Cooperation in Polygynous Households

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Using a carefully designed series of public goods games, we compare, across monogamous and polygynous households, the willingness of husbands and wives to cooperate to maximize household gains. Compared to monogamous husbands and wives, polygynous husbands and wives are less cooperative, one with another, and co-wives are least cooperative, one with another. The husbands' and wives' behavior in a corresponding series of *inter*-household games indicates that these differences cannot be attributed to selection of less cooperative people into polygyny. Finally, behavior in polygynous households is more reciprocal and less apparently altruistic.

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Many programs aimed at reducing poverty in Low and Middle Income Countries (LIMCs) involve transfers to households of either cash or in-kind resources (Morduch 2011; Baird *et al.* 2014; Banerjee *et al.* 2015; Banerjee, Karlan and Zinman 2015). The optimal design of such programs depends on how decisions are made within households. Understandably, considerable attention has been given to the issue of whether positive effects on children's and other household outcomes are greatest when the transfer recipient is the husband or the wife (e.g., Thomas 1990, 1994; Duflo 2003; Yoong, Rabinovich and Diepeveen 2012; Benhassine *et al.* 2015; Akresh, de Walque and Kazianga 2016; Ambler 2016) and, relatedly, to husband-wife differences in resource allocations and to spousal cooperativeness (e.g., Manser and Brown 1980; McElroy and Horney 1981; Browning *et al.* 1994; Udry 1996; Iversen *et al.* 2011; Bezu and Holden 2015).

However, as the roll-out of such programs in Africa gathers momentum (Garcia and Moore 2012), another issue is beginning to loom large: that of how such programs should be adapted to accommodate *polygynous* households. In some countries in sub-Saharan Africa, many in West Africa, over 40 percent of women are in polygynous marriages (Elbedour *et al.* 2002; Dalton and Leung 2014). This is raising new challenges for policy makers interested in optimizing program impacts and highlighting gaps in our understanding of how decision making differs between polygynous and monogamous households (World Bank 2010; Baland and Ziparo 2017).

In this paper, we investigate whether and how spousal cooperativeness differs between monogamous and polygynous households. We hypothesized that cooperation would be lower within polygynous households. Our reasoning was as follows. Polygyny is associated with higher male premarital social and/or economic status and hence better *ex ante* prospects (e.g., Hames 1996; Zeitzen 2008; Chaudhary *et al.* 2015). However, it is also associated with worse welfare outcomes, especially for junior wives and their children, even after controlling for

household resources and number of children (Amey 2002; Hadley 2005; Tertilt 2005; Bove and Valeggia 2009; Gyimah 2009; Shepard 2013). The gap between *ex-ante* prospects and *ex-post* welfare outcomes suggests that polygynous households are less efficient and this could be owing to the members of such households being less cooperative.

Cooperation could be lower in polygynous compared to monogamous households for many reasons including competition between co-wives, larger spousal age gaps, reduced paternity certainty, and lower genetic relatedness (Jankowiak, Sudakov and Wilreker 2005; Henrich, Boyd and Richerson 2012). Compared to monogamous spouses, members of polygynous marriages, in particular co-wives, have been found to engage in more self-serving strategic behavior. For instance, polygynous wives strategically raise their fertility in response to an increase in the fertility of their co-wives in order to maintain bargaining power over resources controlled by the husband (Rossi 2016); and co-wives have been found to be more conditional in their cooperativeness, one with another, compared to husbands and wives when cultivating land for household consumption (Akresh, Chen and Moore 2012, 2016).

By inviting spouses to make decisions with real monetary consequences in a series of two-person public goods games (PGGs), we generate directly comparable measures of the extent to which husbands cooperate with their wives, wives with their husbands, co-wives with each other, and husbands and wives with members of other households. We compare cooperation across monogamous and polygynous households and investigate whether cooperation within polygynous households varies depending who is interacting with whom. Using data on participants' beliefs about others' cooperativeness, we also undertake a preliminary investigation into whether the differences in cooperation can be explained by differences in how husbands and wives condition their own

cooperativeness on their beliefs about the cooperativeness of their spouses and co-wives.

Overall, we find high contribution rates in *intra*-household games, but in polygynous husband-wife pairs, we find lower contribution rates than in monogamous husband-wife pairs, and contribution rates are even lower in co-wife pairs. In games with adults from other households, contribution rates are much lower and do not differ between monogamous and polygynous household members, suggesting that the difference in *intra*-household contribution rates are owing to an effect of the marriage institution rather than the selection of less cooperative people into polygyny. Further, we find that there are differences across the household types in the way husbands and wives condition their cooperativeness on how much they believe their spouses and co-wives will cooperate. Specifically, behavior in polygynous households is more reciprocal and less apparently altruistic than in monogamous households. This is consistent with findings from studies using observational data (Akresh, Chen and Moore 2012, 2016; Rossi 2016).[1] Our experiment complements these field-based studies as it allows us to investigate *intra*-household cooperation in a controlled environment and make informative *ceteris paribus* comparisons between *intra*- and *inter*-household cooperation.

This paper contributes to the growing literature on cooperation between spouses in lab-type experiments. Most of the studies in this literature focus on monogamous households (Peters *et al.* 2004; Mani 2010; Iversen *et al.* 2011; Castilla and Walker, 2013; Cochard, Couprie and Hopfensitz 2014; Kebede *et al.* 2014; Munro *et al.* 2014; Castilla 2015; Beblo and Beninger 2016). To our

[1] In fact, Akresh, Chen and Moore (2012, 2016) find that where reciprocity is greater, cooperation is higher. However, they focus on a decision-making context in which contributions are observable, so, free-riding is punishable and threats of punishment sustain cooperation. Altruism in this context undermines cooperation because it undermines individuals' ability to credibly threaten to punish. In contrast, we focus on a context in which contributions cannot be observed, and free-riding cannot be punished. In this context, altruism supports cooperation, *ceteris paribus*, and so too does reciprocity but only if it is accompanied by a belief that the other will also cooperate.

knowledge, the only other experimental study looking at *intra*-household cooperative efficiency in polygynous households is by Munro *et al.* (2010). However, they investigated neither differences in behavior across the various dyads within polygynous households nor differences in *inter*-household cooperation.

The remainder of this paper is structured as follows. The next section presents our experimental design and procedures. Section II presents the main results. Section III concludes.

I. Methods

A. Participant sample and study context

The experiment was conducted in Kwara State, Nigeria, in June and July 2013 as a complement to a panel survey of 613 adults of whom 492 were married. During the final survey round, all adult respondents were invited to participate in a workshop to investigate how people make decisions about money. Of the 492 married invitees, all but four showed up. The six spouses of the four no-shows were excluded from the analysis. Also excluded from the analysis were the members of one household with two co-wives but no husband and eight polygynous households with three wives. The final analysis sample consisted of 448 married individuals who were in either monogamous (110 men, 110 women) or polygynous marriages involving two wives (76 men, 152 women).

Most of the participants were from the Nupe ethnic group, the majority ethnic group in Niger State and an important minority in Kwara state. There are approximately 3.5 million Nupe and they live in central and northern Nigeria.[2] Their geographical proximity to the Yoruba, the second-largest ethnic group in Nigeria, has led to many cross-cultural influences. Living arrangements among

[2] https://en.wikipedia.org/wiki/Nupe_people, accessed 08-01-2018

Nupe and Yoruba people in northern Kwara state are comparable, based on patrilineal and patrilocal family structures in which polygyny is common (Ajadi *et al.* 2015).

Nupe marriages are usually arranged, rarely formally registered and almost always involve a bride price (Nadel 1942). The bride price is an exchange of resources for rights over a woman and a confirmation of the bonds between two families and kinship groups. The bride-price transaction has the significance of a contract to which the two families are guarantors (Nadel 1942; Katcha 1978). The number of wives a man has is an indicator of wealth and status (Nadel 1942). Both deuterogamy (i.e., marrying the wife of a deceased brother) (Ajadi *et al.* 2015) and divorce are common in Nupe culture (Katcha 1978).

Polygynous families tend to co-reside, although each wife (with her children) usually occupies her own room or group of rooms within the compound and shares meals principally within her own nuclear household (Katcha 1978). Formally, the Nupe adhere to the maximum of four wives stipulated by the Quran to ensure equal treatment of each wife. However, informally, more partners are allowed, for example, in the form of concubines or older *ex*-wives who remain in the family compound, and inequalities between spouses are tolerated (Nadel 1942; Strassmann 1997; Ukwuani *et al.* 2002).

Individuals in our study area are predominantly involved in farming, trading and agriculture-related business. Thirty percent of married women work as farmers or farm laborers, while 60 percent are traders. Despite similarities between Yoruba and Nupe (see also Oni 1996), rural Nupe women have somewhat greater agency over productive resources compared to their Yoruba neighbors (Ajadi *et al.* 2015). Decision-making power is tilted towards Nupe men in what types of crops to grow, which agricultural inputs to purchase, and whether to sell land and large livestock, and towards Nupe women in the sale of smaller

animals (goats, chicken) and when to take crops to the market. Women generally generate and keep part of their own income.

Table 1 provides descriptive information about our participant sample. Notable differences across the monogamous and polygynous sub-samples are that polygynous households are larger, polygynous husbands have more children, and the wives of polygynous husbands tend to be less educated. Moreover, polygynous households are more likely to be Muslim and reside in rural areas. We will control for these differences in the analyses.

(Table 1 around here)

B. Experimental task

Each participant played a series of linear two-person public goods games (PGGs). At the start of each game, a participant was given an initial endowment. Initial endowments varied and were known only to the recipients.[3] With a 95 percent probability, a participant's initial endowment was 220 Naira (₦220) in each game (approximately US$1.50, one-third of median daily cash income).[4] However, each participant faced a 5 percent chance of receiving an initial endowment between ₦180 and ₦20. The range of possible initial endowments was common knowledge, but participants did not know the probabilities associated with each.

Each participant then had to decide, in private, how much of that initial endowment to contribute to a shared fund and how much to keep. The money they chose to keep they could put in their pocket straight away. Once both playing partners had made their contributions, the shared fund was multiplied by 1.5 and divided equally between the two. Participants maximized their joint earnings from the game by contributing their entire initial endowment to the shared fund. However, a participant maximized individual earnings, given any playing

[3] This gave spouses a chance to hide money from each other.

[4] The median daily cash income from employment, agriculture and business for the participant sample was ₦600. The exchange rate at the time of the games (July 2013) was US$0.615 = 100 Naira.

partner's contribution, by contributing nothing and going home with his or her own initial endowment plus three-quarters of the partner's contribution.

Each participant played the PGG three times, each time with a different playing partner. Every monogamous husband (wife) played one game with his (her) wife (husband). Every polygynous husband played one game with each of his two wives. Every wife of a polygynous husband played one game with her husband and one with her co-wife. In addition, monogamous (polygynous) spouses played their remaining two (one) games with an adult from another household (*inter*-household).

At the start of each *intra*-household PGG, participants were told the precise identity of their playing partner. At the start of each *inter*-household PGG they were told that they were playing with "a man" or "a woman" in the same workshop. Hence, participants in the *inter*-household games played with adults from other households *and* they did not know their playing partners' identities, only their gender.[5]

The order of the games was randomized and participants received no indication that husbands, wives, and co-wives would play together until the start of their first *intra*-household game. These design details both minimized the likelihood of, and allowed us to investigate and rule out the possibility that participants played their three games as a portfolio rather than as a series of separate interactions. Ruling out portfolio decision-making is important because, in the presence of such decision-making, any observed behavioral differences across monogamous and polygynous households could be owing to the former playing only one *intra*-household game, while the latter played two. For instance, polygynous husbands and wives could contribute differently from monogamous

[5] Had we revealed the identity of the *inter*-household playing partners, both their reputations and the characteristics of their relationships, while unknown to us, would have affected contribution decisions.

husbands and wives owing to differences in total expected earnings from the three games.[6]

After playing all three games, participants were asked to guess how much their partner in each game contributed, assuming an initial endowment of ₦220. The beliefs were not elicited before playing the games to avoid priming the participants to think specifically about strategic considerations.

Participants received their earnings from the three shared funds to which they could have contributed as a single payment with no breakdown at the end of the workshop. Because of this and the fact that participants' initial endowments were known only to themselves, participants could contribute significantly less than their initial endowments while claiming to have contributed all.

C. Procedures

A single team conducted the workshops in all 16 communities. In each workshop, the participants received training in the PGG as a group. Then, during one-to-one interviews, each participant's comprehension was tested and their contribution decisions elicited.[7] Once all the participants had made their decisions, each was paid in private. At every stage of a workshop the team followed a script and detailed protocol. The workshops were conducted entirely in Nupe.[8]

In most communities, two workshops were conducted, both on the same day. The exceptions were two small villages where a single workshop was planned due to small sample size, four villages in Shonga district in each of which the two planned workshops were amalgamated into one for logistical reasons, and one town (Lafiagi town) in which three workshops were held due to large sample size. Participants were randomly assigned to one of the workshops in their

[6] In Online Appendix Section 3, we test for portfolio effects and show that they are not driving our results.

[7] Comprehension of the game was good with more than 90 percent of test questions correctly answered.

[8] See Online Appendix Section 6 for English translations of the scripts, the corresponding visual aids, and the detailed protocol.

community. On average, a workshop involved 28 participants (minimum eight, maximum 50) and participants earned around ₦847 from the games plus a ₦250 show-up fee.

Substantial care was taken to avoid communication within workshops and spillovers within and between communities. The workshops took place in community buildings, such as schools or health or community centers, with at least two separate rooms. The group training was given to all the participants in one room. The second room was used as a waiting room for those who had completed their interviews. Preplanned seating arrangements in the training room ensured that marriage groups (spouses as well as co-wives) were separated. Participants were not allowed to talk to each other until they had finished their individual interviews and reached the waiting room, where they received a drink and a snack.

Participants in the two workshops in a community were not allowed to mix to avoid communication.[9] Workshops within a single district were planned such that they would start the day *after* the weekly market day in that district. Spillovers between communities on days other than market days were expected to be very limited.

II. Results

A. Contribution rates by marriage type

The left-hand panel of Figure 1 presents the distributions of contribution rates for monogamous and polygynous spouses and co-wives when playing one with another, within households, and the bars in the right-hand panel present the

[9] In Lafiagi, the third workshop was held on a second, consecutive day. Participants in Lafiagi were dispersed across neighborhoods, limiting potential communication between participants assigned to different workshops.

corresponding mean contribution rates. The test result in the right-hand panel pertains to the null hypothesis that mean contribution rates do not differ across polygynous and monogamous marriage groups.

(Figure 1 around here)

Overall, *intra*-household contribution rates are high. The left-hand panel reveals that within both household types, most spouses contributed their entire initial endowment. However, the right-hand panel indicates that polygynous marriage group members were, on average, significantly less cooperative, one with another, compared to those in monogamous marriages (p = 0.047). On average, monogamous spouses contributed 88 percent of their initial endowment to the shared fund, while polygynous spouses contributed only 78 percent.[10]

B. Contribution rates by participant and playing partner type

Next, we investigate whether cooperation within each household type varies systematically depending on who is interacting with whom. Figure 2 presents the mean contribution rates for each type of husband and wife when interacting with their spouses and, in the case of wives of polygynous husbands, their co-wives. The figure also presents the results of a series of comparison-of-means tests focusing on various pairs of defined subsamples.[11]

(Figure 2 around here)

Figure 2 indicates that, when playing with their spouses, polygynous husbands and wives contributed significantly less than monogamous husbands and wives: 80 percent on average compared to 88 percent (p = 0.051). Further dividing the

[10] The decisions made in the *intra*-household PGGs reflect both a willingness to make financial contributions to the common pot and, working in the opposite direction, a willingness to hide personally held resources. We find a correlation between decisions made in the *intra*-household PGGs and how much participants knows about each other's finances in everyday life, but no correlation with financial contributions to household expenditures. For further details see Section 5 of the Online Appendix.

[11] These test results were derived from the regressions presented in Appendix Table A1.

sample reveals that, when playing with their wives, polygynous husbands contributed significantly less than monogamous husbands: 79 percent on average compared to 89 percent (p = 0.033). In contrast, the difference between the contributions made by the wives of monogamous and polygynous husbands when playing with those husbands was not significant: 87 percent compared to 80 percent (p = 0.133).

The figure also indicates that, while the contribution rates of wives in polygynous marriages playing with their husbands were statistically indistinguishable from their husbands' contribution rates (80 percent compared to 79 percent), the contribution rates of co-wives when playing with each other were significantly lower at 76 percent (p = 0.068 in a pooled analysis, $p < 0.001$ in a within-wife (fixed effects) analysis).

To sum up, Figure 2 reveals that the lower contribution rate in polygynous households compared to monogamous households was driven by two factors. First, when playing with their spouses, polygynous husbands and wives contributed significantly less than monogamous husbands and wives, with the difference being driven primarily by husbands. Second, when co-wives played together, their contribution rates were significantly lower than when they played with their husbands.

C. Controlling for other factors

Next, we investigate whether the differences described in 3.1 and 3.2 are owing to cross-subsample variations in the participants' experiences during the experimental sessions or individual characteristics. Column (1), Table 2, presents the regression results supporting the key comparison-of-means findings already

described.[12] Column (2) presents the same set of regression results but after socio-economic and experimental controls have been added.[13]

(Table 2 around here)

In Panel A, adding these controls has very little impact on the size and significance of the mean difference in contribution rates between monogamous and polygynous marriage group members when playing *intra*-household games. The same applies when focusing on husband-wife interactions only in Panel B.

In Panel C, adding controls reduces the size and significance of the difference between monogamous and polygynous husbands. Indeed, once the controls are added, we can no longer reject the null that monogamous and polygynous husbands are equally cooperative when interacting with their wives. This loss in significance is owing entirely to the inclusion of number of children in the regression.[14] This is suggestive of a possible mechanism driving the mean difference. However, when number of children is included, while the *p*-value on the *Polygynous* identifier increases to 0.120 (just insignificant) the *p*-value on the number of children variable is 0.950, indicating a loss of power owing to multicollinearity rather than mechanism identification. The *Polygynous* identifier and the number of children variable are, indeed, highly correlated ($p = 0.038$, see Table 1 for subsample means).

Panel D focuses on wives' contributions only, and includes a variable for polygynous wives playing with a female playing partner ('P x FPP') to identify the difference in the cooperativeness of polygynous wives depending on whether they are interacting with their husbands or their co-wives. When controls are

[12] The within-wife, fixed effects, regression is omitted in the interest of brevity.

[13] See Online Appendix Section 2 and Tables A2-A5 for definitions of control variables and the results of the regressions with controls in full. See Online Appendix Section 3 and Tables A6-A8 for analyses including further controls that allow us to rule out portfolio decision-making.

[14] See Online Appendix Table A4. The number of children *with the playing partner* (instead of total own number of children) and its interaction with *Polygynous* are not significant either (results available upon request).

added, the difference between wives of monogamous and polygynous husbands (indicated by the coefficient on *Polygynous*) increases and becomes significant at the 5 percent level (p = 0.034). This gain in significance cannot be attributed to the inclusion of any one specific control.[15] The inclusion of controls does not affect the significant difference in polygynous wives' contribution rates depending on whether they are interacting with their husbands or their co-wives.

D. Selection versus causation

Next, we investigate whether the difference in contribution rates between monogamous and polygynous households is causal, i.e., being in a polygynous marriage causes people to be less cooperative, or owing to selection, i.e., less cooperative people select into polygyny.

If cooperation is lower in polygynous households as a result of selection, we would expect members of polygynous households to be less cooperative also when playing with members of other households, i.e., when playing *inter*-household games. The whiskered white circles in the right-hand panel of Figure 1 indicate the mean contribution rates by the same samples of spouses but when playing with members of other households. Contributions by both monogamous and polygynous spouses were significantly lower in *inter*-household games and, if anything, the contribution rate for the monogamous spouses was lower (36 percent) than the contribution rate for the polygynous spouses (39 percent).[16] In Table 2, Columns (3)-(4), we show that this difference is statistically insignificant for the full sample (Panel A).

Focusing on the husbands, in Table 2, Panel C, Columns (3)-(4), we investigate whether men who select into polygynous marriage are less cooperative

[15] See Online Appendix Table A5.

[16] These contribution rates are similar to those observed in public good games around the world. For example, Wilkinson and Klaes (2012) indicate that, in general, anonymously matched unmarried subjects contribute about half of their endowments.

towards others in general and towards women specifically. We do the latter by including an indicator for whether the playing partner was female and the interaction between this and *Polygynous* in the analysis. The insignificance of the coefficient on *Polygynous* indicates that there was no difference in the contribution rates of monogamous and polygynous husbands when they were playing with men from other households. The insignificance of the coefficient on the interaction between *Polygynous* and *Female playing partner* indicates that playing with a woman rather than a man from another household did not affect contribution rates differently for polygynous versus monogamous husbands. Finally, the insignificance of the sum of the coefficients on *Polygynous* and the interaction term indicates that there was no difference in the contribution rates of polygynous and monogamous husbands when they were playing with women from other households.

Turning to the wives, the insignificant coefficients on *Polygynous* in Table 2, Panel D, Columns (3)-(4), indicate that we cannot reject the null hypothesis that the wives of monogamous and polygynous husbands were equally cooperative when playing with men to whom they were not married.

Finally, consider the finding that the contribution rates of co-wives when playing with each other were lower than when they were playing with their husbands (see Table 2, Panel D, Column (1)). As the critical difference is *within* wife, this cannot be owing to selection of women into polygyny based on their cooperativeness with other people. However, women who are less inclined to cooperate with other women, while being no less inclined to cooperate with men, could have selected into polygynous marriage. The statistical insignificance of the coefficient on the interaction between *Polygynous* and *Female playing partner* in Table 2, Panel D, Column (3), indicates that we cannot reject the null that, in *inter*-household games, playing with a woman did not affect contribution rates differently for wives of monogamous versus polygynous husbands.

In sum, these estimations offer no evidence of selection of men and women into polygyny based on either their cooperativeness with other people in general or their differential willingness to cooperate with men and women. Thus, we conclude that the lower cooperation rate within polygynous marriage groups was owing to an effect of the marriage institution rather than selection. Polygyny causes spouses to be less cooperative, one with another. Further, within polygynous marriages, wives are even less cooperative with their co-wives than they are with their husbands.

E. The conditioning of cooperation on beliefs about others' cooperativeness

One possible explanation for the difference in *intra*-household cooperativeness between monogamous and polygynous marriage groups is that the behavioral foundations of cooperation vary across the two types. Cooperation can be motivated by altruism, in which case husbands and wives will not deviate from full cooperation even when they believe that their spouse is likely to do so. Adherence to a strong cooperative norm would have a similar effect. Alternatively, cooperation may be based on reciprocity and, hence, conditional on the cooperation of others. In this case, husbands and wives will deviate from full cooperation when they believe that their spouse or co-wife will do likewise. More conditional and less altruistic or norm-driven unconditional cooperation could explain the lower cooperation rate within polygynous households. Using data on participants' beliefs about their playing partners' contributions, we can undertake a preliminary investigation into whether participants' own contributions are conditioned on beliefs about others' contributions and whether this varies across monogamous and polygynous households.[17]

[17] The usefulness of this analysis depends on the quality of the beliefs data. If the elicited beliefs are inaccurate or biased and the inaccuracy or bias differs between members of monogamous and polygynous households, the validity of our comparative findings would be undermined. Online Appendix Section 4 and Table A9 present the beliefs data and rule out concerns about its quality.

(Figure 3 around here)

Figure 3 presents the estimated linear relationships between husbands' and wives' own contributions and their beliefs about their playing partners' contributions for: monogamous husbands and wives when playing with each other (solid dark, purple line); polygynous husbands and their wives when playing with each other or wives with their co-wives (solid light, green line); monogamous husbands and wives when playing with members of other households (dashed dark, purple line); polygynous husbands and their wives when playing with members of other households (dashed light, green line).[18]

Focusing, first, on *intra*-household interactions, husbands and wives who believed that their spouses or co-wives would contribute 100 percent of their initial endowments chose to contribute 95 percent of their own initial endowment on average, regardless of whether their household was monogamous or polygynous. However, husbands and wives who believed that their spouses or co-wives would contribute less than 100 percent conditioned their own contributions differently depending on whether their household was monogamous or polygynous.

Within monogamous households, a 10 percentage point reduction in belief about a spouse's contribution is associated with a 4 percentage point reduction in one's own contribution. Within polygynous households, a 10 percentage point reduction in belief about a spouse's or co-wife's contribution is associated with a significantly (p = 0.006) larger 7 percentage point reduction.[19] This analysis, combined with the histogram in the left-hand panel of Figure 1, indicates that full cooperation is a common reference point for members of both monogamous and

[18] Figure 3 is derived from the regressions presented in Online Appendix Table A10, columns (1) and (3).

[19] These findings are robust to the inclusion of experimental and socio-economic controls (see Online Appendix Section A4 and Table A10). When the controls are added, we also find that cooperation is significantly more conditional between co-wives as compared to between polygynous husbands and their wives (p = 0.070).

polygynous households, but that they respond differently when they anticipate that their spouses or co-wives are going to deviate from this reference point. A closer inspection of the data reveals that the difference between the estimated relationships is primarily owing to differences in the relative frequencies of full unconditional versus conditional cooperation.[20]

Here, once again, we can exploit the *inter*-household PGGs involving the same husbands and wives to investigate whether being in a polygynous marriage causes individuals to become more reciprocally cooperative with their spouses and co-wives or whether more reciprocating types are more likely to select into polygynous marriages. We cannot reject the null that the two dashed lines in Figure 3 have the same intercept and the same slope. When playing with members of other households, a 10 percentage point reduction in belief about a playing partner's contribution is associated with a 5 percentage point reduction in one's own contribution.[21] It is also worth noting that the conditioning of cooperation on beliefs differs markedly depending on whether the interaction is *intra*- or *inter*-household. In the former, cooperation tends to be either high and unconditional or conditional. In the latter it tends to be either minimal and unconditional or conditional.[22]

To sum up, monogamous spouses are more inclined to be unconditionally cooperative, that is, they contribute (almost) their entire initial endowment irrespective of how much they expect their spouse to contribute. In contrast, when polygynous household members expect their spouses or co-wives to deviate from full cooperation, they are more inclined to make conditionally cooperative decisions, that is, to contribute approximately the same amount as they expect their spouse or co-wife to contribute. Thus, cooperation appears motivated more

[20] See Online Appendix Section 4 and Table A11 for details.

[21] Online Appendix Table A10 indicates that these findings are robust to the inclusion of experimental and socio-economic controls.

[22] See Online Appendix Section 4 and Table A11 for details.

by altruism or adherence to a strict cooperative norm in monogamous households and more by reciprocity in polygynous households. Finally, there is no evidence to suggest that individuals select into polygyny depending on how they condition their cooperativeness on their beliefs about others' cooperativeness.

III. Conclusion

Using a carefully designed experiment to measure cooperation between all possible interacting pairs within monogamous and polygynous households, we find that, while *intra*-household cooperation is high and the majority of spouses aim to maximize joint utility, cooperation is lower within polygynous compared to monogamous households. In part, this is because cooperation is lower between polygynous husbands and their wives as compared to monogamous husbands and their wives and, in part, this is because cooperation is particularly low between co-wives. In contrast, we find no differences in cooperativeness between monogamous and polygynous spouses when they interact with men or women from other households, indicating that the differences in *intra*-household cooperation are causal rather than owing to selection.

Turning to behavioral foundations, we find that cooperation between monogamous spouses tends to be unconditional and consistent with high levels of pure altruism or strict adherence to norms of spousal cooperation. In comparison, cooperation between polygynous spouses and co-wives tends to be more reciprocal, a considerable proportion cooperating only to the extent that they believe the other with whom they are interacting will cooperate. Further, when playing with members of other households, there is no difference in how monogamous and polygynous spouses condition their contributions on beliefs about the other's contribution, indicating that the differences in the foundations of cooperation between monogamous and polygynous households are not owing to reciprocal types being more inclined to select into polygyny.

The experiment was designed to document whether and how cooperation differs between polygynous and monogamous households and to rule out potential selection of less cooperative individuals into polygyny. While there is more research to be done, especially with regard to the behavioral and other mechanisms underpinning the differences in cooperation that we observe, our findings provide a strong foundation upon which to build.

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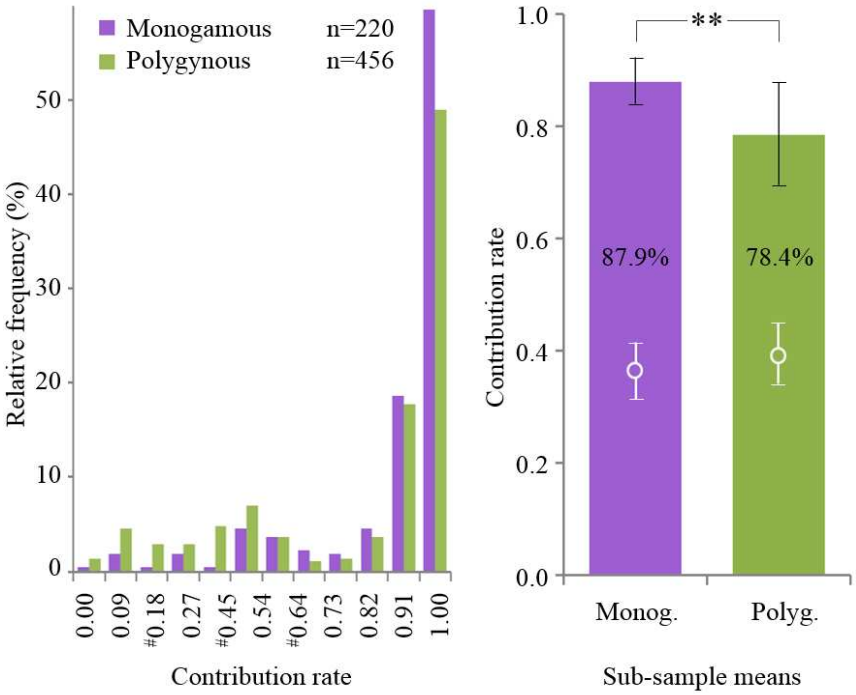
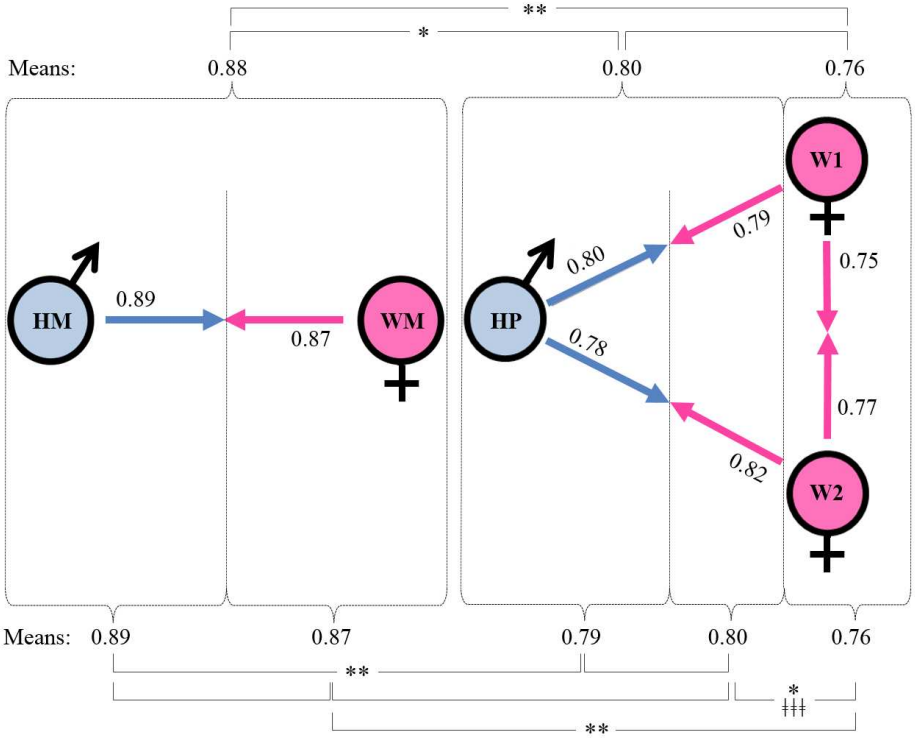
FIGURES AND TABLES

Figure 1 Contributions to the shared fund by monogamous and polygynous spouses



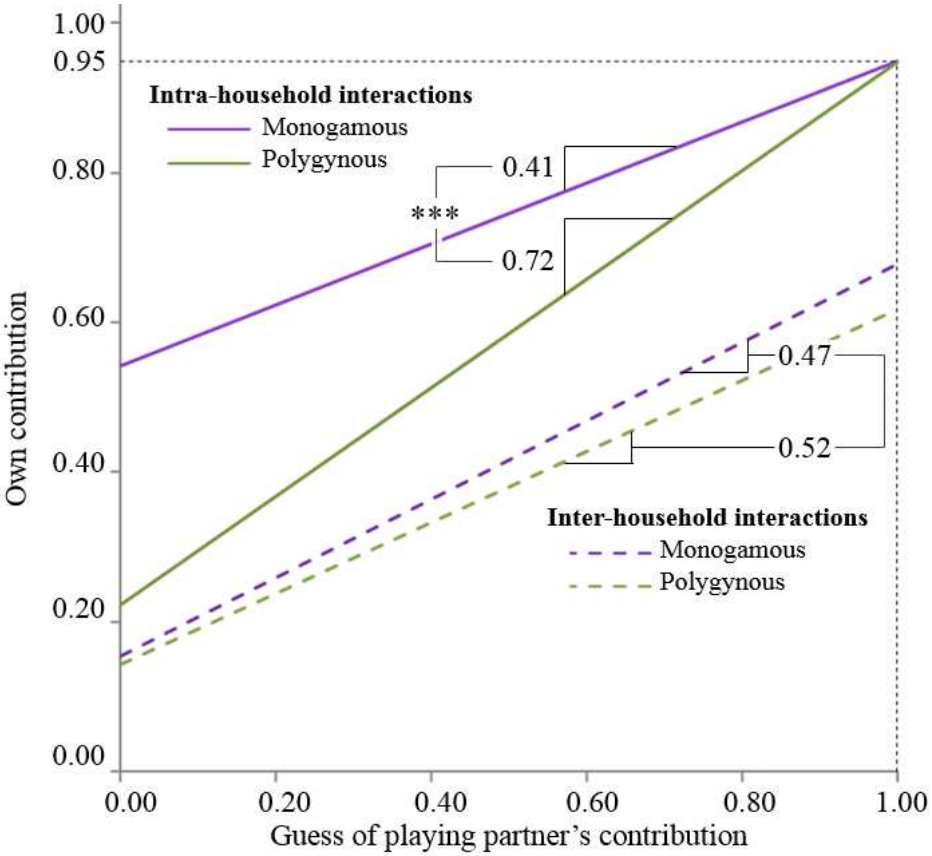
Note: Contribution rate is the amount contributed to the shared fund as a proportion of initial endowment. Each observation is a contributing decision. The left-hand panel presents the distributions of contribution rates for monogamous spouses when playing together (dark, purple) and polygynous husbands and their wives when playing in pairs (husbands with wives or co-wives together) (light, green). The right-hand panel presents the mean contribution rates. The black vertical whiskers are 95% confidence intervals generated using a linear regression of contribution rates on polygyny, in which inter-dependence within workshops is accounted for using a wild bootstrap (Cameron, Gelbach and Miller, 2008). The test result indicated by the horizontal bracket at the top of the panel is derived from the same regression: ** = difference significant at the 5% level. The circle and whiskers in white within each bar indicate the mean and 95% confidence interval of the contribution rate for the same participant subsample, but when playing with members of other households. # = bin expanded to accommodate slightly higher and lower contribution rates owing to initial endowments not always equaling 220 naira.

Figure 2 Contributions to the shared fund by marriage, spouse, and playing partner type



Note: The Mars symbols (blue) indicate husbands. The Venus symbols (pink) indicate wives. HM = monogamous husband; WM = monogamous wife; HP = polygynous husband; W1 = first wife of a polygynous husband; W2 = second wife of a polygynous husband. An arrow emanating from one symbol in the direction of another indicates the contributions made by spouses of former symbol type when playing with spouses of latter symbol type. The proportion inscribed on each arrow is the mean contribution rate. The means listed above and below the diagram are for pooled subsamples defined by the vertical dotted lines and corresponding braces. The test results on the horizontal square brackets above and below these means are derived from a series of linear regressions presented in Appendix Table A2 in which dependence within workshops is accounted for using a wild bootstrap. Within each pooled subsample (defined by vertical dotted lines and braces), the regressions indicate that the contribution rates can be pooled. ** = significantly different at the 5% level according to the pooled regression analysis; * = significantly different at the 10% level according to the pooled regression analysis; ǂǂǂ = significantly different at the 1% level according to a within-wife analysis. n = 676.

Figure 3 The conditioning of own cooperation on beliefs about playing partners' cooperation among monogamous and polygynous spouses



Note: The two solid lines are derived from a single linear regression in which the dependent variable is own contribution when interacting with spouse or co-wife; the two dashed lines are derived from a single linear regression in which the dependent variable is own contribution when interacting with a member of another household; potential dependence within workshops is accounted for using a wild bootstrap; *** = slopes significantly different from zero at the 1% level.

Table 1 Participant sample characteristics

	Monogamous		Polygynous	
Variable	**Male**	**Female**	**Male**	**Female**
Age	48.38	37.89	48.42	36.81
Household size	5.527	5.527	8.934	8.934
Education (years)	6.771	2.783	6.173	1.553
Education (category):				
- No education	0.342	0.642	0.361	0.757
- (Some) primary completed	0.181	0.226	0.253	0.204
- (Some) secondary completed	0.248	0.085	0.173	0.039
- Higher education	0.229	0.047	0.213	0.000
Nupe	0.914	0.915	0.960	0.974
Muslim	0.867	0.840	0.960	0.954
Earning	0.952	0.896	0.973	0.927
Wealth	-0.001	-0.001	-0.080	-0.080
Urban	0.318	0.318	0.105	0.105
Number of children	4.818	4.818	8.680	4.309
Comprehension of game	3.682	3.745	3.697	3.671
Observations	110	110	76	152

Note: Age = age in years; household size = number of household members; education = years of formal education completed; Nupe = 1 if participant belongs to Nupe ethnic group; Muslim = 1 if participant Muslim; earning = 1 if participant brings monetary income into household; wealth = household-level asset index; urban = 1 if household in an urban area; number of children = reported by wives (for monogamous husbands, we use number reported by their wife; for polygynous husbands, we use the sum of the number of children reported by first and second wife); comprehension of game = number (out of 4) of test questions about game correctly answered.

Table 2 Intra-household and inter-household contribution rates by player type

Dependent variable (DV) = contribution rate = contribution ÷ initial endowment

	Intra-household no controls (1)			Intra-household with controls (2)			Inter-household no controls (3)		Inter-household with controls (4)	
Panel A. ***Husbands and wives contributions***										
Polygynous (P)	-0.095	(0.047)	**	-0.099	(0.024)	**	0.026	(0.329)	0.034	(0.319)
Observations	676			663			668		649	
Panel B. ***Husbands and wives contribution in husband-wife interactions only***										
Polygynous (P)	-0.083	(0.051)	*	-0.076	(0.045)	**	n/a		n/a	
Observations	524			511						
Panel C. ***Husbands contributions only***										
Polygynous (P)	-0.100	(0.033)	**	-0.080	(0.120)		$< 1e^{-3}$	(0.991)	0.027	(0.687)
Female playing partner (FPP)	n/a			n/a			-0.023	(0.378)	-0.020	(0.422)
P x FPP	n/a			n/a			0.092	(0.289)	0.063	(0.526)
Sum of coeffs on P + (P x FPP)	n/a			n/a			0.092	(0.323)	0.089	(0.453)
Observations	262			253			296		285	
Panel D. ***Wives contributions only***										
Polygynous (P)	-0.066	(0.133)		-0.091	(0.034)	**	-0.008	(0.890)	0.002	(0.960)
Female playing partner (FPP)	n/a			n/a			-0.008	(0.756)	-0.019	(0.333)
P x FPP	-0.043	(0.068)	*	-0.044	(0.076)	*	0.045	(0.465)	0.042	(0.552)
Sum of coeffs on P + (P x FPP)	-0.109	(0.029)	**	-0.134	(0.007)	***	0.037	(0.657)	0.044	(0.626)
Observations	414			410			372		364	

Note: Table presents coefficients and sums of coefficients from linear regressions and, in parentheses, p-values corresponding to two-tailed tests of H_0: coefficient or sum of coefficients equals 0; in Panels A and B, the one explanatory variable of interest is 'Polygynous'; in Panels C and D, the three explanatory variables of interest are 'Polygynous', 'Female playing partner' and the interaction between the two; in Panel B, there are no *inter*-household model estimations because the focal sample is contributions in husband-wife interactions; p-values are adjusted to account for *inter*-dependence within workshops using a wild bootstrap (Cameron, Gelbach and Miller, 2008); in Panel C 'Female Playing Partner (FPP)' and the interaction term drop out of the *intra*-household models because husbands play all of their *intra*-household games with women (their wives); in Panel D, 'Female Playing Partner (FPP)' drops out of the *intra*-household estimations for wives because monogamous wives play only with men (their husbands) and the coefficient on the interaction term identifies the difference in the contribution rates of wives of polygynous husbands when interacting with their co-wives and when interacting with their husbands; Controls are initial endowment, session size, order of play in session, delay identifier, second/third session in community identifiers, second/third game in session identifiers, enumerator identifiers, participant age, education, ethnicity, religion, earning identifier, wealth, urban identifier and log number of children(with one added before appling the log transformation). For the full definitions of these controls, see note for Online Appendix Table A2; *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

ONLINE APPENDIX

Cooperation in Polygynous Households

Abigail Barr, Marleen Dekker, Wendy Janssens, Bereket Kebede and Berber Kramer

Contents

Section 1: Regression analyses supporting Figure 2

The comparison-of-means test results reported in Figure 2 were derived from the regressions presented in Table A1 below. The regression in column (1) takes contribution rate in an *intra*-household PGG as the dependent variable and a set of explanatory variables that identify each of the possible player-partner pairings using monogamous husbands playing with their wives as the basis for comparison: a *monogamous wife* when playing with her *husband*, a *polygynous husband* when playing with his first (senior) and second (junior) wife (*wife 1* and *wife 2*, respectively), a *polygynous* wife (*wife 1* or *wife 2*) when playing with her *husband*, and a first or second wife when playing with her co-wife. Column (2) focuses on the same contribution decisions, but consolidates these indicators into pairings including a polygynous husband (either as decision maker or as playing partner) and co-wife pairings, using monogamous husbands and wives when playing with each other as the basis for comparison. *F*-tests indicate that the restrictions imposed as we move from Column (1) to Column (2) cannot be rejected. Column (3) and (4) present estimates of the same model as Column (2), but for husbands and wives separately. Thus, the basis for comparison is contributions by *monogamous* husbands (wives) when playing with their wives (husbands). Finally, the regression in Column (5) focuses on the contributions of wives in polygynous marriages only and includes decision-maker fixed effects.

Table A1 Contributions within households by different playing partner matches

Dependent variable = contribution rate = contribution ÷ initial endowment.

	All spouses			All spouses			Husbands only			Wives only			Wives in polygynous marriages only		
	(1)			(2)			(3)			(4)			(5)		
Constant	0.890	(<1e^{-8})	***	0.879	(<1e^{-8})	***	0.890	(<1e^{-8})	***	0.869	(<1e^{-8})	***	0.803	(<1e^{-8})	***
Monogamous wife with husband	-0.021	(0.445)													
Polyg. husband with wife 1 (PHW1)	-0.087	(0.083)	*												
Polyg. husband with wife 2 (PHW2)	-0.113	(0.018)	**												
Polyg. wife 1 with husband (W1PH)	-0.104	(0.056)	*												
Polyg. wife 2 with husband (W2PH)	-0.070	(0.183)													
Wife 1 with wife 2 (W1W2)	-0.113	(0.037)	**												
Wife 2 with wife 1 (W2W1)	-0.119	(0.061)	*												
Pair includes polygynous husband (PPH)				-0.083	(0.051)	*	-0.100	(0.033)	**	-0.066	(0.133)				
Pair are co-wives (PCW)				-0.120	(0.045)	**				-0.109	(0.049)	**	-0.043	(0.008)	***
Experimental controls	no			no			no			no			no		
Socio-economic controls	no			no			no			no			no		
Decision maker fixed effects	no			no			no			no			yes		
Test null: coeffs PPH = PCW (*p*-value)				0.201						0.066					
Test null: coeffs PHW1 = PHW2 = W1PH = W2PH (*p*-value)	0.685														
Test null: coeffs W1W2 = W2W1 (*p*-value)	0.383														
Observations	676			676			262			414			304		
R^2	0.030			0.027			0.036			0.021			0.045		

Note: Coefficients and corresponding *p*-values (bootstrapped to account for clustering, null: coefficient equals 0, in parentheses) from linear regressions reported. Basis for comparison in Column (1) is monogamous husband when playing with wife. Basis for comparison in Columns (2) is monogamous playing pair. Basis for comparison in Columns (3) and (4) is monogamous husbands and monogamous wives, respectively. Basis for comparison in Column (5) is pair includes polygynous husband. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. W1 = first wife of a polygynous husband; W2 = second wife of a polygynous husband.

Section 2: Analysis of contributions including experiment-related and socio-economic controls

Table A2 presents a series of regressions estimating the effect of polygyny on spouses' contributions in the *intra*-household PGGs when controls are included. The regression in column (3) is also reported in brief in Table 2, Panel A, column 2, in the paper.

Table A3 presents a series of regressions estimating the effect of polygyny on spouses' contributions in the husband-wife PGGs when controls are included. The regression in column (3) is also reported in brief in Table 2, Panel B, column 2, in the paper.

Table A4 presents a series of regressions estimating the effect of polygyny on husbands' contributions in the intra-household PGGs when controls are included. The regression in column (3) is also reported in brief in Table 2, Panel C, column 2, in the paper.

Tables A4 presents a series of regressions estimating the effects of polygyny and co-wife interaction on wives' contributions in the intra-household PGGs when controls are included. The regressions in column (3) are also reported in brief in Table 2, Panel D, column 2, in the paper.

Table A2 Contributions by monogamous and polygynous spouses: Regression analysis with controls

Dependent variable = contribution rate = contribution ÷ initial endowment

	All spouses (1)			All spouses (2)			All spouses (3)		
Constant	0.820	($<1e^{-8}$)	***	0.740	($<1e^{-8}$)	***	0.741	($<1e^{-8}$)	***
Polygynous	-0.099	(0.017)	**	-0.098	(0.015)	**	-0.099	(0.024)	**
Experimental controls									
- Initial endowment†	$3.5e^{-4}$	(0.693)		$3.4e^{-4}$	(0.716)		$3.5e^{-4}$	(0.720)	
- Session size	0.009	(0.015)	**	0.007	(0.027)	**	0.007	(0.025)	**
- Order	-0.004	(0.011)	**	-0.003	(0.083)	*	-0.003	(0.071)	*
- Delay	-0.082	(0.017)	**	-0.064	(0.176)		-0.064	(0.186)	
- Second session	0.040	(0.704)		0.025	(0.786)		0.025	(0.790)	
- Third session	0.150	(0.025)	**	0.084	(0.092)	*	0.084	(0.093)	*
- Second game	-0.007	(0.707)		0.000	(0.978)		0.001	(0.959)	
- Third game	-0.001	(1.000)		0.001	(0.935)		0.001	(0.934)	
- Enumerator 2	0.008	(0.850)		0.005	(0.933)		0.005	(0.928)	
- Enumerator 3	0.068	(0.107)		0.092	(0.022)	**	0.091	(0.022)	**
- Enumerator 4	0.028	(0.600)		0.052	(0.287)		0.051	(0.315)	
- Enumerator 5	-0.019	(0.802)		0.011	(0.911)		0.010	(0.921)	
- Enumerator 6	-0.073	(0.259)		-0.061	(0.315)		-0.061	(0.313)	
- Enumerator 7	-0.003	(0.924)		0.010	(0.770)		0.010	(0.770)	
- Enumerator 8	0.101	(0.041)	**	0.115	(0.018)	**	0.115	(0.018)	**
Socioeconomic controls									
- Age				-0.001	(0.517)		-0.001	(0.525)	
- Education				0.005	(0.077)	*	0.005	(0.071)	*
- Nupe (=1)				-0.055	(0.231)		-0.055	(0.233)	
- Muslim (=1)				0.208	(0.039)	**	0.208	(0.041)	**
- Earning (=1)				-0.052	(0.382)		-0.052	(0.377)	
- Wealth				0.033	(0.125)		0.033	(0.119)	
- Urban (=1)				0.043	(0.122)		0.043	(0.113)	
- Log number of children							-0.001	(0.950)	
Observations	676			665			663		
R^2	0.140			0.199			0.199		

Note: Coefficients and corresponding *p*-values (bootstrapped to account for clustering, null: coefficient equals 0, in parentheses) from linear regressions reported. Initial endowment = the amount (in naira) received in envelope; session size = number of participants in session (de-meaned); order = order of play (1 = 1st) in session (de-meaned); delay = 1 if session started later than prearranged time; second/third session = 1 if participant played in the second/third session held in the community; second/third game = 1 if decision made in second/third game played by participant; enumerator # = 1 if decision elicited in interview conducted by enumerator number #; age = age in years; education = years of formal education completed; Nupe = 1 if participant belongs to Nupe ethnic group; Muslim = 1 if participant Muslim; earning = 1 if participant brings monetary income into household; wealth = household-level asset index; urban = 1 if household in an urban area; log number of children = natural logarithm of the number of children that a participant has (with a one added before applying the log transformation). † If we use a dummy equal to 1 if the initial endowment was less than 220 naira, the size and significance of the coefficients on *Polygynous* in columns (2) and (3) are unchanged. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A3 Contributions by monogamous and polygynous spouses in husband-wife interactions: Regression analysis with controls

Dependent variable = contribution rate = contribution ÷ initial endowment

	All spouses (1)			All spouses (2)			All spouses (3)		
Constant	0.811	($<1e^{-8}$)	***	0.682	($<1e^{-8}$)	***	0.683	($<1e^{-8}$)	***
Polygynous	-0.083	(0.030)	**	-0.075	(0.023)	**	-0.076	(0.045)	**
Experimental controls									
- Initial endowment†	$-3.8e^{-4}$	(0.571)		$-2.8e^{-4}$	(0.669)		$-2.9e^{-4}$	(0.669)	
- Session size	0.007	(0.027)	**	0.004	(0.135)		0.004	(0.139)	
- Order	-0.002	(0.306)		$-3.8e^{-4}$	(0.828)		$-4.1e^{-4}$	(0.814)	
- Delay	-0.044	(0.383)		-0.009	(0.887)		-0.008	(0.894)	
- Second session	0.063	(0.500)		0.051	(0.559)		0.051	(0.560)	
- Third session	0.156	(0.011)	**	0.061	(0.218)		0.061	(0.222)	
- Second game	0.003	(0.856)		0.010	(0.623)		0.010	(0.609)	
- Third game	-0.013	(0.629)		-0.008	(0.790)		-0.008	(0.793)	
- Enumerator 2	0.022	(0.557)		0.020	(0.643)		0.021	(0.643)	
- Enumerator 3	0.090	(0.028)	**	0.107	(0.010)	**	0.107	(0.010)	**
- Enumerator 4	0.032	(0.476)		0.053	(0.264)		0.050	(0.283)	
- Enumerator 5	0.032	(0.648)		0.048	(0.459)		0.048	(0.468)	
- Enumerator 6	-0.078	(0.253)		-0.066	(0.307)		-0.066	(0.305)	
- Enumerator 7	0.002	(0.947)		0.010	(0.758)		0.010	(0.759)	
- Enumerator 8	0.098	(0.033)	**	0.113	(0.013)	**	0.113	(0.012)	**
Socioeconomic controls									
- Age				-0.001	(0.648)		-0.001	(0.634)	
- Education				0.005	(0.054)	*	0.005	(0.053)	*
- Nupe (=1)				-0.035	(0.524)		-0.035	(0.529)	
- Muslim (=1)				0.199	(0.035)	**	0.199	(0.036)	**
- Earning (=1)				-0.034	(0.576)		-0.035	(0.567)	
- Wealth				0.031	(0.094)	*	0.031	(0.091)	*
- Urban (=1)				0.083	(0.010)	**	0.083	(0.011)	**
- Log number of children							$4.1e^{-5}$	(0.990)	
Observations	524			513			511		
R^2	0.126			0.193			0.193		

Note: Coefficients and corresponding *p*-values (bootstrapped to account for clustering, null: coefficient equals 0, in parentheses) from linear regressions reported. Initial endowment = the amount (in naira) received in envelope ; session size = number of participants in session (de-meaned); order = order of play (1 = 1st) in session (de-meaned); delay = 1 if session started later than prearranged time; second/third session = 1 if participant played in the second/third session held in the community; second/third game = 1 if decision made in second/third game played by participant; enumerator # = 1 if decision elicited in interview conducted by enumerator number #; age = age in years; education = years of formal education completed; Nupe = 1 if participant belongs to Nupe ethnic group; Muslim = 1 if participant Muslim; earning = 1 if participant brings monetary income into household; wealth = household-level asset index; urban = 1 if household in an urban area; log number of children = natural logarithm of the number of children that a participant has (with a one added before applying the log transformation). † If we use a dummy equal to 1 if the initial endowment was less than 220 naira, the size and significance of the coefficients on *Polygynous* in columns (2) and (3) are unchanged. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A4 Contributions by monogamous and polygynous husbands: Regression analysis with controls

Dependent variable = contribution rate = contribution ÷ initial endowment

	Husbands only (1)			Husbands only (2)			Husbands only (3)		
Constant	0.797	(<1e^{-8})	***	0.644	(<1e^{-8})	***	0.647	(<1e^{-8})	***
Polygynous	-0.087	(0.058)	*	-0.081	(0.039)	**	-0.080	(0.120)	
Experimental controls									
- Initial endowment†	-0.001	(0.001)	***	-0.002	(0.004)	***	-0.002	(0.002)	***
- Session size	0.005	(0.122)		0.002	(0.500)		0.002	(0.515)	
- Order	0.000	(0.954)		0.000	(0.921)		0.000	(0.889)	
- Delay	-0.063	(0.585)		-0.043	(0.727)		-0.042	(0.733)	
- Second session	0.061	(0.597)		0.050	(0.602)		0.050	(0.604)	
- Third session	0.184	(0.007)	***	0.067	(0.258)		0.067	(0.267)	
- Second game	0.016	(0.527)		0.013	(0.629)		0.014	(0.611)	
- Third game	-0.008	(0.839)		-0.003	(0.970)		-0.003	(0.975)	
- Enumerator 2	-0.001	(0.998)		0.006	(0.913)		0.007	(0.908)	
- Enumerator 3	0.085	(0.312)		0.103	(0.236)		0.102	(0.228)	
- Enumerator 4	0.085	(0.179)		0.117	(0.082)	*	0.114	(0.083)	*
- Enumerator 5	0.204	(0.009)	***	0.180	(0.031)	**	0.178	(0.031)	**
- Enumerator 6	-0.022	(0.802)		-0.006	(0.936)		-0.006	(0.941)	
- Enumerator 7	0.050	(0.346)		0.050	(0.383)		0.050	(0.378)	
- Enumerator 8	0.121	(0.062)	*	0.158	(0.009)	***	0.158	(0.010)	**
Socioeconomic controls									
- Age				0.000	(0.829)		0.000	(0.784)	
- Education				0.006	(0.155)		0.006	(0.154)	
- Nupe (=1)				-0.007	(0.936)		-0.006	(0.946)	
- Muslim (=1)				0.217	(0.019)	**	0.217	(0.016)	**
- Earning (=1)				-0.113	(0.089)	*	-0.113	(0.098)	*
- Wealth				0.031	(0.171)		0.031	(0.158)	
- Urban (=1)				0.093	(0.069)	*	0.093	(0.066)	*
- Log number of children							-0.004	(0.905)	
Observations	262			255			253		
R^2	0.126			0.220			0.220		

Note: Coefficients and corresponding *p*-values (bootstrapped to account for clustering, null: coefficient equals 0, in parentheses) from linear regressions reported. Initial endowment = the amount (in naira) received in envelope ; session size = number of participants in session (de-meaned); order = order of play (1 = 1st) in session (de-meaned); delay = 1 if session started later than prearranged time; second/third session = 1 if participant played in the second/third session held in the community; second/third game = 1 if decision made in second/third game played by participant; enumerator # = 1 if decision elicited in interview conducted by enumerator number #; age = age in years; education = years of formal education completed; Nupe = 1 if participant belongs to Nupe ethnic group; Muslim = 1 if participant Muslim; earning = 1 if participant brings monetary income into household; wealth = household-level asset index; urban = 1 if household in an urban area; log number of children = natural logarithm of the number of children that a participant has (with a one added before applying the log transformation). † If we use a dummy equal to 1 if the initial endowment was less than 220 naira, the size and significance of the coefficients on *Polygynous* in columns (2) and (3) are unchanged. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A5 Contributions by monogamous and polygynous wives: Regression analysis with controls

Dependent variable = contribution rate = contribution ÷ initial endowment

	Wives only (1)			Wives only (2)			Wives only (3)		
Constant	0.821	(<1e^{-8})	***	0.911	(<1e^{-8})	***	0.907	(<1e^{-8})	***
Polygynous (P)	-0.072	(0.085)	*	-0.091	(0.039)	**	-0.091	(0.034)	**
(P) × Female playing partner	-0.043	(0.080)	*	-0.044	(0.076)	*	-0.044	(0.076)	*
Experimental controls									
- Initial endowment†	1.7e^{-4}	(0.880)		1.9e^{-4}	(0.884)		2.0e^{-4}	(0.884)	
- Session size	0.013	(0.005)	***	0.012	(0.003)	***	0.012	(0.003)	***
- Order	-0.007	(0.006)	***	-0.007	(0.023)	**	-0.007	(0.026)	**
- Delay	-0.095	(0.018)	**	-0.110	(0.003)	***	-0.110	(0.003)	***
- Second session	0.032	(0.746)		0.024	(0.805)		0.024	(0.810)	
- Third session	0.122	(0.057)	*	0.128	(0.084)	*	0.128	(0.086)	*
- Second game	-0.012	(0.597)		-0.003	(0.873)		-0.003	(0.867)	
- Third game	-0.002	(0.936)		-0.006	(0.844)		-0.006	(0.832)	
- Enumerator 2	0.022	(0.789)		0.016	(0.858)		0.016	(0.869)	
- Enumerator 3	0.057	(0.276)		0.093	(0.040)	**	0.093	(0.038)	**
- Enumerator 4	-0.010	(0.872)		0.011	(0.916)		0.011	(0.914)	
- Enumerator 5	-0.061	(0.477)		-0.031	(0.689)		-0.030	(0.710)	
- Enumerator 6	-0.099	(0.200)		-0.084	(0.281)		-0.084	(0.285)	
- Enumerator 7	-0.030	(0.498)		-0.012	(0.778)		-0.013	(0.771)	
- Enumerator 8	0.089	(0.159)		0.094	(0.149)		0.093	(0.152)	
Socioeconomic controls									
- Age				-0.003	(0.187)		-0.003	(0.184)	
- Education				0.002	(0.698)		0.002	(0.691)	
- Nupe (=1)				-0.116	(0.064)	*	-0.115	(0.070)	*
- Muslim (=1)				0.200	(0.057)	*	0.200	(0.057)	*
- Earning (=1)				-0.060	(0.331)		-0.061	(0.321)	
- Wealth				0.027	(0.379)		0.027	(0.394)	
- Urban (=1)				-0.032	(0.574)		-0.031	(0.596)	
- Log number of children							0.005	(0.845)	
Observations	414			410			410		
R^2	0.194			0.246			0.246		

Note: Coefficients and corresponding *p*-values (bootstrapped to account for clustering, null: coefficient equals 0, in parentheses) from linear regressions reported. (P) × Female playing partner = 1 if a woman is playing with her co-wife; Initial endowment = the amount (in naira) received in envelope ; session size = number of participants in session (de-meaned); order = order of play (1 = 1st) in session (de-meaned); delay = 1 if session started later than prearranged time; second/third session = 1 if participant played in the second/third session held in the community; second/third game = 1 if decision made in second/third game played by participant; enumerator # = 1 if decision elicited in interview conducted by enumerator number #; age = age in years; education = years of formal education completed; Nupe = 1 if participant belongs to Nupe ethnic group; Muslim = 1 if participant Muslim; earning = 1 if participant brings monetary income into household; wealth = household-level asset index; urban = 1 if household in an urban area; log number of children = natural logarithm of the number of children that a participant has (with a one added before applying the log transformation). † If we use a dummy equal to 1 if the initial endowment was less than 220 naira, the size and significance of the coefficients on *Polygynous* in columns (2) and (3) are unchanged. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Section 3: Ruling out portfolio decision-making

Several aspects of the experimental design served to both minimize the possibility of and facilitate an investigation into portfolio decision-making. Specifically, (a) participants were told the "type" of their partner for a game (for example, "your husband," "your wife," "a (wo)man who is also here today," and "your co-wife") just prior to that game, so they did not know with whom they would play in future games; (b) no indication was given to participants that the games would be played between spouses and co-wives until the first time each participant played such a game; (c) the order in which a participant met each of his or her playing partners was randomized; and (d) there was no feedback about the behavior of playing partners or payoffs between games.

Features (a), (b) and (c) created random variation in participants' perceptions of their three-game portfolio structure as they moved from one game to the next. So if the participants were trying to play all three games as a portfolio, they would play the same game, in terms of partner type, differently depending on which other partner types they had already played with. In Tables A6, A7, and A8, we exploit these features and, thereby, exclude the possibility that portfolio decision-making is driving our results.

Table A6 Contributions within households: Do spouses play their second intra-household games differently from their first?

Dependent variable = contribution rate = contribution ÷ initial endowment

	(1)		(2)		(3)		(4)		(5)		(6)	
Constant	0.820	(<1e^{-8}) ***	0.826	(<1e^{-8}) ***	0.829	(<1e^{-8}) ***	0.832	(<1e^{-8}) ***	0.818	(<1e^{-8}) ***	0.822	(<1e^{-8}) ***
Polygynous	-0.099	(0.017) ***	-0.108	(0.004) ***								
Monogamous wife with husband					-0.025	(0.371)	-0.025	(0.375)				
Polyg. husband with wife 1 (PHW1)					-0.097	(0.046) **	-0.102	(0.046) **				
Polyg. husband with wife 2 (PHW2)					-0.122	(0.014) **	-0.126	(0.011) **				
Polyg. wife 1 with husband (W1PH)					-0.109	(0.019) **	-0.113	(0.016) **				
Polyg. wife 2 with husband (W2PH)					-0.073	(0.125)	-0.078	(0.104)				
Wife 1 with wife 2 (W1W2)					-0.146	(0.018) **	-0.150	(0.008) ***				
Wife 2 with wife 1 (W2W1)					-0.123	(0.051) *	-0.125	(0.042) **				
Pair includes polygynous husband (PPH)									-0.087	(0.021) **	-0.093	(0.014) **
Pair are co-wives (PCW)									-0.122	(0.026) **	-0.127	(0.011) **
Second intra-household game			0.018	(0.471)			0.009	(0.764)			0.012	(0.645)
Experimental controls	yes		yes		yes		yes		yes		yes	
Socio-economic controls	no		no		no		no		no		no	
Test null: coeff PPH = coeff PCW (*p*-value)									0.226		0.268	
Observations	676		676		676		676		676		676	
R^2	0.140		0.141		0.145		0.145		0.143		0.143	

Note: Coefficients and corresponding *p*-values (bootstrapped to account for clustering, null: coefficient equals 0, in parentheses) from linear regressions reported. Basis for comparison in Columns (1) and (2) is monogamous husband when playing with wife. Basis for comparison in Columns (3) and (4) is monogamous playing pair. Basis for comparison in Columns (5) and (6) is monogamous husbands and monogamous wives, respectively. For list and definitions of controls, see note for Table A2 above. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

The regressions in Table A6 investigate whether participants played their second *intra*-household game differently from their first. Here, the regressions only include participants' contribution decisions when playing with a spouse or a co-wife. The dependent variable is the amount contributed to the public good as a proportion of the initial endowment. The explanatory variable of interest here is *Second intra-household game*, which equals 1 if the contribution was made in the participant's second *intra*-household game. Note that this variable will never equal 1 for a member of a monogamous marriage but equals 1 for half of the contributions made by members of polygynous marriages. Because of this, if *Second intra-household game* is a determinant of contributions in *intra*-household games, its omission will be leading to bias in our main results.

Table A6, Column (1) presents a version of the model presented in Table 2, Panel A, Column (2) (in paper), the version here excludes socio-economic controls; Column (3) presents the same model as Table A1, Column (1), but with experimental controls added; and Column (5) presents the same model as Table A1, Column (2), but with experimental controls added. Columns (2), (4), and (6) present the same models as Columns (1), (3), and (5) respectively, but with *Second intra-household game* included as an additional explanatory variable.[1] The coefficient on *Second intra-household game* is always small and insignificant and the size and significance of the coefficients on the variables of principal interest are barely perturbed. From this, we conclude that the differences in contribution rates for monogamous versus polygynous participants cannot be explained by the second *intra*-household game that only polygynous participants played.

[1] We exclude the socio-economic controls here because their inclusion has little effect on the results of principal interest (see Table A2-A5). We include the experimental controls because *Second intra-household game* is such a control and excluding the other experimental controls would be inconsistent. The results are robust to the exclusion of the other experimental controls.

To further investigate this, Table A7 analyzes whether participants play their second *intra*-household game differently from their first, this time focusing only on the decisions made by members of polygynous households. Once again, in every regression the coefficient on *Second intra-household game* is insignificant, and the estimated coefficient on *Playing pair are co-wives* is barely perturbed and remains significant when the analysis is focused on wives' contributions only.[2]

Table A7 Contributions within households: Do polygynous spouses play their second intra-household games differently from their first?

Dependent variable = contribution rate = contribution ÷ initial endowment

	All polygynous			**Polygynous husbands**			**Polygynous wives**		
	(1)			**(2)**			**(3)**		
Constant	0.726	($<1e^{-8}$)	***	0.741	($<1e^{-8}$)	***	0.726	($<1e^{-8}$)	***
Playing pair are co-wives	-0.036	(0.255)					-0.047	(0.091)	*
Second intra-household game	-0.016	(0.787)		0.080	(0.384)		-0.056	(0.376)	
Experimental controls	yes			yes			yes		
Socio-economic controls	no			no			no		
Observations	456			152			304		
R^2	0.159			0.167			0.223		

Note: Coefficients and corresponding p-values (bootstrapped to account for clustering, null: coefficient equals 0, in parentheses) from linear regressions reported. For list and definitions of controls, see note for Table A2. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Finally, Table A8 tests for portfolio play in the *inter*-household games, that is, participants' contributions when playing with members of other households. Column (1) investigates whether monogamous husbands and wives play their second *inter*-household game differently from their first. They do not; the coefficient on *Second inter-household game* is small and insignificant. Columns (2) and (3) test whether participants played *inter*-household games differently depending on whether they had already played an *intra*-household game. The regressions in both columns include *Polygynous* and a dummy variable equal to 1 if the participant had already played an *intra*-

[2] Including decision-maker fixed effects in this analysis does not significantly change the results.

household game *(PostIntra)*; in addition, Column (3) controls for an interaction between these two variables because perceptions of the three-game portfolio could have differed between monogamous and polygynous participants only among those who had already played an *intra*-household game. The coefficients on *PostIntra* as well as the interaction term are small and insignificant. Thus, prior play of *intra*-household games has no effect on contributions in *inter*-household games, irrespective of whether the contributor is monogamous or polygynous.

Table A8 Do monogamous spouses play their second inter-household games differently from their first? And do spouses play inter-household games differently depending on whether they have already played an intra-household game?

Dependent variable = contribution rate = contribution ÷ initial endowment

	Interhousehold decision by monogamous spouses			**All interhousehold decisions**			**All interhousehold decisions**		
	(1)			**(2)**			**(3)**		
Constant	0.510	(<1e^{-8})	***	0.475	(<1e^{-8})	***	0.465	(<1e^{-8})	***
Second intra-household game	-0.003	(0.956)							
Polygynous				0.037	(0.172)		0.065	(0.196)	
Intrahousehold game already played (PostIntra)				-0.002	(0.977)		0.006	(0.884)	
Polygynous * PostIntra							-0.045	(0.551)	
Experimental controls	yes			yes			yes		
Socio-economic controls	no			no			no		
Observations	440			668			668		
R^2	0.106			0.074			0.075		

Note: Coefficients and corresponding *p*-values (bootstrapped to account for clustering, null: coefficient equals 0, in parentheses) from linear regressions reported. For list and definitions of controls, see note for Table A2. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

To sum up, the difference in *intra*-household cooperativeness between members of polygynous and monogamous marriage groups is not owing to differences in the portfolios of games they played.

Section 4: The conditioning of cooperation on beliefs about others' cooperativeness

The usefulness of our conditional cooperation analysis depends on the quality of the beliefs data. If the elicited beliefs are inaccurate or biased (or both) but the inaccuracy or bias is not correlated with participants' household types, this will only affect the power of the analysis. However, if any inaccuracy or bias differs between members of monogamous and polygynous households, this will undermine the validity of our comparative findings. We did not incentivize the beliefs elicitation. Reassuringly, in the context of student public goods games, this procedure only reduces accuracy but does not increase bias (Gächter and Renner 2010). However, in *intra*-household games, there are additional reasons to be cautious about possible bias – for example, husbands and wives might inflate the reported beliefs out of loyalty and this could differ between monogamous and polygynous spouses.

In Table A9 we check that elicited beliefs about others' contributions were neither biased on average nor differentially biased depending on whose belief it was about whom. Bias can be calculated by subtracting the playing partner's actual contribution rate from the guesser's belief about that contribution and is negative when the guess is too low and positive when the guess is too high. The mean biases for the *intra*-household pair types vary from minus 6.2 to plus 4.4 percentage points of the initial endowment. For *inter*-household pairings, the mean bias is 6.9 percentage points. None of these mean biases are significantly different from zero. Inaccuracy, the absolute distance between the playing partner's actual contribution rate and the guesser's belief about that contribution rate, varies from 14.5 to 20.9 percentage points of the initial endowment for *intra*-household pairings. Reassuringly, inaccuracy is higher at 32.3 percentage points for *inter*-household pairings. Importantly, there is no systematic difference in biases or in inaccuracy between monogamous and polygynous household pairings.

Table A9 Bias in and inaccuracy of participant's guesses of playing partner's contributions

Variable	Bias Guess–Actual	Inaccuracy |Guess–Actual|
Monogamous		
Husband guesses wife's contribution	-0.056	0.199
Wife guesses husband's contribution	-0.045	0.145
Polygynous		
Husband guesses 1st wife's contribution	0.016	0.164
Husband guesses 2nd wife's contribution	-0.062	0.194
1st wife guesses husband's contribution	-0.026	0.208
1st wife guesses 2nd wife's contribution	-0.051	0.182
2nd wife guesses husband's contribution	0.044	0.209
2nd wife guesses 1st wife's contribution	0.038	0.167
Inter-household		
One guesses the other's contribution	0.069	0.323

Note: Guess = participant's guess of the amount his or her playing partner contributed in a game, assuming an initial endowment of 220 naira, as a proportion of 220. Actual = amount that participant's playing partner contributed in the same game as a proportion of the partner's initial endowment.

Table A10 presents the conditional cooperation analysis. Figure 2 in the paper is derived from the regressions presented in Columns (1) and (3) of Panel A. The regressions in Panel A, Columns (2) and (4) indicate that adding controls to the analysis of contributions made in *intra*- and *inter*-household interactions respectively has little effect on the size and significance of the coefficients on the variables of interest.

The regression presented in Columns (1) and (2) of Panel B include an indicator variable for co-wives playing together and the interaction between this and the guessed contribution rate of the playing partner. In the regression without controls (Column 1) neither of these additional variables are significant. However, the regression with controls (Column 2) indicates that, co-wife interactions are more reciprocal than polygynous-husband-wife interactions ($p = 0.070$).

Table A10 Conditional cooperation in monogamous and polygynous households: Regression analysis

Dependent variable = contribution rate = contribution ÷ initial endowment

	Intra-household no controls		Intra-household with controls		Inter-household no controls		Inter-household with controls	
	(1)		(2)		(3)		(4)	
Panel A								
Constant	0.542	(<1e^{-8}) ***	0.382	(0.002) ***	0.144	(<1e^{-8}) ***	0.202	(0.051) *
Guessed contrib. rate (G)	0.408	(0.001) ***	0.380	(<1e^{-8}) ***	0.472	(<1e^{-8}) ***	0.470	(<1e^{-8}) ***
Polygynous	-0.319	(0.002) ***	-0.332	(0.001) ***	0.010	0.779	0.014	(0.793)
Polygynous*G	0.316	(0.004) ***	0.319	(0.001) ***	0.051	0.482	0.061	(0.441)
Observations	676		663		668		648	
R^2	0.435		0.510		0.202		0.272	
Panel B								
Constant	0.542	(<1e^{-8}) ***	0.380	(0.003) ***	n/a		n/a	
Guessed contrib. rate (G)	0.408	(0.001) ***	0.377	(<1e^{-8}) ***				
Polygynous	-0.277	(0.018) **	-0.289	(0.008) ***				
Polygynous*G	0.266	(0.030) **	0.262	(0.028) **				
Co-wives	-0.110	(0.172)	-0.116	(0.157)				
Co-wives*G	0.134	(0.115)	0.156	(0.070) *				
Observations	676		663					
R^2	0.438		0.514					

Note: Coefficients and corresponding *p*-values (bootstrapped to account for clustering, null: coefficient equals 0, in parentheses) from linear regressions reported. Guess = guess of playing partner's contribution assuming an initial endowment of 220 naira as a proportion of 220 naira. For list and definitions of controls, see note for Table A2 above. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table A11 cross-tabulates the beliefs and own contribution rates for monogamous spouses in *intra*-household games in the upper panel (i), for polygynous spouses and co-wives in *intra*-household games in the middle panel (ii), and for both in inter-household games in the lower panel (iii, on next page). Darker shading of a cell indicates that a higher proportion of the observations in that column fall in that cell.

In the *intra*-household games, a large proportion of the observations pertaining to both household types are located either in the top two rows of the cross-tabulations or on or near the main diagonal. However, among monogamous spouses, the top two rows are more prominent, while among polygynous spouses and co-wives the main diagonal is more prominent.

In the *inter*-household games, the top two rows are not at all prominent, the main diagonal is somewhat prominent, and the lower rows are more populated although with considerable variance.

Table A11 Conditional cooperation: Cross-tabulation of beliefs about playing partners' contribution rate and own contribution rate

Panel (i) Monogamous

Own contribution rate	0.00	0.09	0.18	0.27	0.36	0.45	0.55	0.64	0.73	0.82	0.91	1.00	
Obs	2	5	1	3	3	25	6	4	7	11	49	104	220
1.00	50	40	0	67	0	36	17	50	43	45	49	79	59.55
0.91	0	20	100	0	0	12	17	0	0	36	29	16	18.64
0.82	0	0	0	0	0	4	0	25	29	0	6	3	4.55
0.73	0	0	0	0	0	4	0	0	0	9	4	0	1.82
#0.64	0	0	0	0	33	0	33	25	0	0	2	0	2.27
0.55	0	0	0	0	0	20	17	0	0	0	2	1	3.64
#0.45	0	0	0	0	33	16	17	0	29	9	2	0	4.55
0.36	0	0	0	0	0	0	0	0	0	0	0	1	0.45
0.27	0	20	0	33	33	4	0	0	0	0	0	0	1.82
0.18	0	0	0	0	0	4	0	0	0	0	0	0	0.45
#0.09	0	20	0	0	0	0	0	0	0	0	6	0	1.82
0.00	50	0	0	0	0	0	0	0	0	0	0	0	0.45

Guess of other's contribution rate

Panel (ii) Polygynous

Own contribution rate	0.00	0.09	0.18	0.27	0.36	0.45	0.55	0.64	0.73	0.82	0.91	1.00	
Obs	2	21	8	10	14	59	24	5	12	12	88	201	456
1.00	0	14	25	30	7	20	4	40	58	33	39	77	48.90
0.91	0	10	0	0	7	7	13	20	0	33	38	16	17.76
0.82	0	0	0	0	0	2	4	0	8	17	9	2	3.73
0.73	0	0	0	0	0	3	0	0	8	8	1	1	1.32
#0.64	0	0	0	0	7	3	8	0	0	0	0	0	1.10
0.55	0	5	0	0	0	5	21	0	0	0	6	1	3.73
#0.45	0	0	0	10	14	25	33	20	0	8	5	0	7.02
0.36	0	0	13	0	29	19	13	20	0	0	2	0	4.82
0.27	0	0	0	20	21	5	4	0	17	0	0	1	2.85
0.18	0	0	38	20	14	2	0	0	8	0	1	1	2.63
#0.09	0	71	25	20	0	3	0	0	0	0	0	1	4.83
0.00	100	0	0	0	0	5	0	0	0	0	0	1	1.32

Guess of other's contribution rate

20%–49% of observations in column fall in this row.
50%–69% of observations in column fall in this row.
70+% of observations in column fall in this row.

Note: Numbers within the cross-tabulations are percentages of observations in the column falling within the given row.

Table A11 (continued) Conditional cooperation: Cross-tabulation of beliefs about playing partners' contribution rate and own contribution rate

Panel (iii) Inter-household

Own contribution rate	0.00	0.09	0.18	0.27	0.36	0.45	0.55	0.64	0.73	0.82	0.91	1.00	
Obs	37	68	52	52	49	186	61	22	25	22	56	37	
1.00	8	1	4	4	2	5	5	0	12	23	13	70	59.55
0.91	0	0	2	0	0	4	2	5	4	5	20	3	18.64
0.82	0	3	0	2	0	1	2	0	4	9	4	0	4.55
0.73	0	0	2	2	0	1	2	14	8	5	2	0	1.82
#0.64	0	0	0	0	2	1	7	27	4	0	4	0	2.27
0.55	3	0	2	6	4	11	23	18	8	0	4	3	3.64
#0.45	0	6	4	8	20	20	25	9	8	5	0	3	4.55
0.36	5	7	2	13	27	10	7	14	4	9	5	3	0.45
0.27	0	9	17	29	16	13	7	5	0	0	11	3	1.82
0.18	3	16	33	15	20	12	8	0	28	36	11	8	0.45
#0.09	14	44	21	12	4	16	13	9	12	9	20	8	1.82
0.00	68	13	13	10	4	5	2	0	8	0	9	0	0.45

Guess of other's contribution rate

20%–49% of observations in column fall in this row.
50%–69% of observations in column fall in this row.
70+% of observations in column fall in this row.

Note: Numbers within the cross-tabulations are percentages of observations in the column falling within the given row.

Section 5. Link between behavior in the lab and in everyday life

In this section, we briefly investigate whether and how behavior in the intra-household PGGs is linked to the behavior of the spouses in their everyday lives. To our knowledge, ours is one of two studies focusing on intra-household decision making that provide evidence of a relationship between behavior observed in an experiment and behavior in everyday life, the other being Hoel (2015).

The decisions made in the PGGs are most readily thought of as decisions about contributing financially to the household. This being the case, one might expect PGG contribution rates to correlate with proportional individual spousal contributions to household expenditures, expressed as a proportion of corresponding individual incomes. However, these financial contribution rates in daily life will have many determinants that, by design, have been excluded from impacting on the PGG contributions. The financial contribution rates in everyday life (hereafter `life') are likely to depend, for example, on monetary incomes, non-financial contributions to the household, and culturally defined responsibilities, and numbers of dependents (young and old and both within and beyond the bounds of the household), all of which are likely to vary across individuals and households.

In contrast, the PGG contributions could only be made in money out of the initial endowments and the variation in these initial endowments was minimal and random. Responsibilities and dependents could have an impact on decisions, but only to the extent that those responsibilities and dependents' needs had been internalized by the participants prior to entering the—to them—new decision making context of the PGGs. Its capacity to exclude many behavioral determinants is one of the advantages of the lab-type approach. Within the context of the current study, this allows us to attribute systematic differences in observed contribution rates to differences in willingness to cooperate. In addition, the approach circumnavigates the problem

of how to aggregate across the many potential domains, financial and otherwise, in which spouses might contribute to households in life. However, these advantages can become a disadvantage when it comes to demonstrating a link between behavior in the lab and behavior in life.

With this in mind, we considered what other aspects of behavior in life should be correlated with contribution rates in the PGGs. Given the asymmetric information about initial endowments, the decisions in the PGG will not only have captured willingness to contribute, but also the willingness of spouses to reveal or share information. Because information is non-rival, sharing it is not subject to budget constraints or dependents' needs, rendering it more likely to be correlated with PGG contributions.

So, in addition to asking each participant what proportion of their monetary income they contribute to household expenditures, we asked how much they thought each of their playing partners knows about their, i.e., the responding participant's, finances (four-point scale normalized, for the purposes of analysis, to 0 – to represent 'nothing' – and 1 – to represent 'full knowledge'). Further, if beliefs and perceptions about others' cooperative behaviors formed in life determine beliefs about their cooperativeness in the PGGs, the participants' perceptions about their spouses and co-wives contributing and information sharing behaviors in everyday life may be positively correlated with their PGG decisions. So, we also asked the participants what proportion of income they thought each of their playing partners contributed to household expenditures and how much they knew about each of their playing partners' finances (same four-point scale as above). Table A12 presents the sub-sample means for each of the everyday life variables described above.

Table A12 Means of contributions to household expenses, knowledge of others' finances and others' knowledge of own finances

	Monogamous		Polygynous	
Variable	**Male**	**Female**	**Male**	**Female**
Prop. income that player contributes to HH expenses	0.734	0.481	0.712	0.432
Prop. income that playing partner contributes to HH expenses	0.414	0.700	0.385	0.558
Knowledge about playing partner's finances	0.608	0.513	0.459	0.364
Playing partner's knowledge about player's finances	0.518	0.613	0.414	0.403
Observations	110	110	76	152

Note: Prop. income that player contributes to HH expenses = share as reported by the player; prop. income that playing partner contributes to HH expenses = share averaged across playing partners as reported by the player; knowledge about playing partner's finances = 0 if player reports knowing 'nothing'; 0.333 if player reports knowing 'a little bit'; 0.667 if player reports knowing 'quite a lot'; and 1 if player reports having 'full knowledge'; playing partner's knowledge about player's finances = 0 if player believes that playing partner knows 'nothing'; 0.333 if player believes that playing partner knows 'a little bit'; 0.667 if player believes that playing partner knows 'quite a lot'; and 1 if player believes that playing partner has 'full knowledge'.

To investigate the correlations, we regressed each of the life variables on the PGG contribution rate and wild bootstrapped to account for the clustering of decisions within sessions for the purposes of inference. The results are reported in Table A13. Columns (1) and (2) reveal no significant correlation between financial contributions to household expenses in life and PGG contributions in the lab. However, Column (3) reveals that those who indicated that their spouses and co-wives knew more about their finances in life contributed more in PGGs with those spouses and co-wives ($p = 0.066$). Column (4) further reveals that contribution rates were increasing in how much participants thought they knew about the PGG playing partners' finances in life ($p = 0.046$).

These findings are consistent with there being a link between behavior in the intra-household PGGs and the behavior of the spouses in their everyday lives. As expected, the results reveal that the co-determination of financial contributions in life and PGG contributions in the lab is limited, while that between information sharing in life and contributing in the PGG is relatively strong.

These lab-life link results also provide an explanation as to why Akresh, Chen, and Moore (2012, 2016) found higher levels of cooperation in co-wife compared to husband-wife interactions, the opposite of what we find in terms of contribution rates. Akresh, Chen, and Moore (2012, 2016) focus on household food production, a context in which low contribution rates can be observed and, thus, punished. They argue that in co-wife interactions, the costs of punishing non-cooperative behavior are lower than in husband-wife interactions. When information about contribution rates is symmetric, lower punishment costs can sustain conditional cooperation. However, in many other real life contexts, as in our experiment, information about contributions is asymmetric and, consequently, enforcement opportunities are limited.

Appendix Table A13 Linkages between behavior in the lab and in life

Dependent variable	Prop. income contributed to HH expenses by player	Prop. income contributed to HH expenses by playing partner	Playing partner's knowledge about own finances	Knowledge about playing partner's finances
	(1)	(2)	(3)	(4)
Constant	0.391 (<1e^{-8}) ***	0.311 (<1e^{-8}) ***	0.356 (<1e^{-8}) ***	0.339 (<1e^{-8}) ***
Contribution rate	0.061 (0.317)	0.101 (0.181)	0.121 (0.087) *	0.130 (0.077) *
Observations	653	638	649	641

Note: Coefficients and corresponding *p*-values (bootstrapped to account for clustering, null: coefficient equals 0, in parentheses) from linear regressions reported. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Definitions: prop. income that player contributes to HH expenses = share as reported by the player; prop. income that playing partner contributes to HH expenses = share averaged across playing partners as reported by the player; knowledge about playing partner's finances = 0 if player reports knowing 'nothing'; 0.333 if player reports knowing 'a little bit'; 0.667 if player reports knowing 'quite a lot'; and 1 if player reports having 'full knowledge'; playing partner's knowledge about player's finances = 0 if player believes that playing partner knows 'nothing'; 0.333 if player believes that playing partner knows 'a little bit'; 0.667 if player believes that playing partner knows 'quite a lot'; and 1 if player believes that playing partner has 'full knowledge'.

Section 6: References

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Section 7: Scripts, visual aids and protocol.

7.1. Script for group training

[INTRODUCTION. BY THE SUPERVISOR (IN ENGLISH), INTERPETATION TO NUPE BY PETER. MAKE SURE SLIDES ARE IN THE RIGHT ORDER AND THAT YOU HAVE TWO BROWN ENVELOPES + MONEY + COMMON BUNDLE FOR DEMONSTRATION.]

Welcome. Thank you for taking the time to come today. We are researchers from the University of Ilorin Teaching Hospital. [INTRODUCE THE RESEARCH TEAM MEMBERS.] *We have invited you here because we want to learn about how people in this area take decisions. You are going to play a game that involves making decisions about money. We will provide you the money, and whatever money you get because of your decisions will be yours to keep.*

The decisions you will make are not difficult, and there are no correct or wrong answers. All you need to think about is making the decisions that seem right to you. It is important to think seriously about your decisions because they will affect how much money you will take home.

Before we ask you to make any decisions, we will tell you everything you need to know about the game. But first we want to say a few other things.

First of all, the money we are going to use to play the game is not our own. We belong to a research organization that has given us the money to use for research.

Second, this study is about how each of you makes decisions on your own. Therefore, it is important that you do not talk or communicate in any other way amongst yourselves once we start explaining the game. This is very important. Please be sure to obey this rule. If just one person communicates with another, it could spoil the research. I'm afraid that if we find you talking or trying to signal to each other, we will have to send you home, and you will not collect money here today. Later you will have an opportunity to ask all your questions.

Third, we would like to kindly request all of you to put your handsets on silence because you cannot take phone calls while in this room. [WAIT FOR A MINUTE.]

Finally, make sure that you listen carefully to us. Each of you could make a good amount of money here today. But this will only be possible if you understand the decisions you are making. So listen to the instructions, ask us your questions when the opportunity arises, and do not sleep.

Okay. Now our instructor will start explaining the game.

[START OF THE GAME. PETER CONTINUES FROM HERE IN NUPE. IZAIA ILLUSTRATES. PETER PAUSES WHEN IZAIA IS ACTING.]

You play the game in pairs. You always play the game with someone else who is here today.

The game starts when we give each of you an envelope like this. [HOLD UP BROWN ENVELOPE.] *It contains some money.* [TAKE OUT THE MONEY THAT IS INSIDE AND SHOW IT.] *The person you are playing the game with will also receive an envelope. However, you will not know how much money is in your partner's envelope, and they will not know how much money is in yours.*

The money in the envelope is yours. You can put all of it or some of it in your pocket (or bag or wrapper) straightaway. **[**PUT A FEW NOTES IN POCKET.] *You can also decide to put some or all back in the envelope.* [PUT THE REST OF THE NOTES BACK IN ENVELOPE.] *Any money you put back in the envelope will go into a common bundle.* [EMPTY ENVELOPE WITH MONEY IN BUNDLE.] *Also your partner will decide how much of his or her own money to put in his or her pocket straightaway, and how much to put back in the envelope to go into the common bundle.* [SHOW ANOTHER BROWN ENVELOPE AND EMPTY IN BUNDLE.] *Both you and your partner will make your decisions in private. So you will not know your partner's decision, and he or she will not know yours.*

So you have to choose to do either of three things with the money in the envelope: either put all the money in your pocket straightaway; or put some in your pocket and put some back into the envelope for the common bundle; or put it all back in the envelope for the common bundle.

Now, to whatever is in the common bundle <supervisor's name> will add half again. [HOLD UP A FEW NOTES AND THEN PUT IT IN BUNDLE.] *For example, if there is ₦100 in the common bundle, <supervisor's name> will add another ₦50 to make the total ₦150. If there is ₦400 in the common bundle, she will add another ₦200 to make a total of ₦600 and so on.*

After that, each of you will get half of the money in the common bundle. [TAKE ALL MONEY OUT OF BUNDLE AND SHOW HALF IN EACH HAND.] *For example, if there is ₦160 in the common bundle after <supervisor's name> has added to it, you will each get ₦80. If there is ₦600 in the common bundle, you will each get ₦300 and so on.*

That is it. That is the game.

[EXAMPLES. IZAIA GETS SLIDES. REMAIN **NEUTRAL**! PETER POINTS AT SLIDES. IF THEY LOOK LIKE THEY ARE ABOUT TO START TALKING, ASK THEM NOT TO. IF THERE ARE QUESTIONS, TELL THEM THAT THEY HAVE AN OPPORTUNITY TO ASK THEM LATER.]

Now, to be sure that you really understand the game, I will give you some examples.

[show image 1] *In this first example a man and a woman are playing the game.*

[show image 2] *Each of them finds ₦220 in their envelope at the start of the game. Each of them decides to put all the money in their pocket straightaway. They both end up with ₦220, exactly the same amount as when they started the game.*

[go back to image 1] *Now let's look at a second example. Again, a man and a woman are playing the game.*

[show image 2] *Each of them finds ₦220 in their envelope at the start of the game.*

[show image 3] *Now suppose that each of them decides to put all ₦220 back into their envelope to go into the common bundle.*

[show image 4] *Both of them did not put any money in their pocket straightaway, but there is ₦440 in the common bundle.*

[show image 5] *<supervisor's name> then adds half as much again to the common bundle. That is, <supervisor's name> adds half of ₦440, which is ₦220, to the common bundle.*

[show image 6] *So now there is ₦660 in the common bundle.*

[show image 7] *Then, the common bundle is divided equally between the man and the woman.*

[show image 8] *So each of them get ₦330. That is, they both end up with much more money than the ₦220 that they started with.*

Now let us see what happens if they put only some of the money back to go into the common bundle instead of all.

[show image 9] *So, here is a different man and woman.*

[show image 10] *As in my first example, each of them finds ₦220 in their envelope at the start of the game.*

[show image 11] *However, in this case, they both decide to put only ₦20 back into their envelopes to go into the common bundle.*

[show image 12] *So each of them puts ₦200 in their pocket straightaway, and there is only ₦40 in the common bundle.*

[show image 13] *<supervisor's name> then adds half as much again to the common bundle. In other words, <supervisor's name> adds half of ₦40, which is ₦20, to the common bundle.*

[show image 14] *So now there is ₦60 in the common bundle.*

[show image 15] *Then, the common bundle is divided equally between the man and the woman.*

[show image 16] *So each of them gets ₦30 from the common bundle to add to the ₦200 they put in their pockets earlier. So, in this case, they both end up with ₦230. This is a lot less than the man and woman got in the previous example, who both put all their money in the common bundle and got ₦330 each.*

*So what we have learned here is that the more money you **both** decide to put back in the envelopes to go into the common bundle, the more money in total you **both** get in the end.*

*But something is tricky in the game. Note that you will never know how much money your partner in the game has decided to put in his or her pocket and how much he or she put back in the envelope. For example, assume you decide to put **all** your money back in the envelope. Assume that your partner puts most in his or her pocket and puts only a **little** back in his or her own envelope. Then, let's see what happens.*

[show image 17] *So, in this example, two men are playing the game.*

[show image 18] *As before, each of them finds ₦220 in their envelope at the start of the game.*

[show image 19] *The man on the left decides to put all of his money back in the envelope to go into the common bundle. However, the man on the right* [POINT TO THE MAN ON THE RIGHT] *decides to put most of the money in his pocket straightaway and puts only ₦20 back in his envelope to go into the common bundle.*

[show image 20] *So, at this stage of the game, the man on the left has no money in his pocket because he has put all his money back in the envelope, while the man on the right has ₦200 in his pocket because he only put ₦20 in the envelope. And so, there is ₦240 in total in the common bundle.*

[show image 21] *<supervisor's name> then adds half as much again to the common bundle. That is, she adds half of ₦240, which is ₦120, to the common bundle.*

[show image 22] *So now there is ₦360 in the common bundle.*

[show image 23] *Then, the common bundle is divided equally between the two men.*

[show image 24] *So each of them gets ₦180 from the common bundle to add to whatever they put in their pockets earlier. So the man who put all of his money in the envelope* **[**POINT TO THE MAN ON THE LEFT**]** *ends up with ₦180. The man who only put ₦20 in his envelope and pocketed the rest* **[**POINT TO THE MAN ON THE RIGHT**]** *ends up with ₦380.*

So now you see the tricky part of the game.

[show overview 1] *If both persons put all their money back in the envelope* [EXAMPLE 220–220 LEFT-HAND SIDE], *they both end up much better off than at the start and get ₦330 each* [EXAMPLE 220–220 RIGHT-HAND SIDE]. *But perhaps* ***one*** *person puts all money in the envelope, and* ***one*** *person puts only a* ***little*** *in the envelope and the rest of it in his or her pocket. Then* ***this*** *person ends up with only ₦180* [EXAMPLE 220–20 RIGHT-HAND SIDE], *so much less than he or she started with. While* ***this*** *person ends up with ₦380, much more than at the start, and more than anyone else in the examples. But note that* ***in total****, these two persons* ***jointly*** *earn* ***less*** *than these two persons.* [EXAMPLE 220–220 RIGHT-HAND SIDE]

[show overview 2] *But remember: if* ***both*** *persons put a little in the envelope and a lot in their pocket, as in this example* [EXAMPLE 0–0 LEFT-HAND SIDE], *and in this example* [EXAMPLE 20–20 LEFT-HAND SIDE], *then* ***both*** *will end up with only ₦220 or ₦230* [EXAMPLES 0–0 AND 20–20 RIGHT-HAND SIDE], *about as much as they started with. So what you end up with also depends on what your partner decides. And you have no way of knowing this before you make your decision.*

Something else that is important to know is that not everyone will start with the same amount of money in their envelopes. Most of you will have ₦220 in the envelope at the start of the game. A few of you may by chance start with less than that, between ₦20 and ₦200. You will not know how much your partner is starting with, and he or she will not know either how much you are starting with. How much is in your envelope depends on which envelope you pick from this box. [IF THEY LOOK LIKE THEY ARE ABOUT TO START TALKING, ASK THEM NOT TO.]

<u>[HOW THE GAME IS GOING TO BE PLAYED.]</u>

OK. So now I am going to tell you how we are to proceed.

Each of you is going to play the game three times. [PUT THREE FINGERS IN THE AIR.] *And each time you play the game with a different partner. There will be a* ***separate*** *common bundle for* ***each*** *of the games that you play. So you will have a separate common bundle with each of the three partners.*

<supervisor's name> will call you one by one. When called, you will go up to <supervisor's name's> desk and pick a white envelope from this box. [POINT TO BOX WITH WHITE ENVELOPES.] *In each white envelope, there are three brown envelopes. In most brown envelopes, you will find ₦220. In a few you will find less money; between ₦20 and ₦200. An enumerator will then escort you to a place where you will make your three decisions in private. That is also the time to ask your questions.*

You will get the money from the three games together in one total amount at the end of the workshop, so you will not know what each individual partner decided and your partners will not know what you decided. Please remember not to talk or communicate with each other in any way. If you have questions about the game, you can ask the enumerators in private.

7.2 Script for individual interviews

Check whether the ID on the participant's badge is the same as the ID on the form. Take the interview form and guide the participant (with his or her envelope) to your bench.

> *"I will explain the game once more. In the white envelope that you picked, there are three brown envelopes. There is one brown envelope for each of the three games. Each game is with a different partner. In most envelopes, there is ₦220. In a few envelopes, there will be less, between ₦20 and ₦200. How much is in yours depends on which envelope you picked from the box."*
>
> *"At the start of each game, I will tell you with whom you are playing this game. You will then count the money in the brown envelope and decide how much to put in your pocket and how much you will put back in the envelope for the common bundle. I will turn away while you are doing so. Your partner will decide how much to put in his or her pocket and in his or her envelope as well. You will both not know what the other one decided."*
>
> *"<supervisor's name> will then increase the amount of money in the common bundle by adding half as much again. And then we will divide the money in the common bundle equally between you and your partner. There will be a separate common bundle with each of the three games."*
>
> *"Do you have any questions?"*
>
> *"Now, let's work through one more example together."*

[show image TE1] "*So, in this example, two women are playing and each of them finds ₦220 in their envelope at the start of the game."*

[show image TE2] "*Suppose that this woman decides to put ₦120 back in her envelope to go into the common bundle* [point to woman on left]. *How much money can she put in her pocket straightaway?"* [Answer to Test Question 1: ₦100.]

If the participant gives the correct answer without help/repeating the question: Correct fast.
If not, repeat the question. If the participant gives the correct answer now: Correct slow.
But if the participant is still struggling after having repeated the question, say:
"*She received ₦220. She puts ₦120 back in the envelope. How much can she put in her pocket straightaway?*"
If the participant gives the correct answer now: Needed help. You can repeat this question if she needs more help. Do not continue until she understands. If necessary, explain images TE1 and TE2 again (use script).
If participant really does not understand: Confused. Ask to deduct ₦120 from ₦220.

[show image TE3] "*OK. Now suppose that this woman decides to put ₦200 back in her envelope to go into the common bundle* [point to woman on right]. *How much money can she put in her pocket straightaway?* [Answer to Test Question 2: ₦20.]

If the participant gives the correct answer without help/repeating the question: Correct fast.
If not, repeat the question. If the participant gives the correct answer now: Correct slow.
But if the participant is still struggling after having repeated the question, say:
"*She received ₦220. She puts ₦200 back in the envelope. How much can she put in her pocket straightaway?*"
If the participant gives the correct answer now: Needed help. You can repeat this question if she needs more help. Do not continue until she understands. If necessary, repeat images TE1 through TE3.
If participant really does not understand: Confused. Ask to deduct ₦200 from ₦220. Will be rare.

[show image TE4] "*OK. So one woman contributed ₦120 to the common bundle and the other woman contributed ₦200, making a total of ₦320. How much will <the supervisor> now add to the common bundle?"* [Answer to Test Question 3: ₦160.]

If the participant gives the correct answer without help/repeating the question: Correct fast.
- If he or she has the right logic (he or she indicates that <the supervisor> will add half of 320 but cannot calculate 320/2), help her do the division and write Correct slow.
- Also, if she gives the correct answer after repeating the question: Correct slow.
- But if the participant is still struggling after having repeated the question, say:
  "Remember. <supervisor's name> will add half of all the money in the common bundle."

If the participant gives correct answer now: Needed help. If the participant is still struggling, say:

"She will add half of ₦320, which is . . . ?"

Correct answer? Needed help. If the participant is still struggling, say:

"How many notes of ₦20 are in the common bundle? [Answer: 16 notes.] *For every note of ₦20 in the common bundle, [the supervisor] will add one note of ₦10. How many notes of ₦10 will <supervisor's name> add?* [Answer: 16 notes.] *So how much naira will <supervisor's name> add to the common bundle?"*

If after that she is still struggling, write Confused. Will be rare.

[show image TE5] "*That's right. She will add ₦160. So the bundle now contains ₦480. Remember that the two women also put money in their pockets straightaway. This money is theirs to keep and is not in the common bundle. This woman* [point at left] *has ₦100 in her pocket, and this woman* [point at right] *has ₦20 in her pocket."*

[show image TE6] "*Now, the common bundle is divided equally between the two women. So each gets ₦240 from the common bundle. So this woman* [point to woman on left] *goes home with ₦240 plus the ₦100 she put in her pocket earlier, making a total of ₦340. What about this woman,* [point to woman on right] *how much does she go home with?*" [Answer to Test Question 4: ₦260.]

"Do you have any questions?"

[See the final page of the script for frequently asked questions and appropriate answers.]

"OK! I think we are ready to play."

[Repeat the steps in this box for games #1, #2, and #3.]

"Let's play your . . . (first/second/third) game."

[1] *"You are playing this game with . . ."* [Give type of partner from interview form.]

- Refer to playing partner written on interview form. DO NOT MAKE A MISTAKE!

[2] *"Please take the brown envelope with a . . . ("1"/"2"/"3") on it out of the white envelope. Open the envelope and let's see how much money you have in it."*

- Check that the participant has the right envelope.
- Watch carefully as the participant counts the money and count with him or her.
- Record the amount of money on the interview form.
- In game #3, also let the participant sign or put thumbprint:
  "Please sign here for the amounts you found in each of the three envelopes."

[3] *"While I am turned away, please decide how much money to put in your pocket and how much to put back in the envelope to go into the common bundle with* [PARTNER]. *Let me know when you are ready."*

- Turn away. Turn back after one-half minute or when the participant signals he or she is done.
- When the participant has finished, take the envelope and put it to one side.
- Check that the participant has put away the money.

"Now I want you to guess how much each of your playing partners left in their envelopes to go into the common bundle. Let's suppose that each of them started out with ₦220 in their envelope. How much do you guess that . . . (you played with in the first/second/third game) left in his or her envelope?"

[Husbands and monogamous wives:] *"Finally, before I let you go, if a . . . [husband/wife] puts some of the money in his/her pocket, do you think he/she will tell that to his/her . . . [wife/husband]?"*

[Polygamous wives:] *"If a wife in a polygamous marriage puts some of the money in her pocket, do you think she will tell that to her . . . (a) husband?*
(b) co-wife?"

"OK! We are finished! Please will you now go and sit over there."

- Take the white envelope, fold it around the brown envelopes and put paper clips on the sides.
- Escort participant to the waiting area.
- Go to <the supervisor>, and give her the form with the envelopes. Await to be assigned your next participant.

[FREQUENTLY ASKED QUESTIONS]

How much do you want me to put back in the envelope?

[Say:] *"There is no right or wrong decision. It is up to you."*

- Never say anything that suggests that some decisions are better than others. Always remain neutral.

What is this game all about?

[Say:] *"This game is research. To understand how people here make decisions about money. Please note that this is not a raffle. We are interested in your decisions."*

Where can I put the money? [if person does not have a pocket]

[Say:] *"In your bag or wrapper."*

Who is the other person (man/woman) that I am playing with?

[Say:] *"This is another person who was also in the group training room."*

Why should I put money in the common bundle?

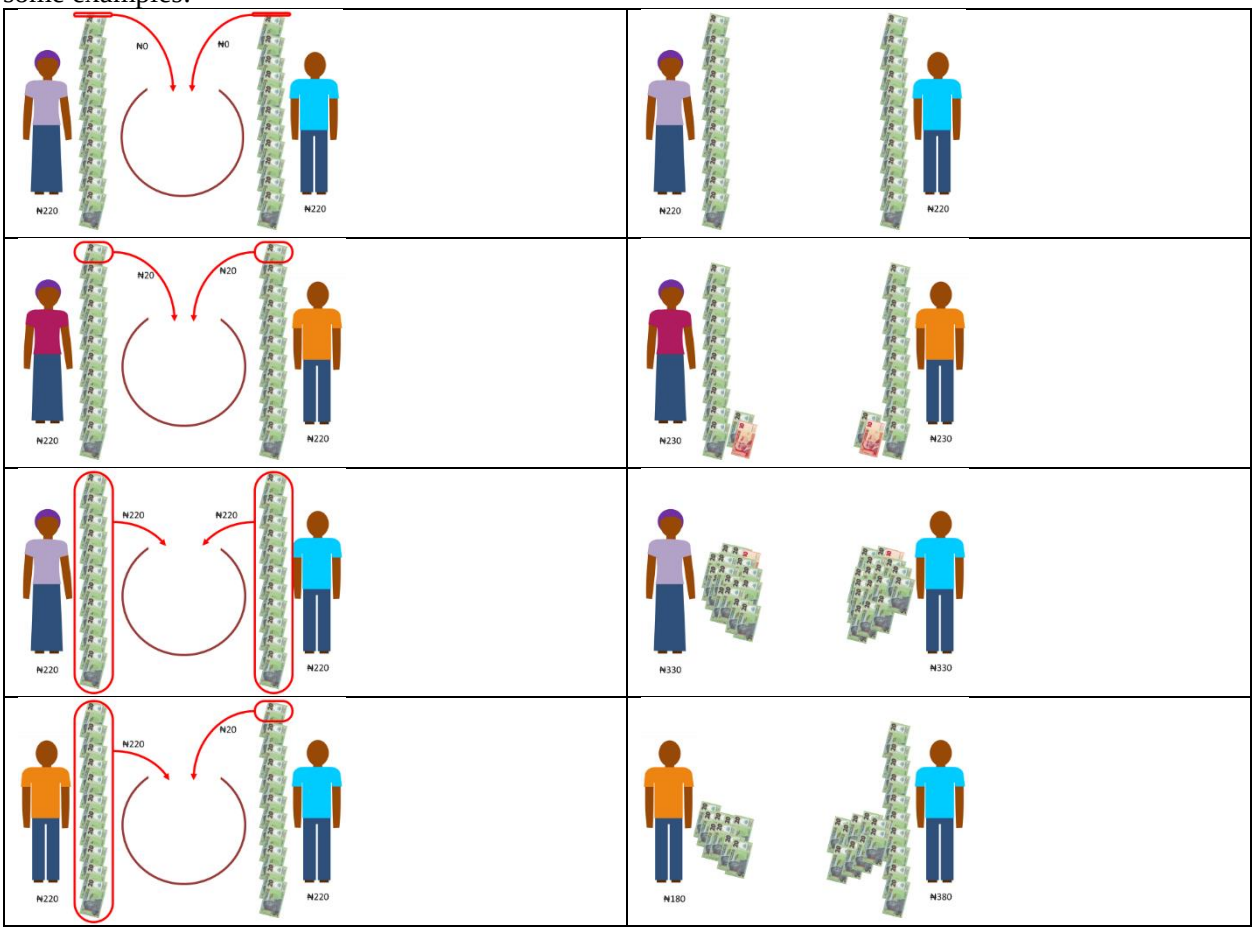
[Say:] *"Because to whatever is in the common bundle, <the supervisor> will add half as much again."*

Can I use money from game 1 in game 2?

[Say:] *"No. You can only use the money from envelope 2 in game 2. And you can only use the money from envelope 3 in game 3."*

7.3 Visual aids

To facilitate understanding, visual aids for group training and individual interviews were used. Here are some examples:



7.4 Protocol

1. Conducting the session

1.1. Setting up the session location

In most villages of the project, two sessions will be conducted. The following notes describe how each session should be organized.

Space: To run a session, you need

- one space large enough to contain all of the participants (seated) for the group training;
- several locations for the individual interviews (these need to be private—that is, the participants must not be seen by anyone when making their decisions about how much money to take out and to leave in the envelopes); and
- one space large enough to contain all of the participants, while waiting to be paid, after they have made their decisions.

The participants for the second session in a community will arrive only after all the participants in the first have vacated the group training space. They can then wait there while the payments for the first session are being made. Do not start registering for the second session until the first is complete. The utmost care should be taken to avoid communication between the participants of the first and second sessions; remember, we want to capture the decisions of individuals and do not want them to be influenced by others who have already played the games.

Furniture: You will need

- a desk for the supervisor at the front of the space used for group training;
- chairs or benches for the participants in the location to be used for group training (if people are used to sitting on the floor, these may not be necessary; if people usually bring their own chairs to meetings, they could be encouraged to do this);
- chairs or benches for the participants in the location where participants will wait once they have played (see previous note and also note that chairs can be moved gradually from the group training area to the waiting area as a session progresses); and
- a pair of chairs (one for enumerator, one for participant) in each location to be used for private interviews (or if people bring their own chairs, they can take their own chair from group training to individual interview to waiting area).

1.2. Materials and setup for a session

Session ID badges: Conference badges bearing the session IDs (to be reused in each session) will be used to identify each participant. At the beginning of each session, participants will be registered and given the badges with the session IDs. It is very important that they receive the correct session ID as indicated on the registration form and the individual interview form. Always double-check!

Envelopes:

- 100 large white envelopes (A5), each containing three standard brown envelopes each containing money
- Within each white envelope, there must be one brown envelope labeled "1," one labeled "2," and one labeled "3." Please make sure that all 300 brown envelopes in the 100 white envelopes are labeled like this.
- Within each white envelope, all three of the brown envelopes must contain the same amount of money.
- The brown envelopes in 95 of the 100 white envelopes must each contain 11 ₦20 notes (₦220 in total).

- The brown envelopes in one of the 100 white envelopes must contain one ₦20 note (₦20 in total).
- The brown envelopes in one of the 100 white envelopes must contain three ₦20 notes (₦60 in total).
- The brown envelopes in one of the 100 white envelopes must contain five ₦20 notes (₦100 in total).
- The brown envelopes in one of the 100 white envelopes must contain seven ₦20 notes (₦140 in total).
- The brown envelopes in one of the 100 white envelopes must contain nine ₦20 notes (₦180 in total).

Place these in a box (preferably the box will be proportioned so that the envelopes stand up on one of their sides so that each and every one is equally accessible to a participant invited to take one). Make sure the envelopes are arranged in such a way that it is easy to pick out one of them. Also make sure the envelopes containing smaller amounts of money cannot be identified by the participants when they look at the box. And make sure that the five envelopes with less than ₦220 in each brown envelope are mixed up with the others (should not be put together as a bunch). A cardboard box, plastic box, crate, or similar can be used for this purpose.

At the end of each session, check the Excel data sheet to see whether any of the envelopes with less than ₦220 per brown envelope were picked. If they were, replace them, like-for-like. Then, replenish the box with enough envelopes containing exactly ₦220 per brown envelope to make it back up to 100 ready for the next session. Have enough envelopes prepared beforehand to replenish the box at the end of Session 1.

Money denominations: In addition to having the right total amount of money for the games, the exact denominations should be made available. For example, the denominations given to players should not constrain them from making contributions they would like to make; and when payments are made to the players at the end of the game, the necessary denominations for payments should be available. Preparing the right denomination of naira requires some planning. Banks in small towns may not have sufficient amounts of the required denominations.

If participants want to change a ₦20 note for two ₦10 notes from their pocket and leave, for example, ₦10, ₦30, or ₦50, and so forth in the envelope, they are allowed to do so. During final payoff, amounts can be rounded up to the nearest multiple of 5.

Visual aids: One set of the visual aids for the group training (size = A2) needs to be set up on a table at the front of the group training space.

Each enumerator who is going to undertake individual interviews needs one set of the visual aids for the individual interviews (size = A4).

Snacks and refreshments: Snacks and refreshments will be provided in the second space where participants arrive after they have made their decisions in the individual interview and where they wait to be paid.

1.3. Data sheet and payoff calculator

For each session, the relevant Excel data sheet and payoff calculator needs to be open on the laptop computer. The laptop officers will be in charge of this.

1.4. Session protocol

Participant arrival: The mobilization officers welcome people as they arrive. The mobilization officers will check their names on the sensitization and mobilization form, and direct them to the registration table. A marriage group must be registered all at once, that is, only after all those in the marriage group who are to attend have arrived. Marriage groups who arrive one short but saying that the one is on his or her way

must wait until that one has arrived before registering. The mobilization officers will tick off the people who have arrived on their sensitization and mobilization form to keep track of the people who are not there yet and who may need further mobilization effort.

In communities with two sessions, people can participate only in the session they are assigned to.

Registration starts when the first participants arrive. Since we do not expect all participants to turn up exactly at the appointed time, a time limit should be allotted to wait for latecomers (not more than 30 minutes after official starting time). The focal person can help mobilize participants who are late if the conditions allow (if their homes are near, for example). Once the group training has started, latecomers cannot participate anymore and will not receive any money. If some invited participants do not show up, adjustments will be made on the data sheet and the individual interview forms. This is described in another manual.

Registration and session ID badges: The registration form for the session has the list of people invited to the session, their survey IDs (from the panel survey), their games session IDs, and a column that should be ticked when participants arrive at the registration desk. When participants register, put a tick in the last column (with a heading "Present (√)"). After registration, participants will be given a badge with their assigned session ID. Make sure that each participant gets a badge with the correct session ID assigned to them as indicated in the registration form. (IT IS EXTREMELY IMPORTANT THAT THIS IS DONE CAREFULLY.)

Each participant is given a badge showing his or her session ID. Session IDs have been printed and put in the badge. IMPORTANT: The first part of a session ID indicates the type of marriage—monogamous (M), polygamous (P2, P3, . . .), co-wives (CW), single men (SM), and single women (SW). The following two numbers indicate specific partners in that type of marriage. These numbers must be the same for all individuals in the same marriage (this is why all the members of a specific marriage group must be registered at the same time).

Seating arrangements: Once a marriage group or individual has been registered and given their conference badges, they should be seated. Marriage groups must be separated. Have a zone where the husbands and single males sit, and another where monogamous, first, and single wives sit. Second wives should be seated apart from co-wives and their husband. The participant officers are in charge of seating people and ensuring that they do not regroup once seated.

Group training: Once all the participants are seated, the supervisor will give an introduction. Participants will be asked to switch off their mobile phones and remain silent. Then, the group trainer reads out the group training script, including the examples. When presenting the examples, the group trainer uses the visual aids.

Individual interviews: Once the group training is complete, the individual interviews start.

The enumerators who are going to do the interviews should join the supervisor at the front desk.

The supervisor calls one person forward at a time starting at the top of the registration form. A person should be called forward only when an enumerator is waiting to escort him or her to the private interview.

When a person comes forward,

- the supervisor checks whether the session ID on the registration form is the same as the session ID on the participant's badge;
- the participant picks any white envelope he or she chooses from the box and is told not to open it until asked to do so;
- the enumerator receives the participant's individual interview form (see Appendix Section 5.2 for examples of session ID numbers and Section 11.3 for an example of an individual interview form); and
- the enumerator escorts the participant to one of the locations set up for private interviews.

During each private interview, the enumerator follows the script for the individual interviews WITH GREAT CARE AND ATTENTION TO DETAIL AT ALL TIMES. The enumerator

- checks whether the session ID on the individual interview form is the same as the session ID on the participant's badge;
- fills in his interviewer ID code and the date at the top of the form;
- LITERALLY reads the description of the game at the beginning of the script;
- LITERALLY READS THE SCRIPT as he works through the example and asks the participant the test questions as written on the script, using the visual aids where appropriate, and records the participant's performance in the test questions on the individual interview form;
- LITERALLY READS THE SCRIPT as he plays games 1, 2, and 3 with the participant;
- records the amounts received in the envelope at the start of each game on the individual interview form;
- asks the participant to sign for the amounts;
- LITERALLY READS THE SCRIPT about the guess questions and records the answers on the individual interview form;
- LITERALLY READS THE SCRIPT about the sharing information questions and records the answers on the individual interview form;
- collects the white envelope from the participant and closes the interview;
- paper-clips all envelopes to the individual interview forms as demonstrated during the training;
- escorts the participant to the waiting area; and
- proceeds to the supervisor to hand in the individual interview form with the envelopes and pick up his next participant.

Calculation and making of payments: When an individual interview form with envelopes paper-clipped to it has been delivered back to the supervisor, she can start processing them. To do this, the supervisor

- checks whether all relevant boxes have been filled in properly by the enumerator;
- opens the envelope on which "1" is written and records the amount of money left in it in the box for "1st" game (in the column titled "Amount left in");
- opens the envelope on which "2" is written and records the amount of money left in it in the box for "2nd" game (in the column titled "Amount left in");
- opens the envelope on which "3" is written and records the amount of money left in it in the box for "3rd" game (in the column titled "Amount left in"); and
- puts the money left in the envelopes into the envelope cash bag.

Once the individual interview form is completely filled in, the supervisor passes it to the laptop officer, who

- enters the data on the individual interview form into the calculator data sheet.

Once all individual interview forms have been entered, the supervisor calls participants forward one at a time and

- takes back their session ID badge;
- pays them the amount next to their session ID in the final payoff column (this amount includes the show-up fee);
- asks them to sign at the bottom of their individual interview form; and
- tells them that they are free to go.

1.5. Transition to second session

Just as it is important for participants not to talk to each other *during* a session (so that they cannot influence each other's decision), it is also important that participants in the first session do not talk to participants who arrive for the second session. Therefore, the transition to the second session should be carefully organized.

Once all participants in the first session have made their individual decisions and have moved to the waiting room where they wait to be paid out, the participants in the second session can enter the group training room. The mobilization officers will record on the sensitization form all participants who have entered.

Only after all participants for the second session are in the group training room can the first-session participants be paid and leave the venue. If most but not all of second-session participants have arrived, the mobilization officers can wait for the latecomers outside the venue to direct new participants immediately to the group training room while urging first-session participants not to talk to the newcomers. Latecomers will be recorded as "arrived" and "late" in the data sheet.

Before registration of the second-session participants, the appropriate ID badges should be returned to the registration desk and put in order. Also, the box with white envelopes should be refilled to contain 100 white envelopes. The data sheet will indicate the number of white envelopes that contained less than ₦220 (see Section 8.1.2) and how much was in those envelopes instead.

2. General guidelines

Experimental games should be conducted in similar conditions for all participants—otherwise, actions of the players will differ depending on the different conditions they experience during the games, and not only because of differences in their individual behavior. To avoid this, research assistants should **strictly adhere to the protocols.** The protocols should be **consistently** implemented **across different sessions** in the same village as well as across villages. Strict adherence to the protocols guarantees that comparable data are collected from all players.

Utmost care should be taken to avoid contamination between sessions. In most of the study villages, two sessions will be conducted. Please ensure as much as possible that participants of the second session are not communicating upon arrival with those from the first session who have already played the games.

The utmost care should also be given to avoid communication and contamination within sessions themselves. Please make clear to the participants that talking to each other after the session has started is strictly prohibited. The threat of expulsion from the game is usually a good enforcement mechanism for this. Enumerators can ask participants to remain silent on the supervisor's behalf.

In addition to players talking to each other, contamination in a session could occur if players can see each other when they make their decisions; observing the decisions of others may influence decisions. To avoid this, please ensure that players are making decisions in private without others observing them. After the game instructions have been read, players should be taken to a place where they can make their decisions in private. In every instance, stress that players should make their own decisions without the influence of others.

The decisions of players can also be influenced by inadvertent actions of research assistants. Research assistants should not give any signal—either verbal or nonverbal—that may give the impression that certain decisions of the players are "good" or "bad." This can be in the form of verbal cues that may encourage the players to choose some decisions. Or it can be in the form of nonverbal cues, such as gestures that show approval or disapproval. Always remember, the games attempt to capture the decisions of the players themselves as much as possible without influence from other players or research assistants.

Research assistants should remember that the experimental games are conducted to learn about the behavior of participants. The purpose of the games is neither to "teach" players nor "help" participants financially. For example, although agricultural extension agents may use games to teach farmers better methods of doing things, these experimental games do not have the objective of teaching something to the participants. Charity organizations give money or other materials to support people, but the experimental games are not providing charity or aid. Always remember, the experimental games are conducted for the purpose of research in order to understand how people make their decisions.

Reading instructions during the games: The scripts should be read slowly, clearly, and in a loud voice. Research assistants should read the scripts without giving any additional explanation. If participants have questions, research assistants should answer the questions as neutrally as possible—that is, without giving any suggestion that certain decisions are better or preferable. The decisions of the participants should be their own.

Research assistants should make sure that they do not impart any information on the nature of the games before the games start; as much as possible, participants have to get information about the games from the instructions.

3. Sensitization

All participants have been informed and invited to the games during the end-line survey of the Financial Diaries. A few days prior to the games (workshop) being held, further sensitization will be done in each community. In each community, a focal person is appointed by the supervisor. The enumerators will first decide on an appropriate venue and timing for the two sessions in consultation with the focal person. They will then fill in the venue and the timing on the personal invitations that will be prepared for all participants. Finally, they will visit all households to hand over the invitation and urge the participants to come to the workshop. The focal person will assist in handing out the personal invitations to participants who are absent at the time of the visit.

In most communities there will be two sessions, run one after the other. In such cases, the starting times for two sessions need to be planned in such a way that the participants who have finished the first session can leave only after participants in the second session have arrived. Planning two hours between the first and second sessions in a community seems best, but this may be adjusted at a later stage in the fieldwork based on your experiences.

Two types of invitation letters are distributed to the households during the sensitization visit. The first is to be used for both monogamous and polygamous married people in the sample, and the second is for unmarried individuals or married individuals whose spouses are living outside the community. On each invitation, the research assistants will write down the date, location, and exact time the participant is expected to show up. If a participant is not present during the sensitization visit, the focal person should deliver the personal invitation to the participant's house.

For married people, please emphasize that the presence of **all spouses** from a household is crucial. Since the workshop requires the participation of all spouses, please encourage and get assurance that all invited spouses will come to the workshop. It is important to clarify that the invitation is not for one person to "represent" the household.

Also, stress that it is important that the husband and his wife or wives all turn up to the workshop together, that is, at the same time.

In some marriages the spouse resides elsewhere, either in the community or outside the community. If a spouse does not live in the household but in the community, he or she is also invited (see separate list for ID codes). Spouses who reside outside the community are not invited.

Singles (or married persons with a spouse outside the community) will receive a personal invitation for a "single" person. They are invited individually and do not need to arrive together with any married individuals in their household.

In most of the villages two sessions will be held, one after the other. Please emphasize that people must come to the session to which they are assigned. People listed for the first session should go to the first session and people listed for the second session should go to the second session. Swapping between sessions is also not allowed—that is, people cannot exchange their places across sessions.

Please explain that, at the workshop, participants will get money that they can take home (a show-up fee of ₦250 and an additional amount of up to ₦800, or somewhat less or even more). Emphasize that the amount of money they will get to take home will depend on the decisions they and others make in the workshop. The amount will vary across participants.

Also explain that the money is from research institutions in Europe and that the information gathered during the workshop will be used only for research and without revealing the individual identities of the participants. Indicate that the game is part of the Financial Diaries research.

Research assistants should strongly indicate that the participation of all invited household members is extremely important. In cases where the invited people definitely know that they cannot make it on the day, please record this fact. But please encourage people to attend and get a firm commitment.

Sensitization will take place one or more days before the workshop takes place. There are five communities in Bacita and Shonga, and six communities in Lafiagi. This means that the team of research assistants will split up in groups of two for the sensitization visits.

For each sensitization visit, the research assistants need to bring the personal invitations (including notes) and the sensitization form(s) for that particular community. The notes that go with the invitation indicate which respondents require particular attention—for example, because we do not yet have a name or have very similar names for different persons, and so forth.

Each workshop is registered on one sensitization form; so if two workshops are to be held in one community, there will be two sensitization forms. The sensitization form lists the names and identification numbers of the participants in the game. If it becomes clear during the handing out of the invitations that a participant will not attend the workshop, that should be indicated on the sensitization form so that the mobilization officers know not to wait for that person at the start of the workshop.