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The Risk of Polygamy and Wives' Saving Behavior

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Abstract

In a polygamous society, all monogamous women are potentially at risk of polygamy. However, the anthropological and economic literatures are silent on the potential impact of the risk of polygamy on the economic decisions of monogamous wives. This paper explores this issue in Senegal, using individual panel data. The paper first estimates a Cox model for the probability of transition to polygamy. Second, it estimates the impact of the predicted risk of polygamy on monogamous wives' savings. The findings show a positive impact of the risk of polygamy on female savings entrusted to formal or informal institutions, which is suggestive of self-protective strategies. The increase in savings comes at the cost of reduced consumption of household food expenditures and wives' private nonfood expenses.

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I. Introduction

Polygamy[1] is widespread in many developing countries, and although it has been declining since the 1970s, it remains persistent especially in sub-Saharan Africa. In 2000, the overall prevalence of polygamy was 28 percent in the 34 countries studied by Fenske (2015), based on data from the demographic and health surveys on ever-married women of childbearing age. Although in a polygamous society only a certain proportion of unions actually become polygamous, almost all monogamous women are faced with the risk of polygamy. As noted by Antoine (2002), in Senegal a majority of women will be in a polygamous union at some point in their lives.

Socio-anthropological research suggests that the arrival of a second wife is mostly viewed by women in a monogamous union as a threat (Madhavan 2002; Antoine 2002). This threat may be exploited by the husband to monitor his wife, who has in general no say in this decision (Madhavan and Bledsoe 2001). The extensive literature review provided by Bove and Valeggia (2009) substantiates this fear since it shows a negative correlation between polygamy and women's health. However, the economic literature is silent on the potential impact of the anticipation of polygamy on the allocation of resources within households. In particular, no paper, to our knowledge, has investigated the strategies that women in monogamous unions may implement in order to avoid the arrival of a cowife or to protect themselves against such an event. Only rare qualitative evidence of such strategic behaviors is provided by demographers: Antoine (2002) mentions one of these strategies of monogamous wives consisting of not sharing their income with their husband and driving him to spend more in order to decrease his saving capacity and impede the arrival of a cowife. Marrying a second wife is indeed costly to the husband: savings are needed to pay for both the wedding and the bride price, which has remained high and remarkably stable over time in Senegal, according to our survey data. As for women, they may have incentives to increase their own savings so as to protect themselves against the arrival of a cowife, which may be viewed as a negative income shock. Depending on their capacity to protect their savings from their husbands, we expect different strategies of monogamous wives in response to an increased risk of polygamy. This article thus intends to fill a gap in the literature on polygamy by exploring the impact of the threat of polygamy on monogamous spouses' saving behavior and resource allocation decisions.

The case of Senegal is particularly interesting since previous studies have shown that the prevalence of polygamy is still high and declines at a slower pace than in most other sub-Saharan countries. The share of young women (aged 20 to 24) in a polygamous union has even increased in rural areas from 1986 to 1997 Antoine (2002). In 2006, according to our data, 38 percent of Senegalese married women aged 15 to 60 are in a polygamous union.

We use original individual panel data from a nationally representative survey (*Enquête Pauvreté et Structure Familiale* [PSF]) conducted in 2006–7 and 2010–12. Our data are unique and particularly suitable for this analysis. Indeed, while survey data in the developing world generally collect information on savings at the

[1] In this article, we use the generic term polygamy for polygyny: polyandry does not exist in Senegal.

household level, the PSF data provide us with information at each survey date on the stock of savings of each household member, which allows us to focus on wives' savings and resource allocation decisions.

We implement a two-step analysis, detailed in the Empirical Approach and Identification Strategy section. In the first step, we obtain for each union the predicted risk of polygamy with a duration model. Identification in the second step relies on the different time patterns of transitions of unions to polygamy depending on the polygamy of the husband's father. We thus make the assumption that the polygamy of the husband's father does not affect the variation of saving behaviors over time other than through the risk of polygamy. Potential violations of this assumption caused by differential inheritance rules across groups or polygamy of the husband's father partly capturing household wealth are investigated and ruled out in the Empirical Approach and Identification Strategy section.

Our main results show that the risk of polygamy has a positive impact on wife savings, but only on savings entrusted to formal or informal institutions, as opposed to savings kept at home, especially for women living in the poorest households. Household food expenditures are found to decrease with the risk of polygamy, suggesting a possible reallocation of women's resources from food consumption to savings. In addition, women facing a larger increase in their risk of polygamy spend more on the education of their children, but this increase in education expenditures is exclusively funded by a higher contribution of their husband, while their own contribution decreases. They are also found to transfer more to their social networks. These results suggest that the risk of polygamy leads monogamous wives to engage in self-protective strategies by investing in assets that are out of the reach of their husbands and in their social networks. On the other hand, the risk of polygamy is not found to affect women's labor market participation. By contrast, the risk of polygamy is positively correlated with monogamous husbands' labor market participation and income, consistent with an accumulation strategy to afford a second wife.

This paper first contributes to the empirical literature on polygamy initiated by Grossbard (1976).[2] While the theoretical framework provided by Grossbard (1980), based on the theory of marriage developed by Becker (1974), accounts for the emergence and persistence of polygamy at the society level, little is known yet on the microdeterminants of polygamy. Indeed, most research in this area is based on the comparison of two groups of individuals according to the type of their union and does not account for self-selection effects. Jacoby (1995) goes further by identifying the causal relationship between female agricultural productivity and polygamy. However, these findings cannot account for the persistence of polygamy in urban areas, as observed in Senegal (Antoine 2002). Controlling for socioeconomic characteristics of both spouses, we find evidence of the transmission of norms regarding polygamy from fathers to sons. In this strand of literature exploring the microdeterminants of polygamy, the approach of this paper is original since we focus on unions and explore the determinants of the transition from monogamy to polygamy based on a survival analysis. Indeed, even in countries where polygamy is the norm, a non-negligible proportion of unions will remain monogamous.

[2] See also Grossbard (2014) for a review.

Second, to the best of our knowledge, this paper is the first to investigate the impact of the anticipation or threat of polygamy on economic decisions of monogamous spouses. The only studies on the effects of polygamy on household economic behavior focus on polygamous households and do not study the impact of the risk of polygamy on nonpolygamous households. Yet, papers analyzing the economic impact of polygamy are scarce, with the exception of Dauphin (2013) and Dauphin and Fortin (2001), who focus on the effect of polygamy on the efficiency of agricultural households, or Grossbard-Shechtman (1986), who studies the impact of polygamy on fertility. At the macroeconomic level, the relationship between polygamy and savings has been explored in a theoretical model by Tertilt (2005). In the authors' model, polygamy leads in particular to high bride prices and high fertility, which crowd out other investments. Descriptive evidence of the relationship between polygamy and savings at the microlevel is provided by De Laiglesia and Morrison (2008). Using household survey data from Ghana, Indonesia, and Côte d'Ivoire, the authors find that polygamous households have lower assets per capita than monogamous ones, but they do not account for self-selection into polygamy. Our paper tests another channel for the impact of polygamy on saving decisions based on the strategic behaviors of monogamous wives "at risk" of polygamy.

The article is structured as follows. Section II discusses evidence of noncooperative behaviors between spouses. In section III, we present our empirical model and identification strategy. The data are described in section IV. Results on the determinants of polygamy and on the impact of the risk on polygamy on savings are presented and discussed in section V. Finally, section VI concludes.

II. The Risk of Polygamy and Savings: Discussion of Potential Channels

Several works have shown that spouses in developing countries do not behave cooperatively, especially in the presence of asymmetries of information (Udry 1996; Ashraf 2009; Castilla and Walker 2013, among others), and that spouses may have conflicting views on the use of household income. For example, different preferences for consumption may lead to different preferences for savings, as modeled by Anderson and Baland (2002), who explain the higher participation of married women from a Kenyan slum to Rotative Savings and Credit Associations (ROSCAs) by a strategy aimed at preserving their savings from their husbands.

Polygamy is of particular interest since it is expected to exacerbate both issues: First, polygamy is a source of asymmetries of information between spouses. Second, it may give rise to opposite incentives to save for husbands and wives. As regards asymmetries of information first, there seems to be a consensus about the fact that men have the final say on whether to take a second wife (Madhavan and Bledsoe 2001). Anecdotal evidence even suggests that, in some instances, the first wife is told about the second marriage of her husband only after the ceremony. Husbands thus have private information on the prospect and date of arrival of a cowife in the household.

In a polygamous context, monogamous husbands and wives may have opposite incentives to save. Note, first, that qualitative evidence in the case of Senegal suggests that husbands and wives pool neither their income nor their savings (Boltz-Laemmel and Villar 2013). No theoretical work has yet investigated the impact of the risk of polygamy on spouses' saving behavior. However, analogies exist with discussions about the risk of marital dissolution in the context of developed countries (González and Özcan 2013).[3] The potential arrival of a second wife represents a potential negative income shock for monogamous wives, who may then have an incentive to increase their precautionary savings. Indeed, in Senegal, the expected contributions of husband and wife to the household budget are not symmetrical: men are expected to provide for their household while women are not (Boltz-Laemmel and Villar 2013). The arrival of a cowife thus implies a decrease in the household per capita income and consumption level, especially if she is accompanied by children from a former union.[4] Monogamously married women may thus have an incentive to save more if the perceived risk of polygamy increases in order to protect themselves against a negative income shock.

Another channel may lead women at risk of polygamy to have higher precautionary savings. Anecdotal evidence suggests that the cohabitation of cowives may be a source of conflict. When faced with the arrival of a cowife, women have an outside option, which is divorce (Antoine 2002; Locoh and Thiriat 1995). Divorce is indeed relatively frequent in Senegal. However, this option is costly since divorced women have to leave their former husband's household and either be taken in by a related household or earn their own living, creating additional incentives for wives to increase their precautionary savings.[5] Two recent papers, in the very different contexts of Ireland and the United States, indeed suggest that women who are faced with a higher risk of divorce both save (González and Özcan 2013) and work more (Papps 2006).

However, the expected impact of an increase in the risk of polygamy on monogamous wives' saving behavior is theoretically ambiguous since it depends on the possibility for women to protect their own savings from being seized by their husbands. Indeed, if the wife's savings can be used by the husband to finance the cost of a second wife, the risk of polygamy is expected to have a negative impact on wives' savings (Antoine 2002). Note that in Senegal data from the PSF survey suggest that the cost of marrying a second wife is high: in addition to the wedding ceremony and the work to set up a room for the new cowife, the husband has to pay a

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[3] Or the risk of late marriage (Kureishi and Wakabayashi 2013). Note that other channels may create different incentives to save for married men and women. One in particular is explored by Browning (2000): based on a two-person household model best suited to the context of developed countries, he shows that the age difference between spouses and the higher longevity of women generates different incentives to save for men and women.

[4] Indeed, 34 percent of polygamous wives of rank 2 were either divorcees or widows before remarrying, while this is the case of only 11 percent of first wives.

[5] Note, however, that in the Senegalese context, divorcing is all the more costly as divorced women are pressed to remarry and are most often constrained to marry as a second- or higher-rank wife. Moreover, divorced women may be constrained to leave some of their children to their husband, which represents a further cost of divorce.

high bride price. From 2001 to 2006, the average bride price for the second wife was about 10.7 percent of the average yearly income of married men.[6]

Depending on the possibility for husbands to seize the private savings of their wives, we may thus expect different strategic behaviors of monogamous wives "at risk" of polygamy. To go further, we need to distinguish different types of savings, depending on their security. While savings held at home may hardly be considered secure, as regards their potential seizure by the other spouse, women have access to other forms of savings and investments. Both qualitative and quantitative data show that the largest share of Senegalese spouses' savings are kept out of the home and entrusted to formal or informal institutions, suggesting that individuals prefer to rely on costly strategies to keep their own resources out of the reach of potential claimants (Boltz-Laemmel and Villar 2013; Boltz, Marazyan, and Villar 2016).

We thus expect women faced with a higher risk of polygamy to increase their secure savings only as a self-protective strategy. In response to the risk of what is likely to be perceived as a negative shock, women may also have higher incentives to invest in other nonseizable assets, such as their social network, which may prove particularly useful in case of their choosing to divorce or, in a long-term strategy, in the education of their children.[7]

Additional channels may explain the impact of the risk of polygamy on wives' economic decisions. As noted by Antoine (2002), monogamous wives may adopt offensive strategies to try to avoid the arrival of a cowife, especially by driving their husband to spend more in order to decrease his saving capacity.

III. Empirical Approach and Identification Strategy

Our empirical analysis first aims at documenting the individual and union determinants of the transition of unions from monogamy to polygamy and, second, at investigating the impact of the risk of polygamy on monogamous wives' strategic saving decisions.

However, the risk of polygamy is not directly observed. We thus adopt a two-step strategy consisting first of (1) estimating a duration model at the union level for transitions from monogamy to polygamy and recovering the predicted risk of becoming polygamous and (2) estimating the impact of this predicted risk of becoming polygamous on saving behaviors of individuals in the population at risk, that is, women in monogamous unions, using the panel dimension of our data to control for individual and union unobserved heterogeneity. Our two-step approach to estimate probabilities for monogamous unions to become polygamous is related to the

[6] It was 13.2 percent for the first wife.
[7] Another long-term investment strategy could lead women at risk of polygamy to increase their fertility. However, the polygamy-fertility nexus is complex since fertility is expected to affect the risk of polygamy. This issue will be explored in a future work.

methodology used by Jacoby, Li, and Rozelle (2002) to study the impact of the risk of land expropriation on farmers' productive investments in rural China.[8]

First Step: Estimation of the Risk of Polygamy

Estimation of a Duration Model

To predict the risk of turning polygamous for individuals in monogamous unions, we estimate a duration model at the union level on the pooled sample of monogamous and polygamous unions made of a husband and his sole or first-rank wife in the first wave of the survey.

Before presenting our model and assumptions, we need to introduce some vocabulary of survival analysis. In our application, individuals in monogamous unions at time t are "at risk" of turning polygamous: the survival function $S(t)$ refers to the probability of being still monogamous at time t, while the failure function $F(t) = 1 - S(t)$ represents the probability of becoming polygamous before time t. The hazard function θ_t refers to the instantaneous transition rate to polygamy at time t, conditional on survival until time t – ie conditional on monogamy until time t.[9]

We first assume that the instantaneous risk for a monogamous union to become polygamous at time t is the hazard rate, $\theta_{i,t}$, which depends on the characteristics of each spouse in union i and on the duration of the marriage t. We choose to estimate a standard semiparametric Cox model stratified by the polygamous status of the husband's father for the instantaneous risk of polygamy for two reasons: First, this variable is one of the strongest predictors of the risk of polygamy, as shown in table S.3 in the supplemental appendix in column (5). Second, the time pattern of transitions to polygamy seems to differ depending on the husband's father's polygamy status, as appears in figure 1.[10]

[Figure 1 about here]

We assume that the instantaneous risk of polygamy for each union i is represented by the hazard function θ_i, which writes:

$$\theta_{i,z}(t, X_{i,1}) = \theta_{0z}(t) \cdot \exp(\gamma' X_{i,1}), (z = 0,1), \qquad (1)$$

where Z is the stratification variable ($Z = z$), equal to 1 if the husband's father is (or was, if deceased) polygamous and 0 if monogamous. $\theta_{0z}(t)$ is the baseline hazard, which is nonparametrically estimated on the two subsamples defined by the

[8] Note, however, that their strategy in the second step is different from ours in that they do not exploit panel data, and identification solely relies on the exclusion of village dummies.
[9] Note that the hazard rate is not a probability and can take any positive real value.
[10] As a robustness check, we estimate a more flexible Royston-Parmar model (Royston and Parmar 2002) and find similar first step results, as shown in table S.3 in the supplementary materials.

stratification variable z. $X_{i,1}$ is a set of time-invariant characteristics of the union and of each spouse determined at the time of marriage and not affected by postmarriage outcomes, to avoid reverse causality issues.[11] In our main empirical specification, we control for both spouses' age at marriage, ethnicity, education, having been fostered before the age of 15, the education and activity of both spouses' parents, and the location of the union (Dakar and other urban areas, as opposed to rural areas).[12]

Prediction of the Risk of Polygamy

Based on equation (1), we predict for each union, at each survey wave, the failure function, which represents the probability to become polygamous before time t. In this specific application, we first argue that the failure function, which is a cumulative distribution function, better captures the relevant perception of the risk of polygamy than the hazard rate, which may be interpreted in a continuous setting as the instantaneous transition intensity to polygamy at time t. Second, saving decisions are likely to be made with a medium to long time horizon, rather than be sensitive to instantaneous risks. Third, contrary to the hazard rate, the failure function is a probability, making the interpretation of the magnitude of the effects more intuitive.

The predicted failure function $\widehat{F_{\iota,zt}}$ is obtained for each union i from the predicted survival $\widehat{S_{\iota,zt}}$:

$$\widehat{F_{\iota,z}}(t, X_{i,1}) = 1 - \widehat{S_{\iota,z}}(t, X_{i,1}) = 1 - \widehat{S_{oz}}(t)^{\exp(\widehat{\gamma'} X_{i,1})} \qquad (2)$$

The predicted failure thus depends on the estimated stratified nonparametric baseline survival, and the predicted hazard ratio, depending on the characteristics $X_{i,1}$ of union i. $\widehat{F_{\iota,zt}}$, is then included as a regressor in our second step resource allocation equations.

More specifically, the second step of our estimation strategy uses the two waves of the survey collected on average 4.3 years apart and focuses on the subsample of unions that have remained monogamous. We are thus interested in the difference between the predicted failure function at the two survey dates ($\widehat{F_{w2}} - \widehat{F_{w1}}$), which represents the probability of becoming polygamous between the two survey waves, denoted, respectively, w_1 and w_2. As noted above, the set of individual- and union-level characteristics $X_{i,1}$ only contains variables that are predetermined at the

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[11] Since inheritance, and in particular housing inheritance, may help husbands to afford the cost of taking a second wife (Lambert, Ravallion, and van de Walle 2014), we estimated an additional specification with a dummy equal to one for the death of the husband's father between the two waves as a time-varying variable likely to affect transitions to polygamy and found similar second step results (available upon request).

[12] Both our first- and second step results are robust to alternative first step specifications. See the Estimation of the Risk of Polygamy section and table S.3 in the supplemental appendix. Second-step results for alternative specifications are available upon request.

time of marriage. Both the predicted risk of becoming polygamous at time w_1 and at time w_2 are thus directly obtained from equation (1), estimated using the first survey wave only. By using the data from the first survey wave only to estimate the risk of becoming polygamous at both survey waves, we thus assume that the pattern of duration dependence and the determinants of polygamy do not change between the two survey waves, which does not seem unrealistic given that the average period between the two waves is only about 4.3 years.

Capturing the impact of the length of marriage on the risk of polygamy through estimated failure rates rather than simply using marriage duration as observed in the data has three advantages. First, using observed marriage duration may lead to errors-in-variable problems, as noted by Jacoby, Li, and Rozelle (2002). Indeed, the actual marriage duration is partly determined by a stochastic process and is subsequently a noisy indicator of the underlying uncertainty faced by monogamous wives as regards a potential transition to polygamy. Second, survival analysis allows us to account for data censoring, corresponding to the fact that some of the monogamous unions in our sample will actually become polygamous in the future but their transition is not observed yet, while we exploit the timing of the transition to polygamy of first-rank polygamous wives. In addition, this strategy allows for a flexible nonlinear relationship between marriage duration and the probability for a union to turn polygamous and accounts for the effect of observed individual and union characteristics on transition patterns.

In our second step, we thus exploit both the variability in the survey dates across households and the fact that the increase in the predicted failure over the course of marriage is nonmonotonous, meaning that we have enough variability across unions in the increase of our risk variable between the two survey waves, $\widehat{F_{i,zt}}$, as shown in figure S.1 in the supplemental appendix.

Second Step: Impact of the Risk of Polygamy on Wives' Resource Allocation Decisions

Empirical Model

We estimate for each outcome the following baseline specification:

$$Y_{it} = \beta_0 + \beta_1 \widehat{F_{i,z}}(t, X_{i,1}) + \delta_1 t_i + \delta_2 t_i^2 + \alpha_i + \varepsilon_{i,t}, \qquad (3)$$

where the dependent variable Y_{it}, is the outcome decision considered—savings, consumption choices, or transfers—of the wife in union i and is measured at time t, $t = w_1, w_2$. We exploit the variability across unions in the interval between w_1 and w_2 and control for the potential nonlinear impact of time by including t_i, the amount of time (in months) elapsed between the two survey waves, and its square. α_i are union fixed effects. $\widehat{F_{i,z}}(t, X_{i,1})$ is the predicted failure for the risk of becoming polygamous before time t, as defined in equation (2) and obtained from the survival analysis conducted in the first step. As explained above, $\widehat{F_{i,z}}(t, X_{i,1})$ depends on the stratification variable Z_i, which is the polygamy status of the husband's father, on time t, and on time-invariant characteristics of the union $X_{i,1}$. Standard errors are

bootstrapped to account for the extra sampling variability induced by the inclusion of a predicted regressor in the model.

We then enrich our baseline specification by controlling for time-varying union characteristics and estimate the following equation:

$$Y_{it} = \beta_0 + \beta_1 \widehat{F_{i,z}}(t, X_{i,1}) + \beta_2{}' X_{i,t} + \delta_1 t_i + \delta_2 t_i{}^2 + \alpha_i + \varepsilon_{i,t}. \qquad (4)$$

Notations are the same as above, and $X_{i,t}$ refers to time-varying spouse or union characteristics of union i at time t, namely the household size, the share of dependents in the household (younger than 17 and older than 60 years), the relative cell size, and dummies equal to 1 if the father of each spouse is deceased.

We finally estimate the following equation, in which we allow all determinants of polygamy included in equation (1) to have a differential impact on economic outcomes Y_{it} over time:

$$Y_{it} = \beta_0 + \beta_1 \widehat{F_{i,zt}}(t, X_{i,1}) + \beta_2{}' X_{i,t} + \beta_3{}'(X_{i,1} \times t_i) + \delta_1 t_i + \delta_2 t_i{}^2 + \alpha_i + \varepsilon_{i,t}. \qquad (5)$$

In equation (5), we add to the set of controls of equation (4) the interaction between all the baseline controls $X_{i,1}$ that were included in the estimation of equation (1) and the time elapsed between the two survey waves t_i. Identification in this last specification relies on one exclusion restriction only: the exclusion of the interaction between time and our first step stratification variable, the polygamy status of the husband's father.

Note that our second step results are robust to changes in specifications and to the estimation of a flexible parametric Royston-Parmar model instead of a Cox model in the first step (results available upon request). In addition, we test a reduced-form specification in which the dummy for polygynous husband's father interacted with the union duration enters the savings equation directly (see table S.6 in the supplemental appendix). Consistent with the results of our two-step empirical strategy, we find that the coefficient on the interaction term is positive and significant for both the stock of the wife's savings and the probability that she saves, driven by savings entrusted to institutions. Note, however, that our two-step analysis captures more finely the nonlinear increase in the risk of polygamy over marriage duration and the differential trends in the risk of polygamy over the two groups (high-risk with husband's father polygamous, and low-risk with husband's father monogamous). Moreover, in the first of our two steps we exploit information on the timing of the entry of the second wife through actual transitions from monogamy to polygamy since it is estimated on the sample of monogamous and polygamous first wives.

Identification Assumptions and Exclusion Restrictions

The use of panel data with union-level fixed effects allows us to identify the impact of a change in the risk of becoming polygamous, controlling for all time-invariant unobserved characteristics of spouses and unions likely to affect both their polygamy status and wives' saving decisions. Identification in the above three specifications

thus relies on the standard panel fixed effect assumption that no other time-variant characteristic than those included in the model is correlated with both the risk of turning polygamous and wives' saving decisions. More specifically, in equations (3) and (4) identification relies on the exclusion of the interaction of our first step time-invariant variables $X_{i,1}$ and Z_i with time. In other words, we make the assumption that all the variables that enter equation (1) as determinants of polygamy do not have a differential impact on resource allocation decisions over time, except through the risk of polygamy. Note, however, that this assumption does not imply that the variables $X_{i,1}$ and Z_i do not explain different allocation decisions and, in particular, different savings levels. We indeed control for the potential impact of all time-invariant individual and union characteristics on savings through union fixed effects.

In our last specification, equation (5), identification relies on the sole exclusion of the interaction of the stratification variable Z_i with time.[13] This exclusion restriction amounts to assuming that the polygamy status of the husband's father does not affect the wife's saving variation over time, other than through the risk of polygamy.

Note that although the polygamy status of the husband's father may induce different initial conditions in terms of wealth endowment (polygamy being often associated with a higher socioeconomic status), this effect is captured by the union fixed effects included in all second step regressions.[14] Moreover, since we control for the interaction of proxies of socioeconomic status such as the education of both spouses and the education and sector of activity of the husband's father, with time we are likely to capture the potential differential effect over time of initial endowments on wives' saving decisions.

Since differential inheritance depending on the polygamy status of the husband's father could make savings trends differ between the two groups, we test additional specifications by including in our set of controls a dummy equal to 1 if the husband has at least one elder brother and the total sibship size.[15] Second step results (shown in table S.5 in the supplemental appendix) are not altered, suggesting that our findings are not driven by potentially different expectations about inheritance across groups. Note in addition that in all specifications with time-varying controls (ie panel B and C in all tables), we control for the death of each spouse's father between the two waves to account for the potential direct impact of inheritance. Finally, we

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[13] In all specifications, identification also relies on the nonlinearity of the failure function with respect to time and the husband's father polygamy status, the baseline survival function being estimated on each strata.

[14] Table S.2 in the supplemental appendix compares the observable characteristics of unions depending on the polygamy status of the husband's father and shows that they mainly differ as regards the ethnicity and education of both spouses.

[15] Controls for the size and age composition of the sibship also capture the potential increase in the risk of polygamy induced by the practice of levirate, as discussed below in the Estimation of the Risk of Polygamy section. See table S.3, column (4), in the supplemental appendix for first step results.

estimate our second step equations separately for unions living in households below and above the median level of per capita household expenditures. We find that the impact of our risk variable is significant for the poorest unions only, which suggests that wealth effects do not drive our results.

Note that since the failure function is a cumulative distribution function, for each union the predicted risk mechanically increases between the two survey waves. One may be concerned with the fact that according to life cycle theories individuals' saving capacity is also expected to increase over time (at least for active-age individuals, which is the case for the largest part of our sample restricted to women aged 15 to 60 years). However, we argue that our second step results are not driven by an omitted variable bias. Indeed, since we use panel data and estimate a model with union fixed effects, we are interested in the impact of within-union variations in the risk of polygamy on the variation of savings. First, we actually control for time in our second step equations by exploiting the variability in the time span between both survey waves across households and even allow for a nonlinear impact of time on savings by including a squared term. Second, our data suggest that the positive within-union variation in the risk of polygamy between the two waves is uncorrelated with marriage duration, as shown in figure S.2 in the supplemental appendix.

Finally, we focus in this second step on wives' economic decisions. Indeed, as mentioned in section II, strong asymmetries of information exist between spouses as regards the potential arrival of a cowife. Our approach in terms of risk of polygamy best applies to the wife, who has no say in her husband's decision to take a second wife. We mention second step results for male employment, savings, and transfers as they help us to shed light on some of the mechanisms behind our results obtained for wives, but they should be interpreted with caution.

Sample Selection

We are faced with a first sample selection issue due to the fact that we focus on monogamous unions that have remained monogamous between the two survey waves. The obvious reason for this choice is that initially monogamous women whose union has become polygamous between the two waves are not facing in the second wave the same incentives in terms of savings and resource allocation as still-monogamous wives. Consequently, unions that are at a higher risk of becoming polygamous before the second wave may also be at a higher risk not to be included in our regression sample since all unions that became polygamous between the two survey waves are mechanically dropped from our second step regression sample. This strategy implies that we are estimating the impact of the risk of polygamy on a sample of unions that are on average facing a lower risk than our population of interest (monogamous wives), which we expect to downward bias our results. Note, however, that since we include union fixed effects, we control for any sample selection driven by time-invariant union characteristics. Attrition issues are further discussed in the supplemental appendix.

Note that since we choose to focus on unions, we identify the effect of the risk of polygamy based on the sample of actual matches only. Since women who are the

most polygamy-averse may have preferred to remain single, we are likely to obtain a lower bound estimate of the impact of the risk of polygamy on savings. However, staying single is not a desirable option for women in the Senegalese society, where social status is highly correlated with marital status. This issue of social status is also related to the question of divorce as an exit option for monogamously married wives in the case of the entry of a second wife into the union. While divorce is possible and relatively frequent in Senegal, a woman who chooses to divorce does not stay single for long and is more likely to remarry as a second- or higher-rank wife, making divorce a very costly and inefficient strategy for monogamous wives who want to avoid polygamy.

Another concern is linked to the fact that the polygamous status of the husband's father is very likely known by the bride, which may imply some form of assortative mating. One interpretation of this is that only women who have no other option marry a man with a high risk of polygamy. Note, however, that this concern may be of second order for women since being married as a first wife, even to a man more likely to become polygamous, is probably preferable to marrying as a higher-order wife. In a context where a probably significant share of marriages are arranged, women who have no choice but marry a high-risk husband might be from a poorer or more traditional background. Yet, we account for these characteristics of the wife by controlling in both our first and second step regressions for the education and sector of activity of both spouses' fathers. We further control for the age difference between husband and wife, and, in additional specifications, we include in the set of regressors the bride price and the amount spent for the wedding as proxies for the bargaining power of the wife. Controlling for these variables, capturing in part the bargaining power of the wife, does not affect our estimation results, which makes us confident that assortative mating does not bias our results. Another interpretation of this potential assortative mating could be that women who choose to marry a man with a higher perceived risk of polygamy may be less averse to polygamy. In such a case, our results would be biased toward zero since we would expect less response to the anticipated risk of polygamy.

IV. Data

The PSF Individual Panel Survey

The data used in this paper come from an original nationally representative household survey, "Poverty and Family Structure" (PSF), conducted in Senegal from 2006 to 2012.[16] The data were collected in two waves, in 2006 and 2007 for the first wave and

[16] The survey has been conducted by a team of French researchers and researchers from the National Statistical Agency of Senegal and is described in detail in DeVreyer et al. (2008). Momar Sylla and Matar Gueye (both of the Agence Nationale de la Statistique et de la Démographie of Senegal [ANSD]), and Philippe De Vreyer (Paris-Dauphine Dauphine, IRD-DIAL), Sylvie Lambert (PSE), and Abla Safir (World Bank) designed the survey. The data have been collected by the ANSD thanks to the funding of the International Development Research Center (IDRC), INRA Paris, CEPREMAP and the World Bank.

from late 2010 to mid-2012 for the second wave, constituting an individual panel. The data provide, in particular, detailed information on marital trajectories, savings, and labor market participation at the individual level. The overall sample in the first wave is made of 1,750 households and 14,450 individuals, in 150 randomly drawn census districts. In the whole sample, 57.1 percent of the individuals are living in a rural area, 48 percent are males, and 95 percent are Muslim. The average household size is between eight and nine members.

The PSF survey data are rich and unique in that they intend to account for the complexity of household structures in Senegalese society. The questionnaire relies on the preliminary identification of household substructures, referred to as cells. Cells are defined as units that are semi-autonomous as regards resource allocation decisions, composed of a cell head and his or her direct dependents—in particular, children, foster children, or widowed mother or father. The average household is made of 2.4 cells of around three members each. Notably, expenditures data were collected at the cell level, with a distinction between expenditures specific to each cell or common to the whole household, and the identification of all contributors to each type of expenditures. This allows us to identify intrahousehold variations in consumption patterns and resources reallocation between spouses.

The PSF data are also particularly suitable for this analysis since savings stock, as well as the flows of transfers sent out and received from individuals out of the household in the past 12 months, were collected at the individual level, meaning in particular that each spouse reports his or her own savings and transfers. We have detailed information about savings; notably, we can distinguish between savings in formal institutions, informal associations, or Rotating Saving and Credit Associations (ROSCA, or *tontine* in Senegal) and savings held at home.

Descriptive Statistics

Our sample of interest in the first step of our empirical analysis is composed of all coresident monogamous and polygamous unions made of a husband and his only or first-rank wife. We restrict our sample to unions in which women are between 15 and 60 years old and drop the 60 unions with the husbands who are Christian. Our final sample for the first step of the analysis is thus made of 1,388 unions surveyed in the first wave of the PSF survey.

On the subsample of 457 men living in a polygamous union (434 observations, once missing values on years of marriage are taken into account), we observe that the majority of polygamous men first married around 25 years old and took a second wife just before 40. The median interval between first and second marriages is 10 years, and 75 percent of second marriages occurred in the first 16 years of the first union.

Table S.1 in supplemental appendix provides descriptive statistics of socioeconomic characteristics of our first step sample made of monogamous and polygamous first-rank unions.

V. Results

Estimation of the Risk of Polygamy

We first estimate a Cox model, stratified by the polygamy status of the husband's father, for the risk of polygamy, as defined in equation (1). The survival function estimated for each strata is presented in figure 1, and estimation results for the $X_{i,1}$ variables are shown in table 1. Hazard ratios (exponentiated coefficients) are reported. Hence, in table 1, a coefficient larger (resp. smaller) than 1 means that the corresponding variable increases (resp. decreases) the likelihood of a transition to polygamy.

Figure 1 suggests that there is no significant difference in the survival function for unions depending on the polygamy status of the husband's father during the first 10 years of marriage, while the gap widens and becomes statistically significant after 15 years of marriage. Unions with sons of polygamous men are more at risk of becoming polygamous than those with sons of monogamous men, consistent with the transmission of preferences for polygamy from father to son.

[Table 1 about here]

As shown in table 1, we find that when the wife has been fostered in childhood the risk for the union to become polygamous is about 30 percent lower, whereas when the husband has been fostered in childhood the risk of polygamy increases by 58 percent for men. An interpretation is suggested by Coppoletta et al. (2011),[17] who explore more finely the impact of different types of fostering in childhood on polygamy in Senegal. They find that only traditional fostering (i.e., to the maternal aunt) decreases the probability for women to be in a polygamous union. For men, the fact that fostering increases the probability of polygamy is driven by nontraditional fostering (i.e., to someone with no family links). These results suggest that traditional fostering tends to protect from polygamy, maybe because it is a substitute to traditional arranged marriages between cousins. In addition, having no education is found to accelerate transitions to polygamy especially for wives, consistent with Grossbard (1976). Living in urban areas decreases the risk of becoming polygamous by 27 percent, which could partly be due to a greater persistence of traditions and a lower land pressure in rural areas, allowing for the accommodation of larger households, though not excluding the possibility of selective migration.

Alternative specifications are presented in table S.3 in the supplemental appendix. Coefficients are found to be particularly stable across specifications. Column (1) of table S.3 in the supplemental appendix is our main specification, also reported in table 1. In columns (2) to (4), additional controls are included: a dummy equal to 1 if the wife's father is polygamous (column (2)), the amount of the bride price and dowry (column (3)), the sibship size of the husband and whether he has any elder brothers (column (4)). We find that the polygamy of the wife's father is

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[17] Coppoletta, R., P. De Vreyer, S. Lambert, and A. Safir. 2011. "The Long Term Impact of Child Fostering in Senegal: Adults Fostered in Their Childhood." Unpublished manuscript, PDF, November, 2011.

positively correlated with the risk of polygamy while the bride price (paid by the husband) is negatively, though weakly, correlated with the risk of polygamy. The latter finding may suggest that the bride price partly reflects the bargaining power of the wife. The bride price may also capture unmeasured characteristics of the wife that may be valuable and make her more productive, which would reduce the husband's motivation to take a second wife.

In column (4) of table S.3 in the supplemental appendix, the inclusion of the sibship variables is aimed at capturing the additional risk of polygamy induced by the practice of levirate. However, none of the sibship variables has a significant impact on the risk of polygamy.[18] In column (5), the Cox model is not stratified and the polygamy status of the husband's father is added to the set of regressors. All else equal, the husband's father being polygamous increases the risk for the union of becoming polygamous by 43 percent at each marriage duration. Finally, in column (6), we estimate a flexible Royston-Parmar model and find similar results.

Impact of the Risk of Polygamy on Wives' Saving Decisions

In the second step of our empirical analysis, we estimate the impact of the risk for each monogamous union to become polygamous on wives's saving decisions based on the Cox estimates obtained in the first step, as presented in table 1. In order to assess the impact of the risk of polygamy, we focus on the panel of unions, which are present in both survey waves and remain monogamous. Estimation results of the impact of the risk of polygamy on wives' savings are presented in table 2. We present in panels A, B, and C, respectively, the estimation results of equations (3), (4), and (5). All specifications include union fixed effects, the number of months elapsed between the two survey waves, t_i, and its square, t_i^2. In addition to these controls, we include in panel B time-varying union characteristics, $X_{i,t}$, that may affect both the probability of polygamy and resource allocation decisions, such as the household structure and whether each spouse's father is deceased. The specification shown in panel C additionally includes the first step time-invariant controls $X_{i,1}$ interacted with the time elapsed between the two survey waves t_i.

[Table 2 about here]

We first explore the impact of polygamy on the stock of total wife's savings (in log) in column (1), entrusted to institutions, including both formal savings and

[18] Note that although the practice of levirate is widespread in Senegal, we identify only a few cases of levirate in our data: among the 535 polygamous wives of order 2 and higher in our data, only 30 were widowed prior to their current union and are married to a brother of their former husband. And in only five of these cases does the levirate correspond to a transition of a monogamous union to a polygamous one. Second-step results are unchanged when including sibship variables in the set of controls in first- and second step regressions.

participation in ROSCAs[19] or other informal savings associations (column (2)), or kept at home (column (3)). Columns (4) to (6) investigate the extensive margin, and the dependent variable is a dummy equal to 1 if the wife has savings of any kind, entrusted to institutions, and kept at home. By looking separately at different kinds of savings, we intend to investigate the potential impact of the risk of polygamy on wives' strategic behaviours, especially whether wives try to keep their savings out of the reach of their husband when facing a higher risk of polygamy. In column (7), the dependent variable is the share of total savings entrusted to institutions.

We find that a higher risk of polygamy has a positive impact on both wives' stock of savings and their probability to save. Results are found to be particularly stable across specifications. The predicted risk of polygamy lies between 0 and 1, hence, based on panel C's results, an increase of 1 percentage point in the predicted risk of polygamy leads to an increase in the stock of savings of around 14.6 percent. This represents an increase of 9,800 FCFA out of an average stock of savings of 67,102 FCFA.[20] As for the saving propensity, a 1 percent increase in the predicted risk leads to an increase in the propensity to save of 1.7 percentage points, representing a 4.5 percent increase in the baseline saving propensity for monogamous wives. Notably, we observe that this increase in savings is totally driven by savings entrusted to institutions. Consistent with this result, the share of savings held in institutions increases with the risk of polygamy, though not significantly at conventional levels in panels A and C. This finding is in line with the hypothesis that wives facing a higher risk of polygamy have incentives to increase their savings, provided that they are out of the reach of their husbands.

[Table 3 about here]

We subsequently investigate potential heterogeneities in the impact of the risk of polygamy on women's savings, depending on household income. Indeed, as explained in section II, we expect women to increase their precautionary savings when faced with a higher risk of arrival of a cowife, most likely perceived as a negative shock. However, this effect will not necessarily be equal across the income distribution. Since individuals in richer households are more likely to have access to formal insurance or borrowing devices, the precautionary motive for saving may be more important for women in relatively poor households. We explore this issue by estimating separately equations (3) to (5) for wife's savings on the subsamples of monogamous unions in households below and above the median per capita level of household expenditures.[21] Results are shown in table 3, in columns (1) to (3) for the poorest unions and in columns (4) to (6) for unions above the median. Consistent with

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[19] For the value of savings held in ROSCAs, we use the sum of the contributions to the pot during the past 12 months. Results are robust to using the value of the pot or half the value of the pot to capture the fact that, on average, half of the pot results from savings and the other half from loan reimbursement (once the pot is received).

[20] 1,000 FCFA ≈ 1.5 EUR.

[21] The level of household expenditures is here classically preferred to household income as a proxy for socioeconomic status.

results shown in table 2, we find that an increase in the risk of polygamy leads to a higher probability for women to save, out of home only. However, this impact is significant only for women living in the poorest households. These results thus give credence to the precautionary motive for savings. Moreover, they allow us to be confident that our results are not driven by our risk variable capturing wealth, as could be argued based on our identification assumption relying on the exclusion of the polygamy status of the husband's father from our second step equation (see discussion of identification issues in the Identification Assumptions and Exclusion Restrictions section).

Consumption, Labor, and Transfers

Going one step further, we are interested in understanding the trade-offs behind saving decisions in response to a higher risk of polygamy and in particular the way consumption is affected.

Household Food Consumption and Cell Nonfood Consumption Levels

As noted above, a unique feature of the PSF data is that information on consumption is available at the cell level, defined as household consumption subunits.[22] Note that the definition of cells has no impact on the measurement of savings, nor on labor or income, since only information on consumption is collected at the cell level.

We thus additionally analyze the impact of the risk of polygamy on the level of household food consumption per capita for all monogamous unions and cell nonfood expenditures, as well as the contributions of both husband and wife to cell expenditures.

[Table 4 about here]

Table 4 presents the effect of the predicted risk of polygamy on the level of household per capita food expenditures (column (1)), on the level of per capita nonfood expenditures of the wife's cell (column (2)), on the level (column (3)) and share (column (4)) of the wife's contribution to the per capita nonfood expenditures of her own cell, and on the level (column (5)) and share (column (6)) of the husband's

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[22] The definition of cells used in the survey implies that the household head and her or his spouse(s) are always part of different cells. However, monogamous husbands who do not head their household are part of the same cell as their wives, implying that we cannot separately observe the consumption decisions of the two spouses. In what follows, we show results on the total sample of monogamous wives, either sharing their husband's cell or being in a separate consumption cell, to maximize our sample size. However, we test the robustness of our results on the subsample of wives in separate cells, that is, wives of the household head, and find similar results (available upon request).

contribution to the per capita nonfood expenditures of the wife's cell.[23] We find that a higher risk of polygamy is associated with a significant and substantial decrease in the level of household per capita food consumption: according to panel C estimates, a 1 percentage point increase in the risk of polygamy leads to a decrease of 1.8 percentage points in household per capita food consumption, which represents an average decrease of 3,600 FCFA per capita, that is, 39,600 FCFA for a household of 11 members, over the past 12 months. As for nonfood cell consumption, we find that an increase in the risk of polygamy leads to a decrease in the total per capita amount (though not significant in all specifications), while the contribution of the husband to the expenditures of his wife's cell increases, both in amount and share. The positive effect of the risk of polygamy on the wife's contributions in panels A and B disappears in panel C when controlling for the potentially differential impact of step 1 control variables over time. We thus find a clear negative impact of the risk of polygamy on consumption, in terms of both household food expenditures and wife's private nonfood consumption. These results, again, clearly suggest that the positive impact of the risk of polygamy on savings presented above cannot be explained by our risk variable capturing wealth. The increased savings of wives faced with a higher risk of polygamy thus seem to be made at the expenses of both food and nonfood expenditures. Moreover, when investigating the potential heterogeneity of the impact of the risk of polygamy on household and wives' consumption choices with respect to income, we find that results on consumption are driven by unions in the lowest part of the distribution, in terms of household per capita expenditures,[24] consistent with the above results on savings.

Wives' Nonfood Consumption Choices

We investigate in this section the impact of the risk of polygamy on nonfood expenditures of the wife's cell. We thus estimate the same equations (3) to (5), controlling in addition for the level of nonfood expenditures in the wife's cell, so as to estimate Engel curves of spending choices. For the sake of simplicity, we choose to present estimation results of equation (5) only in table 5. The dependent variables in the different columns represent the levels of expenditures on different items for the wife's cell. In the first part of the table, the dependent variables are the total level of nonfood expenditures of the wife's cell, and in parts 2 and 3 the dependent variables are the level of the cell nonfood expenditures funded by the wife and the husband, respectively. Part 1 results show that the cell level consumption choices of women faced with a higher risk of becoming polygamous change, with larger amounts spent on the education of their children: we find that a 1 percentage point increase in the risk of polygamy leads to an increase of the wife's cell expenditures devoted to education by 12 percent. Interestingly, the resuls from parts 2 and 3 show that this

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[23] Note that at wave 1 the average shares of cell nonfood expenditures contributed by the wife and the husband are, respectively, 25 percent and 61 percent, the remaining share being contributed by other household members or individuals out of the household.

[24] Results not shown, available upon request.

increase is only funded by the husband's contributions, while the level of expenditures on education financed by the wife decreases by about 7 percent. We also find that the risk of polygamy is correlated with an increase in the level of expenditures on clothing of the wife's cell funded by the husband.[25]

[Table 5 about here]

Our results on consumption choices at the wife's cell level are thus consistent with self-protective strategies, consisting for women of investing in their children's education, in anticipation of the arrival of a cowife. However, we find that the increase in education expenditures is caused by an increase in the husband's contribution, while the contribution of the wife decreases. We find, similarly, that the contribution of the husband to the wife's cell expenditures on clothing increases, while the total level of expenditures remains unchanged and the wife's own contribution decreases (though not significantly).[26] These latter results seem to give credence to the offensive strategies aimed at leading husbands to spend more so as to reduce their saving capacity, as described in Antoine (2002), combined with self-protective strategies. But they may also be interpreted as resulting from a defensive strategy on the part of the husband to reduce the likelihood that his wife will divorce in response to the arrival of a second wife. Our results on the increased contribution of the husband to the expenditures of the wife's cell are also consistent with a strategy of the husband aimed at signaling to potential second wives that he is a "good" husband who takes care of his first wife. However, the latter interpretation seems to be ruled out by our finding that an increase in the risk of polygamy is associated with a decrease in household food expenditures, which is the most observable consumption item.

Labor and Transfers

Since the prospect of polygamy may affect spouses' labor supply, we investigate the link between our risk variable and the number of weeks worked by both spouses in the past 12 months. We do not find strong evidence that women adjust their labor supply in response to an increase in the risk of polygamy. Results are shown in the supplemental appendix (table S.4). Indeed, the coefficient on the risk variable is not significant for women, except for the negative and marginally significant coefficient (at the 12 percent level), obtained in panel C specification only, for wives' probability to earn any income. As for husbands, we find a positive correlation between the risk of polygamy and the number of weeks worked; however, the strong positive effect on earnings in panels A and B is not significant anymore in panel C.[27]

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[25] As noted above, results on male outcomes should be interpreted cautiously since the husband is the one who decides on the potential arrival of a second wife.

[26] Again, these results are driven by unions in the poorest households. Separate results for unions in households under and above the median per capita expenditures are available upon request.

[27] We additionally explored the correlation between husbands' saving decisions and the risk of polygamy. While we found some positive correlations in panels A and B

[Table 6 about here]

Finally, we investigate in table 6 whether spouses who are more at risk of polygamy rely more on their social network outside the household. We focus in the first six columns on transfers received and sent by monogamous women over the past 12 months. We find a robust and significant positive effect of the risk of polygamy on transfers sent at both the extensive and intensive margins in panels A and B, but not on transfers received. Similar results are obtained for transfers from or to wives' kin, although coefficients are not statistically significant at conventional levels. As for husbands, we find in the last two columns a positive and significant correlation between the risk of polygamy and both the probability to send transfers and amounts transferred.

Results on male outcomes are consistent with a strategy consisting of accumulating more resources through an increased labor supply and increased savings (though our results on savings are not significant at conventional levels for men) when planning to take a second wife. Men are also found to transfer more out of their households, possibly to the future second wife or her family. As for monogamous wives, we find strong evidence that they invest more in their social networks when faced with a higher risk of polygamy, again consistent with a self-protective strategy. In case of financial needs, caused in particular by a possible future divorce, women are likely to rely on their kinship ties to get financial help or accommodation.

VI. Conclusion

This paper is the first to investigate the impact of the anticipation of polygamy on the economic decisions of monogamous women. We thus intend to contribute to the scarce economic literature on polygamy by exploring a new channel for the impact of polygamy on saving decisions based on the strategic behaviors of monogamous wives at risk of polygamy, who constitute a large population in countries where polygamy is legal.

In the first step of our empirical strategy, we estimate a semiparametric Cox model stratified by the polygamy status of the husband's father and predict the risk of a monogamous union to become polygamous. We then use this prediction to estimate the impact of the risk of polygamy on saving behaviors of monogamous wives. The use of panel data with union-level fixed effects allows us to identify the impact of a change in the risk of becoming polygamous, controlling for all the time-invariant and numerous time-varying characteristics likely to affect both the risk of polygamy and wives' saving decisions.

We find that women react to an increase in the risk of polygamy by increasing their savings and investing in what could be interpreted as informal insurance devices, through redistribution in their social networks and increased expenditures on the education of their children. These self-protective strategies are found to be

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between the probability of polygamy and savings, these results did not hold in panel C, the sign being even reversed. Results are available upon request.

implemented especially by women in the poorest households, who are less likely to have access to formal insurance schemes and are more economically vulnerable. These strategies come at the cost of lower consumption levels both in terms of household per capita food expenditures and wives' nonfood private expenditures.

Hence, in this paper, we provide strong evidence that in non-nuclear households in developing countries spouses may act noncooperatively and invest in strategies aimed at keeping their resources out of the reach of other household members. More specifically, this article contributes to a better understanding of how polygamy and, even more, the potential risk of polygamy shape women's saving and resource allocation decisions, which is crucial to being able to design adequate and well-targeted policies aimed at developing social protection for vulnerable socioeconomic groups, in particular women.

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FIGURE 1. Survival Estimate from the Cox Stratified Model

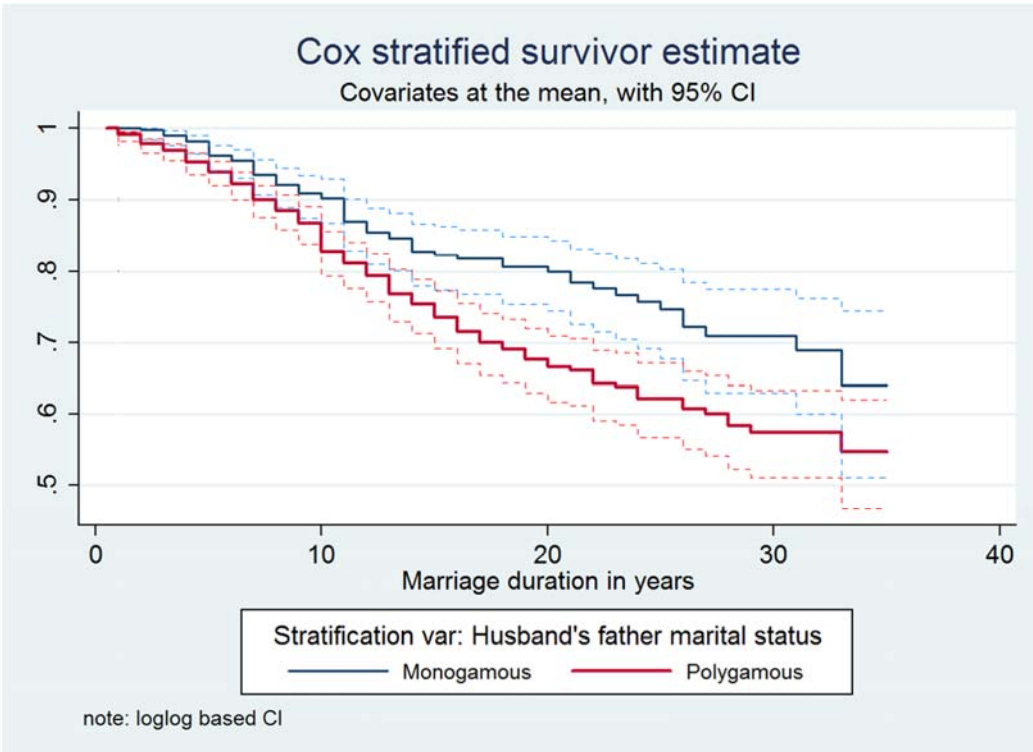

TABLE 1. First-Step Estimation Results for the Risk of Polygamy

Hazard ratio estimates from a stratified Cox model for transitions to polygamy	
Wife controls	
Age at marriage	0.977
	(0.018)
Serere ethnicity	0.630
	(0.257)
Pulaar ethnicity	1.036
	(0.385)
Minority ethnicity	1.062
Ref: Wolof ethnicity	(0.334)
Fostered before 15	0.668**
	(0.124)
No formal education	1.709**
	(0.416)
Secondary education or higher	1.350
Ref: Primary education	(0.487)
Husband controls	
Age at marriage	0.969***
	(0.011)
Serere ethnicity	0.974
	(0.393)
Pulaar ethnicity	0.636
	(0.238)
Minority ethnicity	0.733
Ref: Wolof ethnicity	(0.235)
Fostered before 15	1.581***
	(0.205)
No formal education	1.298
	(0.257)
Secondary education or higher	1.005
Ref: Primary education	(0.294)
Union controls	
Dakar region	0.833
	(0.147)
Other urban area	0.729*
Ref: Rural area	(0.135)
Additional controls†	Yes
Number of observations	1356

Semi-parametric Cox proportional hazard model stratified by the polygamy status of the husband's father; exponentiated coefficients are presented (hazard ratios); robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The estimation sample includes all monogamous unions and polygamous unions made of husband and first-rank wife aged 15 to 60, in the first wave of the PSF Survey.

† Additional controls include dummies for Koranic education of both spouses' parents, and for formal education and sectors of activity of both spouses' fathers.

Data source: PSF Survey, wave 1 (2006-2007)

TABLE 2. Impact of the Risk of Polygamy on Wives' Savings, *Panel Fixed Effect Estimation*

	(a)			(b)			(c)
	Savings stock (in log)			Has savings (dummy)			Share in
	Total	Institutions	At home	Total	Institutions	At home	institutions
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: equation (3), incl. time, t and t^2, union FE†							
Estimated risk of polygamy, $\widehat{F}_t$	12.078*	13.839**	2.167	1.474**	1.650***	0.437	0.310
	(6.188)	(6.008)	(3.389)	(0.595)	(0.577)	(0.379)	(0.248)
Number of observations	1548	1548	1548	1548	1548	1548	1522
Number of unions	774	774	774	774	774	774	761
Within R2	0.011	0.011	0.029	0.017	0.015	0.034	0.84
Panel B: equation (4), incl. time-varying controls X_t, t and t^2, union FE‡							
Estimated risk of polygamy, $\widehat{F}_t$	14.417**	17.172**	0.801	1.499**	1.776***	0.317	0.415*
	(7.179)	(6.847)	(3.658)	(0.686)	(0.654)	(0.401)	(0.240)
Number of observations	1482	1482	1482	1482	1482	1482	1462
Number of unions	741	741	741	741	741	741	731
Within R2	0.021	0.024	0.052	0.026	0.027	0.058	0.84
Panel C: equation (5), incl. 1st-step controls × time $X_1 \times t$, X_t, t, and t^2, union FE⋆							
Estimated risk of polygamy, $\widehat{F}_t$	14.649*	15.756**	-2.399	1.665**	1.767**	-0.070	0.403
	(8.070)	(7.894)	(4.349)	(0.778)	(0.754)	(0.459)	(0.345)
Number of observations	1482	1482	1482	1482	1482	1482	1462
Number of unions	741	741	741	741	741	741	731
Within R2	0.063	0.060	0.091	0.071	0.068	0.097	0.84
Unconditional mean (wave 1)	3.94	3.76	0.47	0.38	0.36	0.05	0.35

Panel union fixed effect model estimates. Standard errors in parentheses are bootstrapped (300 replications); + $p<0.12$ * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Dependent variables: col (a): stock of savings of the wife (in log); col. (b): a dummy equal to one if wife has savings, col. (2) and (5) correspond to savings entrusted to informal or formal institutions, col. (3) and (6) to savings kept at home. In col. (7): Share of the total stock of savings entrusted to informal or formal institutions

Sample: monogamous unions in the two waves.

$\widehat{F}_t$: predicted failure probability estimated by a Cox survival model stratified by the polygamy status of the husband's father (see Table 1).

All regressions include union fixed-effects

† Controls not shown: time (in months) between the two survey waves and its square

‡ Controls not shown: time, time squared, dummies for the deceased father of each spouse, household size, relative cell size, share of dependents

⋆ Controls not shown: time, time squared, dummies for the deceased father of each spouse, household size, relative cell size, share of dependents, all step-1 controls (see Table 1) interacted with time

In col. 7: we additionally control for the total level of savings in log

Data source: PSF Survey, waves 1 and 2 (2006-2007 and 2010-2012)

TABLE 3. Impact of the Risk of Polygamy on Wives' Savings Below and Above Median Household Expenditures, *Panel Fixed Effect Estimation*

Wife's savings (dummy)	**Below median**			**Above median**		
	Total	Institutions	At home	Total	Institutions	At home
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: equation (3), incl. time, t and t^2, union FE†						
Estimated risk of polygamy, $\widehat{F}_t$	1.868**	2.013**	0.229	0.821	1.035	0.454
	(0.917)	(0.907)	(0.426)	(1.025)	(0.996)	(0.728)
Number of observations	760	760	760	788	788	788
Number of unions	380	380	380	394	394	394
Within R2	0.039	0.037	0.063	0.0049	0.0037	0.015
Panel B: equation (4), incl. time-varying controls X_t, t and t^2, FE‡						
Estimated risk of polygamy, $\widehat{F}_t$	1.736*	2.069**	0.133	0.921	1.190	0.277
	(0.982)	(0.945)	(0.475)	(1.041)	(1.017)	(0.749)
Number of observations	726	726	726	756	756	756
Number of unions	363	363	363	378	378	378
Within R2	0.048	0.045	0.10	0.041	0.042	0.052
Panel C: equation (5), incl. 1st-step controls × time $X_1 \times t$, X_t, t and t^2, union FE⋆						
Estimated risk of polygamy, $\widehat{F}_t$	1.933+	2.076*	-0.536	1.402	1.301	0.370
	(1.243)	(1.215)	(0.618)	(1.458)	(1.366)	(0.940)
Number of observations	726	726	726	756	756	756
Number of unions	363	363	363	378	378	378
Within R2	0.13	0.12	0.18	0.12	0.12	0.12
Unconditional mean (wave 1)	0.34	0.33	0.33	0.43	0.41	0.41

Panel union fixed effect model estimates. Standard errors in parentheses are bootstrapped (300 replications); + p<0.12 * p<0.10, ** p<0.05, *** p<0.01.
Dependent variables: col. (1) and (4): a dummy equal to one if wife has savings, col. (2) and (5) a dummy equal to 1 if wife has savings entrusted to informal or formal institutions, col. (3) and (6) a dummy equal to 1 if wife has savings held at home.
Sample: Col. (1) to (3): monogamous unions in the two waves, below median household per capita expenditures. Col. (4) to (6), monogamous unions in the two waves, above median household per capita expenditures
$\widehat{F}_t$: predicted failure probability estimated by a Cox survival model stratified by the polygamy status of the husband's father (see Table 1).
All regressions include union fixed-effects
† Controls not shown: time (in months) between the two survey waves and its square
‡ Controls not shown: time, time squared, dummies for the deceased father of each spouse, household size, relative cell size, share of dependents
⋆ Controls not shown: time, time squared, dummies for the deceased father of each spouse, household size, relative cell size, share of dependents, all step-1 controls (see Table 1) interacted with time
Data source: PSF Survey, waves 1 and 2 (2006-2007 and 2010-2012)

TABLE 4. The Risk of Polygamy and the Level of Food and Nonfood Consumption
Panel Fixed Effect Estimation

	Household (food)	Cell (non-food)				
			Wife contribution		Husband contribution	
	Amount (p. cap. in log)	Amount (p. cap. in log)	Amount (p. cap. in log)	Share	Amount (p. cap. in log)	Share
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: equation (3), incl. time t and t^2, union FE[†]						
Estimated risk of polygamy, $\widehat{F}_t$	-3.062***	-4.696+	16.150***	0.903**	11.783*	0.925*
	(0.849)	(2.949)	(6.269)	(0.410)	(6.251)	(0.502)
Number of observations	1532	1548	1548	1458	1548	1548
Number of unions	766	774	774	729	774	774
Within R2	0.019	0.016	0.056	0.011	0.016	0.15
Panel B: equation (4), incl. time-varying controls X_t, t and t^2, union FE[‡]						
Estimated risk of polygamy, $\widehat{F}_t$	-2.140***	-3.650	16.805**	0.870*	17.631**	1.072*
	(0.716)	(2.978)	(6.810)	(0.482)	(6.851)	(0.563)
Number of observations	1470	1482	1482	1396	1482	1482
Number of unions	735	741	741	698	741	741
Within R2	0.10	0.024	0.066	0.018	0.025	0.16
Panel C: equation (5), incl. 1st-step controls × time $X_1 \times t$, X_t, t and t^2, union FE[*]						
Estimated risk of polygamy, $\widehat{F}_t$	-1.779*	-6.381*	1.429	-0.155	16.452*	1.484*
	(0.922)	(3.466)	(8.397)	(0.613)	(9.466)	(0.769)
Number of observations	1470	1482	1482	1396	1482	1482
Number of unions	735	741	741	698	741	741
Within R2	0.15	0.058	0.13	0.097	0.060	0.21
Unconditional mean (wave 1)	11.8	10.3	4.40	0.25	8.04	0.61

Panel union fixed effect model estimates. Standard errors in parentheses are bootstrapped (300 replications); + p<0.12, * p<0.10, ** p<0.05,*** p<0.01.
Dependent variables: col (1): Level of per capita household food consumption (in log); col. (2): Level of per capita cell non-food consumption; col. (3): Level of per capital cell non-food consumption funded by the wife (in log), col (4.) share of cell non-food consumption funded by the wife; col. (5): Level of per capital cell non-food consumption funded by the husband (in log), col (4.) share of cell non-food consumption funded by the husband.
Sample: monogamous unions in the two waves;
All regressions include union fixed-effects
† Controls not shown: time (in months) between the two survey waves and its square
‡ Controls not shown: time, time squared, dummies for the deceased father of each spouse, household size, relative cell size, share of dependents.
* Controls not shown: time, time squared, dummies for the deceased father of each spouse, household size, relative cell size, share of dependents, all step-1 controls (see Table 1) interacted with time
Data source: PSF Survey, waves 1 and 2 (2006-2007 and 2010-2012)

TABLE 5. The Risk of Polygamy and the Level of Nonfood expenditures per Type of Commodities of Wives, *Panel Fixed Effect Estimation*

*Estimation of equation (5), incl. 1st-step controls, × time $X_1 \times t$, and X_t, t, t^2, union FE**

Level of cell non-food expenditures (in log) per commodity type	Clothing (1)	Personal care (2)	Furniture (3)	Phone (4)	Education (5)	Transport (6)	Other (7)
Part 1: Total level of cell non-food expenditures							
Estimated risk of polygamy, $\widehat{F}_t$	2.386	-7.895	-20.814***	2.215	12.056*	-8.152	-12.605**
	(5.529)	(5.537)	(7.711)	(7.371)	(6.659)	(8.486)	(4.971)
Number of observations	1482	1478	1482	1478	1482	1482	1482
Number of unions	741	739	741	739	741	741	741
Within R2	0.076	0.081	0.47	0.13	0.14	0.17	0.085
Unconditional mean (wave 1, in FCFA)	46723.4	25307.3	2289.2	9376.8	9483.7	11055.5	11055.5
Part 2: Level of expenditures funded by the wife							
Estimated risk of polygamy, $\widehat{F}_t$	-9.387	3.358	-2.395	2.698	-6.635*	-2.327	-0.852
	(7.152)	(8.529)	(3.260)	(6.648)	(3.991)	(6.924)	(2.616)
Number of observations	1478	1478	1478	1478	1478	1478	1482
Number of unions	739	739	739	739	739	739	741
Within R2	0.100	0.092	0.044	0.096	0.044	0.11	0.051
Unconditional mean (wave 1, in FCFA)	7202.7	13167.5	792.1	2818.6	1200.9	3613.3	3608.4
Part 3: Level of expenditures funded by the husband							
Estimated risk of polygamy, $\widehat{F}_t$	18.598**	-7.901	-11.289**	12.962**	18.926***	-1.576	-5.797+
	(8.628)	(7.953)	(4.839)	(6.281)	(6.845)	(8.090)	(3.547)
Number of observations	1478	1478	1478	1478	1478	1478	1482
Number of unions	739	739	739	739	739	739	741
Within R2	0.058	0.089	0.073	0.080	0.062	0.073	0.082
Unconditional mean (wave 1, in FCFA)	33916.8	11893.9	1004.0	5578.1	7360.0	6381.1	6372.4

Panel union fixed effect model estimates. Standard errors in parentheses are bootstrapped (300 replications); * p<0.10, ** p<0.05,*** p<0.01
Dependent variables: Level of cell non-food per capita expenditures per type of commodities
Sample: monogamous wives in the two waves
$\widehat{F}_t$: predicted failure probability estimated by a Cox survival model stratified by the polygamy status of the husband's father (see Table 1)
All regressions include union fixed-effects
* Controls not shown: time, time squared, dummies for the deceased father of each spouse, household size, relative cell size, share of dependents, all step-1 controls (see Table 1) interacted with time
In all columns, we control for the level of non-food consumption (in log)
Data source: PSF Survey, waves 1 and 2 (2006-2007 and 2010-2012)

TABLE 6. The Risk of Polygamy Risk and Spouses' Transfers, Received and Sent, out of the Household

	Wife						Husband	
	Transfers sent			Transfers received			Transfers sent	
	To anyone		To kin	From anyone		From kin	To anyone	
	Amount (log)	Dummy	Dummy	Amount (log)	Dummy	Dummy	Amount (log)	Dummy
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: equation (3), incl. time, t and t^2, union FE†								
Estimated risk of polygamy, $\widehat{F_t}$	12.101*	1.165*	0.682	4.672	0.901	0.803	18.066**	2.058***
	(6.337)	(0.691)	(0.698)	(7.402)	(0.634)	(0.596)	(7.358)	(0.777)
Number of observations	1548	1548	1546	1542	1548	1546	1414	1414
Number of unions	774	774	773	771	774	773	707	707
Within R2	0.076	0.088	0.049	0.071	0.063	0.059	0.089	0.10
Panel B: equation (4), incl. time-varying controls X_t, t and t^2, union FE‡								
Estimated risk of polygamy, $\widehat{F_t}$	13.430*	1.267+	0.844	4.904	0.877	0.801	19.849***	2.239***
	(7.228)	(0.777)	(0.744)	(7.507)	(0.711)	(0.652)	(7.209)	(0.751)
Number of observations	1482	1482	1480	1476	1482	1480	1396	1396
Number of unions	741	741	740	738	741	740	698	698
Within R2	0.081	0.092	0.058	0.071	0.062	0.058	0.11	0.12
Panel C: equation (5), incl. 1st-step controls × time $X_1 \times t$, X_t, t, and t^2, union FE⋆								
Estimated risk of polygamy, $\widehat{F_t}$	0.440	-0.699	-0.363	0.527	0.088	0.139	2.651	0.144
	(9.109)	(0.979)	(0.896)	(9.072)	(0.915)	(0.835)	(9.034)	(0.970)
Number of observations	1482	1482	1480	1476	1482	1480	1396	1396
Number of unions	741	741	740	738	741	740	698	698
Within R2	0.14	0.17	0.10	0.12	0.11	0.11	0.18	0.20
Unconditional mean (wave 1)	3.72	0.38	0.30	2.35	0.23	0.21	4.19	0.41

Panel union fixed effect model estimates. Standard errors in parentheses are bootstrapped (300 replications);+ p<0.12 * p<0.10, ** p<0.05, *** p<0.01.
Dependent variables: transfers sent and received from individuals out of the household over the past 12 months.
Sample: monogamous unions in the two waves.
$\widehat{F_t}$: predicted failure probability estimated by a Cox survival model stratified by the polygamy status of the husband's father (see Table 1).
All regressions include union fixed-effects
† Controls not shown: time (in months) between the two survey waves and its square
‡ Controls not shown: time, time squared, dummies for the deceased father of each spouse, household size, relative cell size, share of dependents.
⋆ Controls not shown: time, time squared, dummies for the deceased father of each spouse, household size, relative cell size, share of dependents, all step-1 controls (see Table 1) interacted with time
Data source: PSF Survey, waves 1 and 2 (2006-2007 and 2010-2012)