controlling for whether the husband got married to a new wife since the last survey took place (column 6 in Table 2). Estimating the model with this additional control, however, does not change the results.[10] Another potential caveat is that the infidelity measure is self-reported and could therefore suffer from reporting bias, an issue which is addressed in Section 5.

(Insert Table 2 here)

4.2.2 Estimation based on relative differences

When estimating the determinants for spousal communication (columns 1 and 2 in Table 3) using relative differences between husband and first wife as regressors, the results are comparable to the results from the estimation based on levels of the bargaining variables. The estimated coefficient on earnings is still negative and significant, however it is only so with respect to the communication variable as reported by the husband. Nevertheless, this implies that the larger the income difference between spouses, the less likely it is that couples raise the issue of HIV prevention in spousal conversations. The coefficient on education differences is again omitted due to the lack of variation over time in the education variable. The relationship variables now fail to be significant at any conventional level. With respect to the society variables, a higher difference in political participation (i.e., if the husband has attended more local political events during the past year than his wife), makes it significantly less likely that the couple has talked about HIV prevention.

Regarding the acceptance of condom use (columns 3 and 4 in Table 3), again only the estimated coefficient on the number of wives is significant and positive, thereby reflecting that polygamous couples appear to be aware of the increased HIV risk that they are facing.

With respect to infidelity (columns 5 and 6 in Table 3), as before, there does not appear to be a significant association between the bargaining power measures and the propensity for male extramarital behavior.

(Insert Table 3 here)

4.2.3 Estimation based on a sub-sample of women with higher bargaining power

When analyzing the determinants of acceptance of condom use within marriage, the results suggest that only the number of wives plays an important role. The insignificant coefficients on the other bargaining power variables, however, could also reflect that on average, the wife's own income for example is not high enough to have a decisive impact on attitudes towards HIV prevention. I therefore re-estimate the model, restricting the sample to those women who have experienced a significant increase in bargaining power over time.

First, I assess whether I find a significant impact of bargaining power on attitudes towards HIV prevention for women whose earnings increased by at least 5,000 Malawi Kwacha between 2006 and 2008. The results provided in columns 1 and 2 of Table 4, show that the number of wives continues to play an important role for the acceptance of condom use within marriage. In contrast to the estimates based on the whole sample, however, also female earnings are significantly and positively associated with improved acceptance of condom use.

The coefficient estimates regarding spousal communication are not reported as the estimation results in an insufficient number of observations. With respect to self-reported male infidelity, the coefficient estimates of the bargaining power variables in column 3 in Table 4 are again insignificant.

Second, I analyze the impact of bargaining power on HIV prevention in a sub-sample of women whose political participation increased from 2006 to 2008. With respect to the acceptance of condom use, the estimated coefficient on male political participation is now significant and negative (columns 4 and 5 in Table 4). In other words, the more local political events that the husband has attended during the last year, the less likely it is that he will be in favor of condom use within marriage. The coefficient on the number of wives remains positive and significant.

As before, the results regarding spousal communication are not reported as the estimation results in an insufficient number of observations. Regarding self-reported male infidelity, the coefficient estimates of the bargaining power variables in column 6 in Table 4 are again insignificant.

(Insert Table 4 here)

4.3 Robustness checks

This section performs several modifications in the estimation equation in order to assess the robustness of the results from the main estimation. By and large, the results remain valid, i.e., increases in female intra-household bargaining power are associated with higher acceptance of HIV prevention among the married couples in the sample.

Mean-min-max approach based on data from junior wives

As aforementioned, polygamy is still a rather common phenomenon among the MDICP survey population, particularly in the Northern region. The analysis conducted above focused on the first wife only. However, detailed information on junior wives is available in the MDICP data set as well (see also Table A.2). As a robustness check, I repeat the analysis including the junior wives where applicable.

The upper part of Table 5 shows estimation results using average values across all spouses. More specifically, if a husband is living in a monogamous relationship, I use the variable for his first wife; if he is polygamous, which is the case for close to 18 percent of the men in the sample, I include the mean of this variable across all his spouses. In the lower part of Table 5, I re-estimate the determinants of attitudes towards HIV prevention, but this time with the maximum value for each bargaining power variable. For example, if a husband has three wives who each attended one, zero, and three local political events during the past year, respectively, I include only information on the wife who attended three local political events. The opposite strategy is used in the middle part of Table 5, where I employ the mininum value of the variables when estimating the propensity for HIV-related spousal communication, acceptance of condom use and self-reported extramarital behavior.

In all of the three robustness checks just described, the results do not change qualitatively when compared to the main analysis. In other words, the results are robust to including the characteristics of all wives and not just the first one, and suggest that higher female intra-household bargaining power is associated with improved attitudes towards HIV prevention.

(Insert Table 5 here)

Potential for variation in the effects of earnings for different income groups

The estimation in the main part of this paper uses logged values of earnings. However, it is possible that the impact of income on attitudes towards HIV prevention varies for different income levels. As a robustness check, I therefore define a categorical variable, measuring whether, e.g., a woman has low, medium or high earnings compared to other women during a given year. The reference category in this case are female survey participants who did not generate any earnings during the past year. Results are provided in Table 6. Including this earnings measure and re-estimating the models leads to relatively similar results. The husband's earnings are again significantly negatively associated with HIV-related spousal communication.

(Insert Table 6 here)

Bargaining power index derived from factor analysis

An alternative to including the bargaining variables individually is to create an index measuring bargaining power based on the aforementioned variables in order to assess the joint effect of the bargaining power variables. I abstain from doing so in the main analysis, as I am interested in the actual contribution of each of the variables to the prevention outcome and thus, an index measure would be somewhat less transparent. In addition, correlation between the variables is relatively low and therefore the data is not well suited for the creation of an index based on, e.g., factor analysis or principal component analysis.

Nevertheless, as a robustness check, I include the results from a re-estimation including a bargaining power index based on factor analysis in Table 7. The coefficient estimates suggest that higher male bargaining power is associated with a lower propensity for HIV-related spousal communication and a lower acceptance of condom use within marriage, which is in line with the results from the main analysis.

(Insert Table 7 here)

Assessing dependence on the choice of functional form

In order to assess whether the results depend on the functional form of the model, which is a linear probability model in the main part of the analysis, as a robustness check I employ a non-linear specification, which has the advantage of providing fitted values that are strictly bounded in the [0,1] interval. Odds ratios from a conditional logit model are provided in Table 8. The results again stress the importance of female bargaining power for HIV prevention. However, the conditional logit model only uses those cases that change over time, e.g., if a couple did not consider condom use as acceptable in the past, but now has changed its perception (Angrist and Pischke, 2009; Menard, 2010). Therefore, the conditional logit

estimation is based on considerably fewer observations, which is why the linear probability model remains the preferred specification in this setting.

(Insert Table 8 here)

5 Open issues and potential extensions

This section discusses remaining issues as well as potential extensions that are beyond the scope of this paper, but that represent exciting avenues for further research.

5.1 Addressing potential reverse causality

In a regression of attitudes towards HIV prevention on intra-household bargaining power, reverse causality could lead to biased estimates if HIV prevention behavior induces an increase or decrease in one of the partner's bargaining power. In the following, the potential for such reverse causality is discussed, together with potential solutions.

With respect to the first and the second dependent variable, HIV-related spousal communication and acceptance of condom use within marriage, reverse causality is not likely to be a major concern. For example, women are unlikely to have higher values in the empowerment variables (e.g., they will not have more income or be more aware of their outside options) because they have talked to their husbands about HIV or because they consider condoms to be acceptable. It seems plausible to assume that causality runs the other way round.

However, as already mentioned above, there is potential for reverse causality in the context of the third dependent variable, male infidelity. As discussed in the main part of the analysis, the extent to which the number of wives is linked to (past) infidelities appears to be limited, as the estimation results do not change when controlling for whether the husband got married to a new wife. However, an additional source of issues regarding reverse causality could be if, for example, the fact that their husband is cheating makes women more aware of their outside options (Reniers, 2008). In general, we would expect women's empowerment to reduce male extramarital behavior. In the case of reverse causality, however, the expected sign of the coefficient is not a priori clear: On the one hand, it is possible that if the majority of men in a society cheats on their wives (i.e., if promiscuity is expected and accepted from men), women do not have sufficient bargaining power to demand fidelity. On the other hand, it could also be that (unprotected) infidelities causes wives to leave their husbands. Thus, there is potential for reverse causality both on an individual

as well as on a societal level and we cannot a priori tell whether this can be expected to change the sign of the coefficient or not.

One way to deal with reverse causality in this context is represented by randomized controlled treatment studies and other experimental approaches. Even though an extension of previous training initiatives (that typically focus on young, unmarried women, as in Bandiera et al., 2012) that include both economic as well as HIV-prevention-related negotiation skills to married participants appears to be promising, such an experimental approach is beyond the scope of this project.

Another way to cope with reverse causality is to use an instrumental variable strategy, which requires an exogenous change in a variable that affects bargaining power, but that does not affect knowledge of HIV or attitudes towards prevention. Advantages and limitations of several potential instrumentation strategies are discussed in the following.

As mentioned in the introduction, Orfei (2012) uses exogenous shocks to kin support as an instrument for female bargaining power. Since the present analysis aims at going beyond economic empowerment, I would need an instrument that reflects social, political and inter-personal factors as well. Furthermore, if the death of the woman's relatives is related to AIDS, this could even further aggravate issues with respect to reverse causality.

Another strategy would be to use political representation of women on the local or regional level as an instrument for the situation of women in society. However, the last local election in Malawi took place in 2000, since then elections have been postponed and are now scheduled to take place in 2014. Other local and regional measures of gender equality could be taken from, e.g. the DHS or the MASEDA dataset. However, these sources are only available for 2004 and 2010, and using them would therefore imply to give up the panel dimension of the data.

Yet another option is represented by using rainfall data as in Duflo and Udry (2004) and to use local variations in rainfall and the implications for crops that are mainly cultivated and sold by men or women. Doing so, however, requires relatively strong assumptions on gender-specific labor distribution with respect to farming. In addition, to the extent that there is an impact of variations in climate factors on agricultural output, this can be expected to be captured with the village, time, and region dummies that I use.

An alternative approach is inspired by de Paula et al. (2013) who find a way to accommodate both unobserved heterogeneity and belief endogeneity (due to dependence of current beliefs on past risky behavior). The authors identify the impact of HIV risk perception on extramarital behavior using the Arellano and Carrasco (2003) semiparametric panel data estimator in a sample of male MDICP participants. For

their analysis, de Paula et al. (2013) use the fact that all MDICP participants were tested for HIV, i.e., that there was no selection into testing, and employ this randomly assigned knowledge shock and the resulting updating of beliefs about own HIV status in order to identify the impact on the propensity for extramarital behavior. Performing a similar type of analysis in a couple data set would require that the knowledge shock does not only take place on an individual level, but that both spouses know the test result of their partner. Since there is no objective information available on this in the MDICP, I would again have to rely on self-reported measures regarding whether participants have informed their spouse about their test result. However, Anglewicz and Chintsanya (2011) assess the reliability of self-reported HIV status disclosure among MDICP participants and find that in particular self-reports of HIV positive men are of questionable reliability. In other words, if one wanted to address reverse cauality in a couple data set in a similar fashion as de Paula et al. (2013), one would have to assume that both spouses know their partner's HIV test results and thereby risk increasing the probability of reporting bias.

Lastly, one could use the randomized financial incentive that was handed out during the HIV test in 2004 which is also employed by Thornton (2008). However, this would again mean to study economic bargaining power only. Furthermore, the average incentive was 1 USD, which is less than 1 percent of the average yearly income. It is therefore not surprising that the incentive is not correlated to the bargaining power measures that I use, which makes the financial incentive an unsuitable instrument for this type of analysis.

Despite the limitations that have just been pointed out, the fixed effects regression approach pursued in the present analysis addresses unobserved heterogeneity as long as it is time-constant (which is a reasonable assumption, given the survey period of four years) and/or if it affects individuals in the regions equally over time. Further, this study is unique in its approach to match all couples' information from 2004 - 2008, which enables to directly assess the effect of an increase in female bargaining power on her own or her husband's attitudes towards HIV prevention, while controlling for the bargaining situation and HIV status of both partners. Nevertheless, the extension of previously applied instruments in the context of HIV prevention to bargaining power concerns among couples remains a highly relevant issue that deserves further investigation in the literature.

5.2 Potential reporting bias

There are potential issues related to the fact most of the survey items included in the analysis contain self-reported information. For example, since it is - for obvious privacy concerns - not possible to observe husbands or wives as they cheat on their partner, self-reported information has to be used, i.e., a variable

that indicates the number of sexual partners the respondent has had over the past year. As pointed out before, the focus on male extramarital behavior is common in the literature due to reliability concerns with respect to self-reported female promiscuous behavior in traditional societies. However, one should not take for granted that men always report their concurrent partnerships accurately. Even though this survey instrument is recommended by UNAIDS, several studies show that men might also report concurrent partnerships incorrectly, thus potentially causing a bias in the results (Helleringer et al., 2011; Maughan-Brown and Venkataramani, 2011). Partly, reporting bias might have been mitigated by the fact that during the MDICP interviews, participants were reminded about the confidenti ality of their answers before they were asked about the number of sexual partners that they have had. Nevertheless, finding a way to deal with potential reporting bias represents another challenge that needs to be overcome.

6 Conclusions

HIV infection risk depends on a range of factors that are sometimes beyond the individual's control. In other words, there are important feedback effects between individual HIV prevention efforts, one's partner's behavior as well as structural factors such as social status or power distribution in the relationship. The starting point for this analysis was the stylized fact that most HIV infections in Sub-Saharan Africa occur during heterosexual intercourse in couple relationships. In this setting, women are significantly more susceptible to get infected with HIV than men, for both biological and social reasons, which is also reflected by the fact that women account for the majority of individuals living with HIV/AIDS in Sub-Saharan Africa.

The novel approach of this study is to use a matched couple panel data set from rural Malawi in order to assess the relationship between intra-household bargaining power (as captured by economic, social and relationship variables) and attitudes towards HIV prevention as well as self-reported infidelity. The data set stems from the 2004, 2006, and 2008 waves of the Malawi Diffusion and Ideational Change Project MDICP and has the advantage of containing socio-economic and demographic information, as well as biomarkers of HIV status of husbands, first and junior wives. Further, due to the panel dimension of the data, the estimation equation can control for individual-, village-, and region-specific unobservable attitudes related to HIV prevention, as well as national and region-specific time trends in the data. In other words, after controlling for the factors just mentioned, the remaining variation in attitudes towards HIV prevention can be expected to be attributed to intra-household bargaining power.

Overall, the results from a fixed effects linear probability model with time trends show that preventive behaviors are affected by a range of variables shaping the life situation of both spouses, which clearly renders support for a more comprehensive and holistic approach towards studying decisions in the context

of HIV prevention. It is particularly interesting to see that factors that are associated with an increase in female bargaining power are also found to correlate with higher acceptance of HIV prevention: Namely, own earnings and attendance of women at local political meetings significantly increase the propensity for HIV-related spousal communication, which is in line with the first hypothesis described in Section 1. For the acceptance of condom use within marriage, the number of co-wives appears to be play a dominant role. However, when analyzing the determinants of condom use for the subsample of most empowered women, higher female earnings are also significantly related to higher acceptance of condom use within marriage, thus providing convincing support for the second hypothesis of this paper. Regarding the determinants of self-reported infidelity, contrary to the third hypothesis from Section 1, there is no significant association with the bargaining power variables detected.

The results are robust to numerous extensions and modifications such as including data on junior wives in the case of polygamous relationships following a mean-min-max approach, defining earnings groups rather than including logged income as a regressor, using a bargaining power index derived from factor analysis, or employing a conditional logit instead of a linear model.

To sum it up it can be said that the results strongly underline the importance of intra-household bargaining power for decisions related to HIV prevention. From a policy perspective, this highlights the importance to take into account the specific HIV prevention needs of persons in couple relationships, particularly in the presence of - culturally or otherwise institutionalized - partnership concurrency. Further, the results strengthen the case of tackling gender inequality in order to effectively fight the spread of HIV/AIDS, since increases in female intra-household bargaining power have been shown to play a significant role in promoting acceptance of HIV prevention among married couples.

The fixed effects regression approach pursued in the present analysis of a unique matched couple data set addresses unobserved heterogeneity as long as it is time-constant (which is a reasonable assumption, given the survey period of four years) and/or if it affects individuals in the regions equally over time. Following from this, there are several avenues for further research. Remaining issues exist regarding the potential for reverse causality, particularly with respect to infidelity in the context of polygamous marriages. Further, as this type of analysis strongly relies on self-reported measures of behavior, it entails a certain risk of reporting bias due to social desirability of attitudes towards HIV prevention. These topics deserve further attention in the literature and represent interesting future extensions of the current analysis.

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NOTES

1. Regarding condom use, the application of bargaining terminology is somewhat less straightforward as in principle, the consent of the male partner would be sufficient. However, if we assume that women have considerably less reasons to be against the use of condoms, provided that they are more susceptible to HIV infection and at the same time experience only negligible discomfort from using condoms, it seems reasonable to ignore the case where the male partner would want to use condoms against the will of the female partner.

2. Instead of distinguishing among cooperative and non-cooperative solutions, one could also apply a Hirschman-type (1970) kind of framework and classify coping mechanisms in terms of exit, voice and loyalty.

3. There are several longitudinal and panel data studies based on data from the Malawi Diffusion and Ideational Change Project that analyze determinants of the perception of HIV risk and prevention methods or extramarital activities. However, none of these studies link data from husbands and wives, but rather the focus is either on non-spousal social network partners (Helleringer and Kohler, 2005; Smith and Watkins, 2005) or the analysis studies male participants only (de Paula et al., 2013).

4. It has to be kept in mind that the main focus of this companion paper is to study attitudes towards HIV prevention over a longer time period during which HIV prevalence has increased significantly and several campaigns have taken place (Gerritzen, 2012). Following couples over such a long period of time is not possible due to data restrictions. Namely, there are not enough observations in the MDICP where both spouses have consistently participated in the survey.

5. Further information on the MDICP sampling strategy, survey response rate, and data quality over time can be found on the MDICP/MLSFH website: http://malawi.pop.upenn.edu/

6. Although not included in the main analysis, data from the second, third, etc. wives of polygamous men are included in the robustness section.

7. This also holds in the MDICP data: When women are asked about the extramarital relationships of

their best female friends, the figures are dramatically higher than if they are questioned regarding their own infidelities.

8. Needless to say, the HIV risk increases not necessarily because husbands cheat on their wives, but mainly because they do so without using protection. However, condom use with other partners appears to be a highly sensitive topic and self-reported information on it seems far from reliable (a large majority of the MDICP participants chose not to respond to questions on condom use with extramarital partners).

9. In 2004, 24 husbands and 17 first wives were found to be HIV positive; by 2008 these figures had increased to 33 husbands and 26 wives. Due to the very small sample size it is not possible to interprete these numbers in a statistically meaningful way. Nevertheless, it seems relevant to note that among those couples where at least one partner is HIV positive, in most cases, the other partner is not infected. Further, the majority of sero-discordant couples consist of HIV-infected husbands and HIV-negative wives. Out of the 24 husbands who were tested HIV positive in 2004, 11 were living with a spouse who was negative and 2 of these wives were tested positively in the consecutive wave. Out of the 17 first wives who were tested HIV positive in 2004, 9 were living with a husband who was negative and one husband was tested positively in the consecutive wave. It is further interesting to see that men who have been found to be infected with HIV tend to remain married (and therefore in the sample), whereas women who have been tested positively and whose husband is not infected, often drop out of the sample, potentially due to divorce.

10. With respect to reverse causality, one could also argue that the marital relationship could deteriorate if the wife raises the issue of HIV prevention. In other words, rather than inducing HIV prevention behavior, HIV-related spousal communication could increase the propensity of men to look for other, potentially less demanding, partners. In order to analyze the potential for such a backlash, I regress male infidelity on a dummy measuring whether the wife reports that they have talked about HIV (together with the usual controls) and the estimated coefficient on HIV-related spousal communication fails to be significant. Therefore, the potential for reverse causality between spousal communication and risky behavior appears to be limited. Detailed results are available on request.

TABLES

Table 1: *Descriptive statistics*

Variable	Obs	Mean	Std. Dev.	Min	Max
		Dependent variables			
communication sp1	1,316	0.874	0.332	0	1
communication h	1,350	0.933	0.251	0	1
difference	0.055***				
condom use sp1	2,009	0.378	0.485	0	1
condom use h	2,020	0.298	0.458	0	1
difference	-0.075***				
infidelity sp1	1,876	0.017	0.128	0	1
infidelity h	1,857	0.100	0.300	0	1
difference	0.081***				
		Economic situation			
earnings sp1	1,906	15,681.66	35,780.15	0	500,000
earnings h	2,047	28,888.26	61,034.57	0	850,000
difference	13,770.60***				
education sp1	2,135	3.996	2.956	0	8
education h	2,230	4.611	2.868	0	8
difference	0.654***				
		Relationship			
nr wives h	2,235	1.209	0.490	1	4
leave beat sp1	2,007	0.786	0.410	0	1
leave beat h	1,986	0.702	0.457	0	1
difference	-0.088***				
		Society			
political sp1	2,007	1.226	2.506	0	30
political h	2,005	2.325	5.056	0	100
difference	1.106***				
		Demographic controls			
HIV sp1	1,850	0.036	0.187	0	1
HIV h	1,910	0.046	0.209	0	1
difference	0.007				
age sp1	2,190	36.659	10.601	15	76
age h	2,235	43.733	11.922	15	79
difference	7.094***				
children sp1	1,951	4.625	2.111	0	12
children h	2,049	5.358	2.937	0	18
difference	0.871***				
relative wealth f	2,217	2.806	0.867	1	5
land f	2,235	0.969	0.173	0	1
central f	2,235	0.341	0.474	0	1
north f	2,235	0.360	0.480	0	1
south f	2,235	0.299	0.458	0	1

Note: Average values based on data from 2004, 2006, 2008 waves of the Malawi Diffusion and Ideational Change Project MDICP (spousal communication for 2004 and 2006 only). Data on husband, first wife and household, indicated by h, sp1 and f, respectively. *** denotes significant differences between spouses' average values based on a two-sided t-test.

Table 2: *Determinants of HIV prevention (level)*

	communication		*condom use*		*infidelity*	
	(1) hus	(2) wife	(3) hus	(4) wife	(5) hus	(6) hus
			Economic situation			
earnings h	-0.012**	-0.018**	0.009	0.011	-0.010	-0.010
	(0.006)	(0.009)	(0.011)	(0.012)	(0.010)	(0.010)
earnings sp1	0.005	-0.003	0.010	0.004	0.001	0.001
	(0.005)	(0.011)	(0.008)	(0.009)	(0.005)	(0.005)
			Relationship			
nr wives h	0.172	0.049	1.024***	0.189**	0.010	
	(0.116)	(0.106)	(0.074)	(0.087)	(0.055)	
new wife h						-0.174
						(0.153)
leave sp1	-0.022	-0.059*	-0.022	-0.037	-0.019	-0.021
	(0.034)	(0.036)	(0.067)	(0.067)	(0.034)	(0.034)
			Society			
political h	-0.007*	-0.002	-0.004	0.005	0.003	0.003
	(0.004)	(0.003)	(0.004)	(0.005)	(0.004)	(0.004)
political sp1	0.006	-0.004	-0.014	-0.009	0.001	0.001
	(0.006)	(0.007)	(0.010)	(0.012)	(0.006)	(0.006)
Observations	865	858	813	809	751	750
Nr of respondents	515	510	501	500	484	484
R-sq overall	0.00798	0.0398	0.0002	0.0025	0.0195	0.0208
Breusch-Pagan (p-value)	0.000165	0.000124	0.0101	0.0741	0.98	0.98
Poolability test (p-value)	8.68e-06	0	0.00147	0.0460	0.360	0.427
Hausman-test (p-value)	0.0135	0.00660	0.335	0.265	0.618	0.579
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Region & village dummies	Yes	Yes	Yes	Yes	Yes	Yes
Time trend	Yes	Yes	Yes	Yes	Yes	Yes
Region-specific time trend	Yes	Yes	Yes	Yes	Yes	Yes

Note: Estimation of HIV prevention (spousal communication and acceptance of condom use within marriage) and risky behavior (self-reported infidelity) on measures of intra-household bargaining power of husband and (first) wife, using a panel data set of married couples from 2006-2008 (2004-2006 for spousal communication). The table displays coefficients from a fixed effects LPM with region-specific time trends, region and village dummies. Estimation controls for education, HIV status, number of children, family wealth, cohort. Data on husband and first wife, indicated by h and sp1, respectively. Columns 1-5 control for the (total) number of wives, whereas column 6 controls whether the husband got married to a new (additional) wife, in order to capture potential reverse causality between infidelity and the number of wives over time. Robust standard errors are indicated in parentheses. Level of significance is denoted by * ($\leq$10%), **($\leq$5%), ***($\leq$1%).

Table 3: *Determinants of HIV prevention (differences)*

	communication		*condom use*		*infidelity*	
	(1) hus	(2) wife	(3) hus	(4) wife	(5) hus	(6) hus
			Economic situation			
earning diff	-0.034***	-0.023	-0.012	0.027	-0.012	-0.012
	(0.012)	(0.019)	(0.021)	(0.024)	(0.013)	(0.013)
			Relationship			
nr wives h	0.169	0.044	1.044***	0.189***	0.016	
	(0.116)	(0.107)	(0.059)	(0.071)	(0.044)	
new wife h						-0.178
						(0.150)
leave diff	0.022	0.058	0.027	0.027	0.022	0.025
	(0.034)	(0.035)	(0.069)	(0.070)	(0.035)	(0.035)
			Society			
political diff	-0.007**	-0.002	-0.000	0.005	0.003	0.003
	(0.003)	(0.003)	(0.003)	(0.005)	(0.004)	(0.004)
Observations	856	849	806	802	745	744
Nr of respondents	514	508	499	498	481	481
R-sq overall	0.0082	0.0462	0.0002	0.0043	0.0214	0.0233
Breusch-Pagan (p-value)	0.000234	0.000114	0.00650	0.0674	0.0502	0.124
Poolability test (p-value)	1.98e-05	0	0.000761	0.0544	0.275	0.333
Hausman-test (p-value)	0.00333	0.811	0.292	0.564	0.813	0.736
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Region & village dummies	Yes	Yes	Yes	Yes	Yes	Yes
Time trend	Yes	Yes	Yes	Yes	Yes	Yes
Region-specific time trend	Yes	Yes	Yes	Yes	Yes	Yes

Note: Estimation of HIV prevention (spousal communication and acceptance of condom use within marriage) and risky behavior (self-reported infidelity) on measures of relative intra-household bargaining power (i.e., difference between values of husband and first wife), using a panel data set of married couples from 2006-2008 (2004-2006 for spousal communication). The table displays coefficients from a fixed effects LPM with region-specific time trends, region and village dummies. Estimation controls for education, HIV status, number of children, family wealth, cohort. Data on husband and first wife, indicated by h and sp1, respectively. Columns 1-5 control for the (total) number of wives, whereas column 6 controls whether the husband got married to a new (additional) wife, in order to capture potential reverse causality between infidelity and the number of wives over time. Robust standard errors are indicated in parentheses. Level of significance is denoted by * ($\leq$10%), **($\leq$5%), ***($\leq$1%).

Table 4: *Determinants of HIV prevention (subsample women with highest bargaining power)*

	women with significant increase in earnings			*women with increase in political participation*		
	condom use		*infidelity*	*condom use*		*infidelity*
	(1) hus	(2) wife	(3) hus	(4) hus	(5) wife	(6) hus
			Economic situation			
earnings h	0.017	0.015	-0.009	0.031	-0.004	-0.024
	(0.018)	(0.016)	(0.014)	(0.020)	(0.022)	(0.022)
earn sp1	0.035**	-0.007	0.004	0.018	-0.022	-0.011
	(0.016)	(0.019)	(0.010)	(0.013)	(0.015)	(0.009)
			Relationship			
nr wives h	1.075***	0.327**	-0.005	1.089***	0.151	0.022
	(0.131)	(0.132)	(0.090)	(0.115)	(0.135)	(0.109)
leave sp1	-0.042	0.093	-0.047	-0.004	-0.020	-0.044
	(0.096)	(0.108)	(0.066)	(0.120)	(0.125)	(0.054)
			Society			
political h	-0.009	0.037*	0.016	-0.037**	-0.017	0.004
	(0.022)	(0.020)	(0.012)	(0.016)	(0.016)	(0.010)
pol sp1	-0.000	-0.017	-0.005	-0.013	-0.012	-0.008
	(0.009)	(0.016)	(0.009)	(0.012)	(0.015)	(0.009)
Observations	334	329	316	252	252	233
Nr of respondents	196	195	193	144	144	141
R-sq overall	0.0112	0.0165	0.0366 l	0.000129	0.0222	0.0172
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Region & village dummies	Yes	Yes	Yes	Yes	Yes	Yes
Time trend	Yes	Yes	Yes	Yes	Yes	Yes
Region-specific time trend	Yes	Yes	Yes	Yes	Yes	Yes

Note: Estimation of HIV prevention behavior for a subsample of couples where the wife's bargaining power has significantly increased over the last time period, using a panel data set of married couples from 2006-2008. The table displays coefficients from a fixed effects LPM with region-specific time trends, region and village dummies. Columns 1-3 display results for a sub-sample of women who experienced a significant increase in earnings (equal to or more than 5,000 Malawi Kwacha) between 2006 and 2008. Columns 4-6 performs the estimation for a sub-sample of women whose attendance of local political events increased between 2006 and 2008. Estimation controls for education, HIV status, number of children, family wealth, cohort. Robust standard errors are indicated in parentheses. Level of significance is denoted by * ($\leq$10%), **($\leq$5%), ***($\leq$1%).
Results for spousal communication are not shown as the estimation results in less than 100 observations.

Table 5: *Determinants of HIV prevention (mean min max across all spouses)*

	communication		*condom use*		*infidelity*
	(1) hus	(2) wife	(3) hus	(4) wife	(5) hus
	Mean values across all spouses				
earnings h	-0.011*	-0.018**	0.008	0.012	-0.010
	(0.006)	(0.009)	(0.012)	(0.012)	(0.010)
earn mean	0.003	-0.002	0.009	0.002	0.002
	(0.005)	(0.011)	(0.008)	(0.009)	(0.005)
nr wives h	-0.066	0.165	1.014***	0.185**	0.010
	(0.071)	(0.179)	(0.075)	(0.087)	(0.055)
leave mean	-0.021	-0.070*	-0.025	-0.015	-0.025
	(0.036)	(0.039)	(0.069)	(0.070)	(0.036)
political h	-0.007*	-0.002	-0.004	0.005	0.004
	(0.004)	(0.003)	(0.004)	(0.005)	(0.004)
pol mean	0.007	-0.004	-0.015	-0.010	0.002
	(0.006)	(0.007)	(0.010)	(0.012)	(0.006)
Obs (respondents)	872 (519)	864 (513)	820 (507)	815 (505)	756 (488)
	Minimum values across all spouses				
earnings h	-0.011*	-0.019**	0.008	0.012	-0.010
	(0.006)	(0.009)	(0.012)	(0.012)	(0.010)
earn min	0.003	-0.002	0.006	-0.001	0.001
	(0.005)	(0.010)	(0.008)	(0.009)	(0.005)
nr wives h	-0.023	0.158	1.008***	0.181**	0.009
	(0.067)	(0.181)	(0.075)	(0.088)	(0.055)
leave min	-0.022	-0.063*	-0.016	0.025	-0.020
	(0.032)	(0.035)	(0.066)	(0.070)	(0.038)
political h	-0.007*	-0.002	-0.004	0.005	0.004
	(0.004)	(0.003)	(0.004)	(0.006)	(0.004)
pol min	0.007	-0.005	-0.016	-0.011	0.001
	(0.007)	(0.007)	(0.010)	(0.012)	(0.006)
Obs (respondents)	872 (519)	864 (513)	820 (507)	815 (505)	756 (488)
	Maximum values across all spouses				
earnings h	-0.011*	-0.018**	0.008	0.011	-0.010
	(0.006)	(0.009)	(0.011)	(0.012)	(0.009)
earn max	0.004	-0.002	0.010	0.005	0.002
	(0.005)	(0.011)	(0.008)	(0.009)	(0.005)
nr wives h	-0.029	0.176	1.022***	0.189**	0.012
	(0.060)	(0.176)	(0.074)	(0.087)	(0.055)
leave max	-0.017	-0.066*	-0.028	-0.058	-0.030
	(0.040)	(0.040)	(0.070)	(0.069)	(0.035)
political h	-0.006*	-0.002	-0.004	0.005	0.004
	(0.004)	(0.003)	(0.005)	(0.005)	(0.004)
pol max	0.006	-0.003	-0.013	-0.009	0.002
	(0.006)	(0.007)	(0.010)	(0.012)	(0.006)
Obs (respondents)	872 (519)	864 (513)	820 (507)	815 (505)	756 (488)
Other controls	Yes	Yes	Yes	Yes	Yes
Region & village dummies	Yes	Yes	Yes	Yes	Yes
Time trend	Yes	Yes	Yes	Yes	Yes
Region-specific time trend	Yes	Yes	Yes	Yes	Yes

Note: Estimation of HIV prevention behavior using the mean, minimum or maximum value of the bargaining power variables across all spouses (in the case of polygamous marriages). For monogamous couples, estimation is carried out as before. A fixed effects LPM with region-specific time trends, region and village dummies is estimated, using a panel data set of married couples from 2006-2008 (2004-2006 for spousal communication). Estimation controls for education, HIV status, number of children, family wealth, cohort. Robust standard errors in parentheses. Level of significance is denoted by * ($\leq$10%), **($\leq$5%), ***($\leq$1%).

Table 6: *Determinants of HIV prevention (earnings in groups)*

	communication		*condom use*		*infidelity*
	(1) hus	(2) wife	(3) hus	(4) wife	(5) hus
	Economic situation				
earn low h	-0.077	-0.140	0.074	0.059	-0.085
	(0.060)	(0.095)	(0.126)	(0.125)	(0.111)
earn med h	-0.158***	-0.151*	0.039	-0.013	-0.063
	(0.059)	(0.081)	(0.131)	(0.132)	(0.115)
earn hi h	-0.113*	-0.155*	0.099	0.134	-0.106
	(0.064)	(0.093)	(0.129)	(0.130)	(0.116)
earn low sp1	0.048	0.034	-0.004	0.013	-0.013
	(0.058)	(0.083)	(0.089)	(0.098)	(0.051)
earn med sp1	0.012	0.023	0.089	0.120	0.019
	(0.055)	(0.097)	(0.089)	(0.101)	(0.050)
earn hi sp1	0.030	-0.034	0.137	-0.010	-0.012
	(0.066)	(0.098)	(0.088)	(0.101)	(0.056)
	Relationship				
nr wives h	0.163	0.052	0.994***	0.183**	0.036
	(0.114)	(0.105)	(0.070)	(0.078)	(0.048)
leave sp1	-0.022	-0.062*	-0.024	-0.042	-0.021
	(0.033)	(0.037)	(0.068)	(0.065)	(0.035)
	Society				
political h	-0.006	-0.002	-0.003	0.005	0.004
	(0.004)	(0.003)	(0.004)	(0.005)	(0.004)
political sp1	0.007	-0.004	-0.016*	-0.008	0.001
	(0.006)	(0.007)	(0.010)	(0.011)	(0.006)
Observations	865	858	813	809	751
Nr of respondents	515	510	501	500	484
R-sq overall	0.0070	0.0406	0.0003	0.0026	0.0155
Other controls	Yes	Yes	Yes	Yes	Yes
Region & village dummies	Yes	Yes	Yes	Yes	Yes
Time trend	Yes	Yes	Yes	Yes	Yes
Region-specific time trend	Yes	Yes	Yes	Yes	Yes

Note: Estimation of HIV prevention behavior, using dummies for earning groups (no, low, medium, high income) in any given year. A fixed effects LPM with region-specific time trends, region and village dummies is estimated, using a panel data set of married couples from 2006-2008 (2004-2006 for spousal communication). Estimation controls for education, HIV status, number of children, family wealth, cohort. Robust standard errors are indicated in parentheses. Level of significance is denoted by * ($\leq$10%), **($\leq$5%), ***($\leq$1%).

Table 7: *Determinants of HIV prevention (factor analysis)*

	communication		*condom use*		*infidelity*
	(1) hus	(2) wife	(3) hus	(4) wife	(5) hus
	Bargaining power wife				
Bargaining power 1 sp1	0.055	0.033	0.106	-0.030	0.024
	(0.049)	(0.087)	(0.070)	(0.079)	(0.052)
Bargaining power 2 sp1	-0.006	-0.062	-0.040	0.012	-0.030
	(0.040)	(0.050)	(0.078)	(0.089)	(0.055)
	Bargaining power husband				
Bargaining power 1 h	0.034	-0.099	0.112	-0.356***	0.042
	(0.103)	(0.105)	(0.134)	(0.127)	(0.098)
Bargaining power 2 h	-0.132**	-0.135**	-0.117	0.063	0.101
	(0.061)	(0.054)	(0.097)	(0.099)	(0.078)
Observations	865	858	813	809	751
Nr of respondents	515	510	501	500	484
R-sq overall	0.0184	0.0227	0.0032	0.0095	0.0232
Other controls	Yes	Yes	Yes	Yes	Yes
Region & village dummies	Yes	Yes	Yes	Yes	Yes
Time trend	Yes	Yes	Yes	Yes	Yes
Region-specific time trend	Yes	Yes	Yes	Yes	Yes

Note: Estimation of HIV prevention behavior, using a bargaining power index derived from factor analysis for any given year. A fixed effects LPM with region-specific time trends, region and village dummies is estimated, using a panel data set of married couples from 2006-2008 (2004-2006 for spousal communication). Estimation controls for education, HIV status, number of children, family wealth, cohort. Robust standard errors are indicated in parentheses. Level of significance is denoted by * ($\leq$10%), **($\leq$5%), ***($\leq$1%).

Table 8: *Determinants of HIV prevention (conditional logit)*

	communication	*condom use*		infidelity
	(1) hus	(2) hus	(3) wife	(4) hus
	Economic situation			
earnings h	0.669	1.003	1.041	0.746*
	(0.181)	(0.060)	(0.088)	(0.112)
earnings sp1	0.110**	1.041	1.023	1.059
	(0.119)	(0.057)	(0.046)	(0.137)
	Relationship			
nr wives h	1.662	3.742***	na	na
	(1.895)	(4.209)	na	na
leave sp1	0.652	0.802	0.771	0.491
	(1.045)	(0.329)	(0.273)	(0.750)
	Society			
political h	0.637	0.905	1.012	1.156**
	(0.192)	(0.057)	(0.017)	(0.079)
political sp1	1.455**	0.953	0.972	1.054
	(0.276)	(0.080)	(0.058)	(0.175)
Observations	72	222	266	76
Pseudo R-sq	0.779	0.112	0.0754	0.287
Other controls	Yes	Yes	Yes	Yes
Region & village dummies	Yes	Yes	Yes	Yes
Time trend	Yes	Yes	Yes	Yes
Region-specific time trend	No	No	No	No

Note: Estimation of HIV prevention behavior, using a panel data set of married couples from 2006-2008 (2004-2006 for spousal communication). The table displays odds ratios from a conditional logit model with a time trend, region and village dummies. I report odds ratios rather than marginal effects in order to avoid the issues with interpreting marginal effects in the presence of individual-specific fixed effects as pointed out in, e.g., (Cameron and Trivedi, 2010, p. 630). Estimation controls for education, HIV status, number of children, family wealth, cohort. Robust standard errors are indicated in parentheses. Level of significance is denoted by * ($\leq$10%), **($\leq$5%), ***($\leq$1%).

APPENDIX A

Table A.1: *Variable descriptions*

Variable name	Description	Type
Dependent variables		
spousal communication	Respondent has talked to spouse about risk of HIV infection	Dummy
acceptance of condom use	Respondent considers condom use within marriage as acceptable	Dummy
(self-reported) infidelity	Respondent reports to have cheated on his current spouse during the last year. (Participants were asked about the number of sexual partners that they had during the last year. Based on the number of wives, it can be derived whether the participant was unfaithful.)	Dummy
Economic situation		
earnings	Earnings that respondent has generated him-/herself during the last year. For 2004, this value has been linearly interpolated by using the previous and the consecutive survey waves from 1998 to 2008. For the main analysis, logged earnings are used, i.e., log(earnings+1), in oder to not lose observations if the earnings variable is zero in one year	Continuous
education	Years of formal education that respondent has had	Continuous
Relationship		
nr wives h	Number of wives that husband has	Continuous
leave	Awareness of options outside of marriage, based on a survey item asking whether it is acceptable for a woman to leave her husband if he beats her	Dummy
Society		
political meetings	Number of local political meetings that respondent has attended during last year	Continuous
Demographic controls		
HIV	Result from HIV test (free of charge, randomly assigned)	Dummy
children	Number of (living) children that respondent has. Respondents with more than 25 children are dropped from the data. Overstating the number of children might reflect a different cultural understanding of family ties, i.e. nieces and nephews will be considered daughters and sons if (financial) responsibility is taken for them (Swidler, 2007)	Continuous
relative wealth	Relative wealth of household (according to interviewer)	Ordinal
cohort	Year of birth	Continuous
central	Lives in Central region (Mchinji district)	Dummy
north	Lives in Northern region (Rumphi district)	Dummy
south	Lives in Southern region (Balaka district)	Dummy

Table A.2: *Available observations*

	Available observations			
	2004	2006	2008	Total
Husband	553	560	534	1,647
Spouse 1	553	560	534	1,647
Spouse 2	80	90	85	255
Spouse 3	13	15	17	45
Spouse 4	2	3	3	8

Note: Available observations, restricted MDICP sample of married couples

APPENDIX B

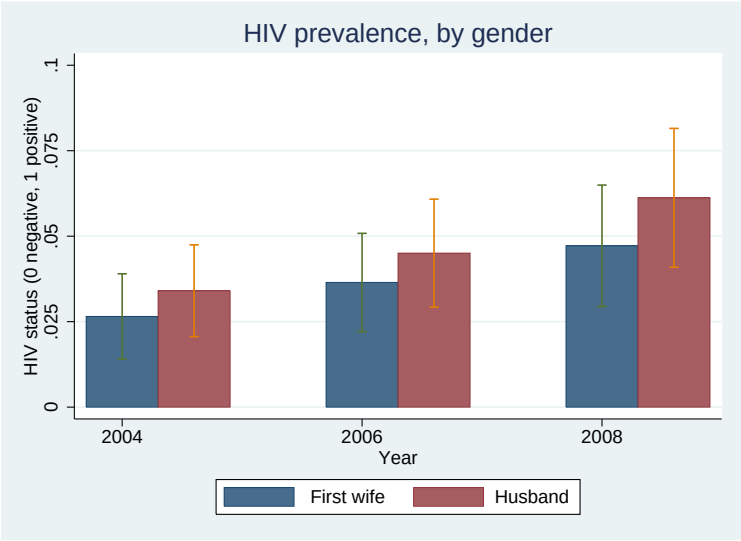

Figure B.1: HIV prevalence, by gender

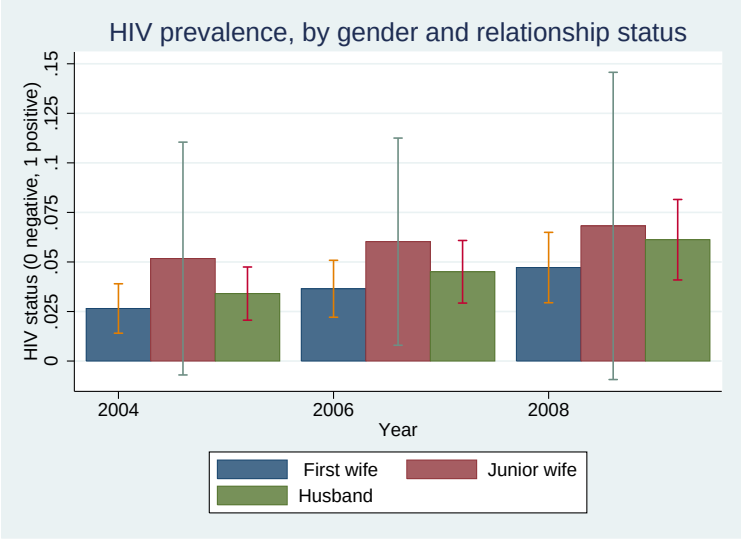

Figure B.2: HIV prevalence, by gender and relationship status

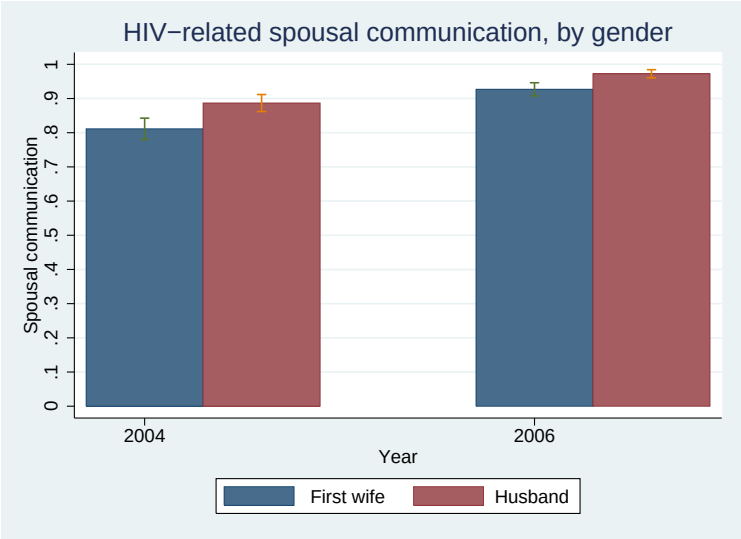

Figure B.3: HIV-related spousal communication, by gender

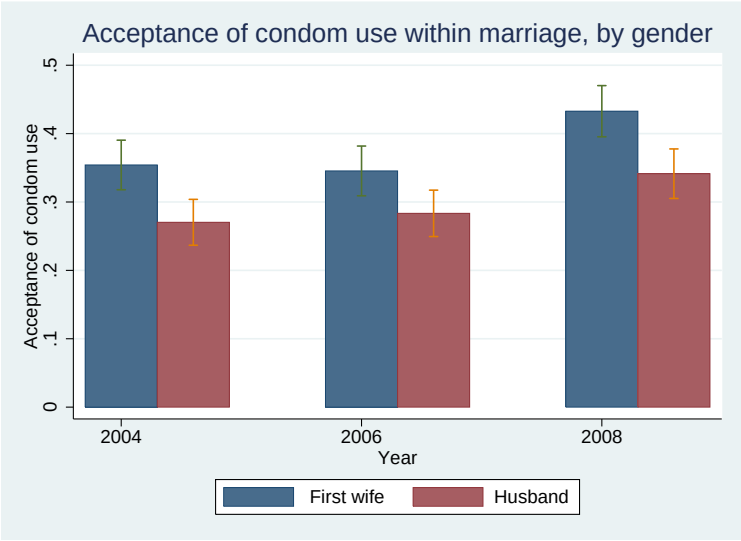

Figure B.4: Acceptance of condom use within marriage, by gender

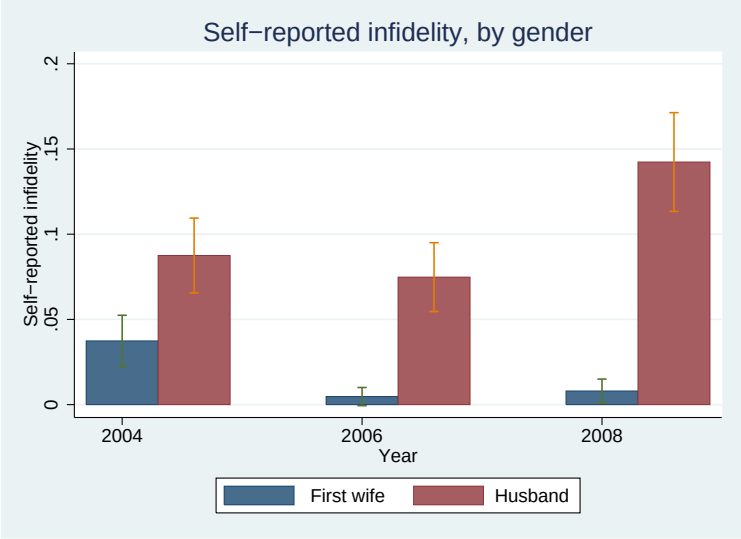

Figure B.5: Self-reported infidelity, by gender

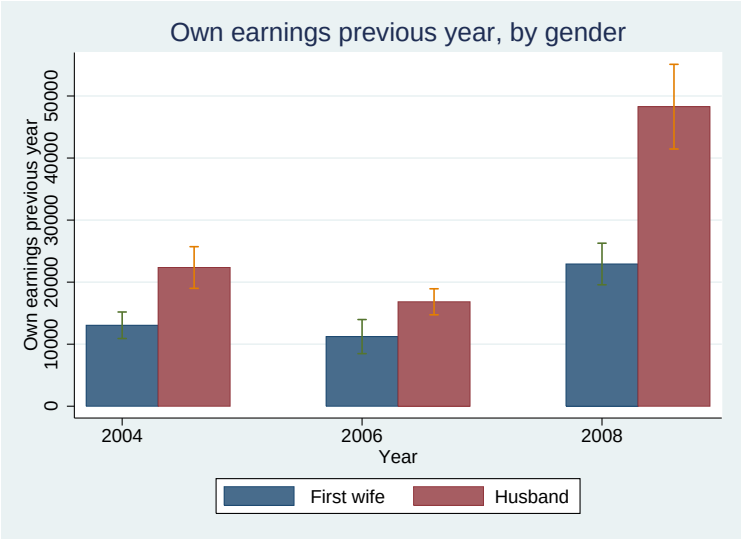

Figure B.6: Own earnings previous year, in Malawi Kwacha, by gender

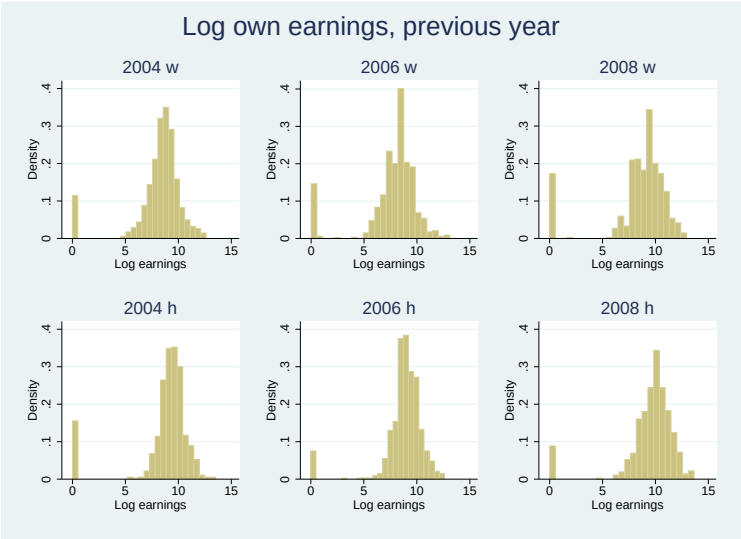

Figure B.7: Log yearly earnings, by gender

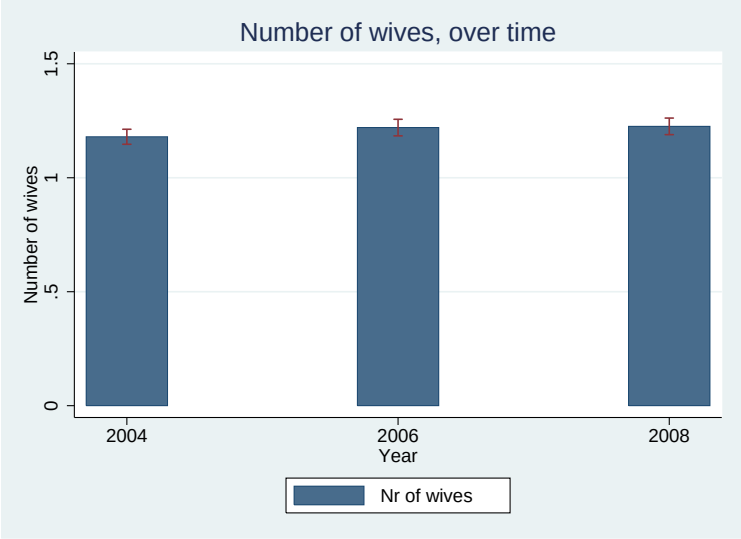

Figure B.8: Number of wives, over time

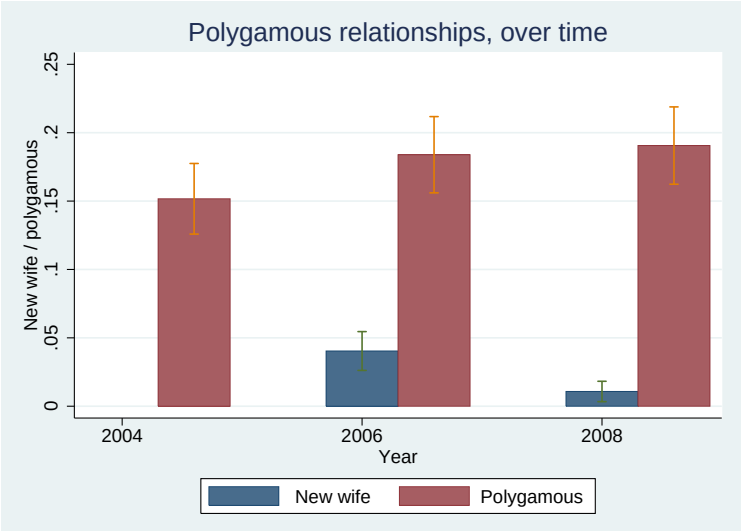

Figure B.9: Share of polygamous relationships, over time

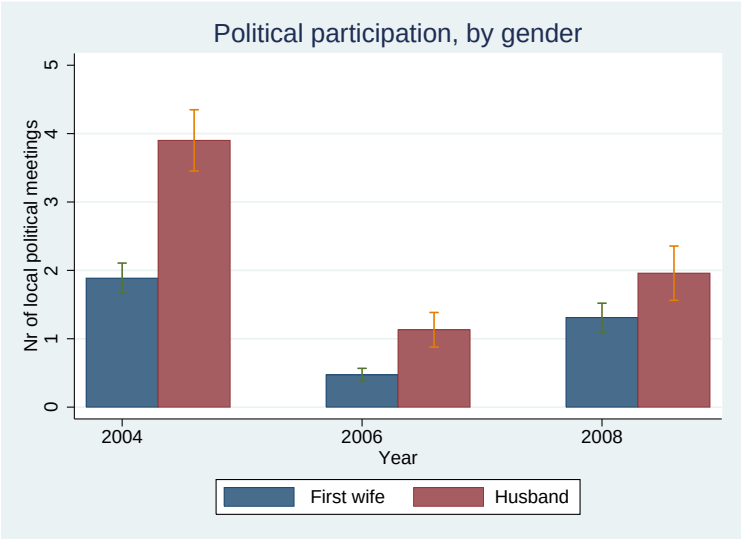

Figure B.10: Political participation, by gender

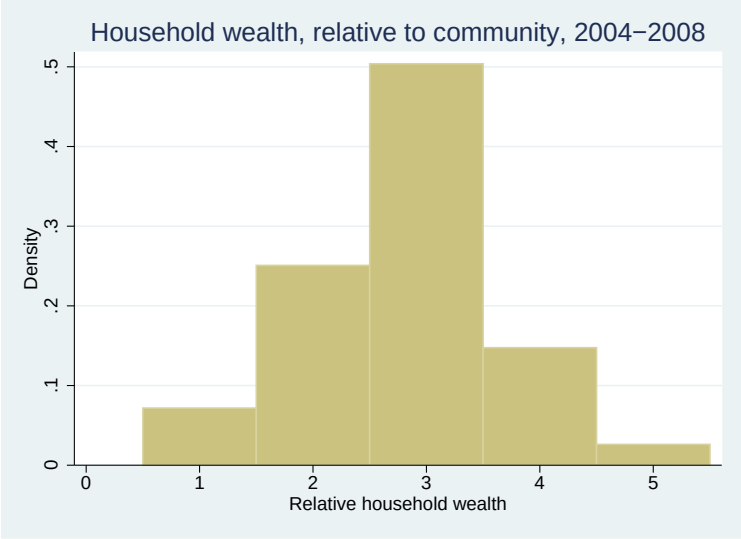

Figure B.11: Household wealth, relative to community, 2004-2008

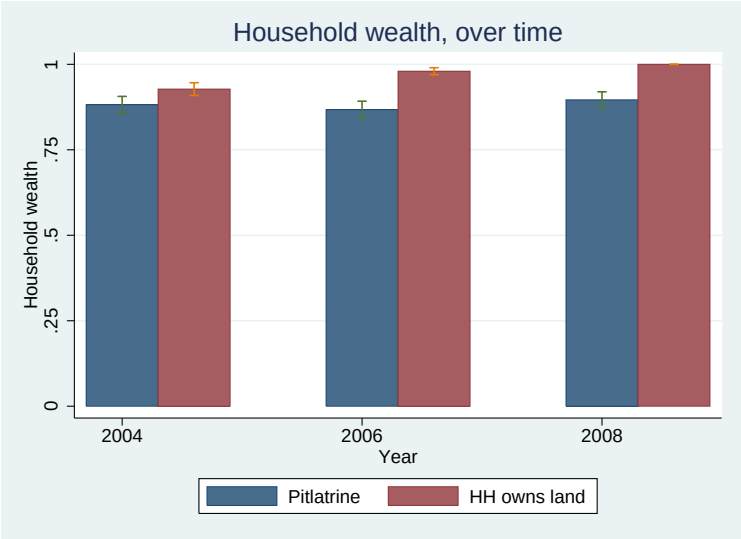

Figure B.12: Household wealth, over time