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# Do spouses realise cooperative gains? Experimental evidence from rural Uganda

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**Abstract**
Intra-household efficiency is tested by using experimental data from variants of a public good game from 240 couples in rural Uganda. Spouses frequently do not maximise surplus from cooperation and realise a greater surplus when women are in charge of allocating the common pool. Women contribute less than men. These results cast doubts on many models of household decision making including unitary and collective models and on Sen's (1990) conjecture of greater female identification with household interests. We also find strong evidence for opportunism, where spouses don't contribute to the common pool even when they are in control of its allocation. Experimental results are correlated with some socio-economic conditions in a manner suggesting that assortative matching improves household efficiency. The development of non-cooperative intra-household models that allow in their empirical implementation for sensitivity to the context-specificity of gender relations seems to be a promising direction for future research.

**JEL classification codes**
C71, D10

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Household behaviour, Cooperation, Gender, Experiments, Africa, Uganda

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## *1. Introduction*

The scope for and gains from cooperation and the implications for poverty reduction are the subject of an extensive literature addressing collective action problems in rural communities in developing countries (Baland and Platteau, 1996, Ostrom, 1990, Ostrom et al., 1994). Much less is known about the extent and determinants of cooperative success or failure at the household level. While some non-experimental studies suggest that spousal frictions along with other factors may not only prevent efficiency gains from being realised but may also impose significant economic burdens on poor households (e.g. Jones 1983; Udry 1996), theories of the household vary in predicting whether efficiency should be expected or not, and rarely link this aspect of household performance to spousal attributes.[1] Along with spousal attributes, another important reason that cooperative gains may not be realised is the presence of asymmetric information between spouses, which is well-documented and widespread (e.g. Pahl 1990, Woolley 2000, Ashraf 2009).[2]

Adding to a hitherto small literature using married couples as experimental participants (e.g. Peters et al. 2004; Bateman and Munro 2003; Ashraf 2009), we test experimentally whether spouses, under conditions of asymmetric information, realise cooperative gains. We present results from variants of public good games involving 240 couples from two villages in rural East Uganda, in which variants are obtained by altering the size of initial endowments and control over allocation (distribution) of the common pool. We find cooperative performance to be better in variants with unequal endowments and when wives are responsible for allocating common pool proceeds. A stark inter-village contrast in the realization of cooperative surplus is uncovered.

[1] Becker (1991) is an exception.

[2] A usually implicit assumption in cooperative bargaining models is the enforceability of contracts, which may break down in the presence of asymmetric information, so that even when the household maxim possesses the Pareto-property, household resource allocation may not be Pareto-efficient.

Contrary to received wisdom (e.g. Sen 1990), women do not invest more in the household public good than men. At the same time, opportunistic behaviour is common. Clues about the spousal and household attributes that are correlated with cooperative performance are gained from econometric analysis of survey data from the participating couples.

At the end of the paper we spell out the implications of our results for household theories, which are briefly reviewed here. Formal models of household behaviour have been classified under the rubrics *unitary*, *Pareto-efficient* or *cooperative* and *non-cooperative* models (Alderman et al. 1995, Haddad et al. 1997). In the unitary approach (Samuelson 1956, Becker 1991), the household is treated as a single agent with a unified set of preferences: all income is pooled and the identity of the income recipient does not affect household behaviour. In Becker (1991), unequal initial endowments are a prerequisite for the latter to prevail. A key feature of cooperative models (Manser and Brown 1980, McElroy and Horney 1981) is the assumption that the household maximand possesses the Pareto property, usually within a context of bilateral bargaining where leverage depends on individual 'threat-points'. [3] Meanwhile, in non-cooperative models (Ulph 1988, Woolley 1988), household members make separate contributions to household public goods within the format of a standard non-cooperative game with suboptimal public goods provision as a possible outcome. Less formal models step beyond this simple taxonomy. For example, Sen's (1990) cooperative conflict model considers the *perceived interests* of household members and postulates that women identify more closely with household

[3] Basu (2006) shows that this relationship runs both ways, and that household decisions may also affect the balance of power, but that the effect of, say, female labour force participation is not instantaneous. In a dynamic perspective, spouses will tend to behave strategically which may result in inefficiency also within so-called collective models.

interests than men. If true, women should be expected to invest more in household cooperative ventures than men.

Early empirical tests of predictions of household models focused on the income pooling assumption in unitary models and specifically the notion that household behaviour is independent of the identity of the person earning income or controlling an asset (e.g., Schultz 1990, Thomas 1990, Browning et al, 1994, Hoddinott and Haddad 1995). These studies found a strong impact of gender identity on labour supply, the health outcomes of children and household expenditure patterns, thus rejecting income pooling. Further, Phipps et al. (1998) contend that husbands and wives pool incomes for some but not other categories of consumption. While the unitary model has been rejected in most cases, evidence in favour of or against cooperative models is more ambiguous. Browning and Chiappori (1998) conclude in favour of Pareto efficiency, in the sense that all cooperative gains are realised, while Jones' (1983) research for Cameroon and Udry's (1996) analysis of multi-plot farming systems in Burkina Faso indicate that spouses forego non-trivial opportunities to make cooperative gains.

A small number of studies have used experimental games to acquire more in-depth insights into household decision-making. In common with the non-experimental literature, existing results reject the unitary model. In a common pool game with a voluntary contribution mechanism in the USA, Peters et al. (2004) compare free-riding behaviour among household members with a control group of strangers and find contributions within family groups to be higher while reductions over time are weaker.[4] In Peters et al.'s samples, many family groups were missing one or more of their adult members, but typically included children. In contrast, Bateman and Munro

[4] Frolich et al. (2004) argue that adding social context and familiarity to an anonymous experimental setting tends to increase contributions and reduce free-riding.

(2003) used only couples. For a series of incentivised choices, they reject Pareto-efficiency, income pooling and the unitary model for a sample of UK households, but do not quantify the magnitude of the observed efficiency loss. In Ashraf's (2009) study of saving and consumption decisions in the Philippines, spouses receive an individual endowment that can be invested in a joint account, a private account or taken as a private gift certificate under alternative experimental conditions. Ashraf does not test directly income pooling or efficiency, but finds men's saving behaviour to be strategic and responsive to whether information about endowments, payoffs and behaviour is kept private or made public, and to whether communication between spouses is allowed. Women's behaviour, in stark contrast to men's, is largely invariant to exogenous changes in the experimental conditions.

None of these existing experiments provide quantitative tests of household efficiency, the magnitude, determinants and locational variation in efficiency losses or income pooling coupled with an incentive compatible experimental design. Our design, which is laid out in the next section, overcomes these important shortfalls.

The rest of the paper is laid out as follows. Section 2 elaborates on our experimental design. While Section 3 reports on the research sites and experimental implementation, Section 4 presents the empirical results. Section 5 discusses the implications of the results.

## *2. Design*

The vehicle for our hypothesis tests is a variant of a two-person game with four stages. At stage 1, each spouse i (i is m for male or f for female) is given an endowment $E_i$ where $E_m + E_f = 4000$ Ugandan Shillings and $E_i \varepsilon (0, 2000, 4000)$. In the second stage each spouse can make a contribution of $x_i$ $(0 \leq x_i \leq E_i)$ to a common

pool. In the third stage total contributions are multiplied by 1.5, and in the final stage either one spouse decides on the division of the common pool or the pool is split 50:50. If the payout from the common pool to individual i is $z_i$, a spouse's monetary payoff is $E_i - x_i + z_i$. If the total value of the pool is y it will equal $(1.5*(x_1 + x_2))$ which in turn equals the sum of payouts from the common pool, $z_1 + z_2$.

The nine possible variants are summarised in Table 1. Cells lower in the table represent variants with larger female endowments while cells to the right represent variants with greater female control over the division of the common pool. The 50:50 variants are voluntary contribution to household public good games. Variants where one person has the entire endowment and controls the division are dictator games, while variants where the identity of the investing individual and the allocating individual differ are trust games. Two of the cells in the table do not contain numbers; these are dictator games that were omitted from the final design because of the lack of interaction between partners and our desire to examine issues of trust. The numbers listed in the other cells label the variants used in the experiment. Two cells contain two numbers because these variants were conducted in both study sites.

(TABLE 1 ABOUT HERE)

In all the games, the private endowment $E_i$ was known only to individual i. The common account and the final allocation from that account was common knowledge. In the (4,000: 0) games, both partners were told that one of them received nothing, and the other some amount between zero and 4,000 Ugandan shillings. Meanwhile, in the (2,000: 2,000) games both partners were told that they received some, potentially different amounts between 100 and 4,000 shillings.

We did not reveal full information about each individual's endowment. For

investment decisions to be truly private, this imposition of asymmetric information is necessary. Theories of household behaviour have had little to say about the impact of asymmetric information on outcomes, despite the widespread evidence of its presence within households (e.g. Pahl 1990, Woolley 2000, Ashraf 2009). Indeed, in follow-up interviews with 51 of the couples participating in our experiments, imperfect knowledge of spousal finances is common, at least according to wives' accounts.[5]

Theoretically, a total surplus maximizer has no incentive to withhold contributions, even in the presence of asymmetric information. Other types of players may wish to hide some or all of their endowment from their partner. In the experiment, they could achieve this by not investing in the common pool, but because there may be other motives for not investing which would apply even if endowments were common knowledge, we cannot simply interpret all failures to invest as attempted deception. For instance, a selfish player in variants 1, 4 or 7 (with 50:50 split) may not invest any sum because the net private return to a common pool investment would be negative.

The most incisive evidence of attempts to deceive is therefore provided in variants where a potential investor also controls the division of the common pool. In this context we measure *opportunism* as the difference $E_i - x_i$ in games where player i has $E_i > 0$ and is the allocator. In variants 3, 5, 8 and 9, we test the null hypothesis of zero opportunism.

In addition to the data from the games, information on basic socio-economic characteristics of the spouses – like occupation, education, age, parental characteristics – was collected by administering post-game questionnaires. This

[5] 72 percent of men claim full knowledge of wives' finances, and 92 percent that their wives fully know theirs. In wives' accounts these figures are startlingly different: 21 and 14 percent, respectively.

additional information presents a chance to scrutinize the correlates of cooperative success and failure in more depth and to study relevant links between contributions and characteristics of individual spouses (and couples).

The next section provides a short description of the study sites and the implementation of the experiments.

## *3. Context*

Bufumbo sub-county and Sironko district are on the slopes of Mt Elgon in south eastern Uganda. This is a densely settled area with an average population density of 284 per $km^2$ and average farm size of 1.4-1.5 ha and rainfall of about 1186 mm (Wakamire 2001). Livelihoods are predominantly agricultural, but still complex and diverse with overlapping production units engaged in crop production, livestock rearing, labouring, petty trading and services, and both joint and individual enterprises are pursued by household members. Both districts have mainly fertile volcanic loams but Sironko is flat, low-lying and has a greater proportion of sandy loam soils suited for maize, beans, soya, groundnuts and sunflower cultivation. Its nucleated centre has more diverse non farming livelihoods, better housing and infrastructure, including electricity, than its outer villages. Bufumbo is higher, wetter, poorer and hillier than Sironko and lacks electricity. Crucially for our purposes, bananas and coffee dominate the upland Bufumbo farming system and maize and beans the lowland Sironko farming system. The gender division of labour is therefore different in each location, with a lower level of women's labour involved in perennial coffee and banana, and a more sex segregated pattern of labour and control, and a higher level of more sex

sequential operations in maize and bean cultivation.[6]

Most residents of Sironko and Bufumbo are Bagisu, a group known for intense conflict over access to resources, and gender ideals of male provider roles which are increasingly difficult for men to live up to (Heald, 1998). Gender relations are expressed formally in terms of absolute male control, but in reality women have considerable freedom to marry whom they choose, divorce and remarry readily when marriage is unsatisfactory, and generally exercise the power that comes from men's dependence on marriage for managing their reputations, and achievement of an important dimension of adult masculinity.

The marital histories of 51 couples interviewed in some depth in the weeks after the experiments show that the great majority of divorces are initiated by wives. Also, very few men said they had thought about divorcing their current spouses, while 74 percent of women said they had, and whilst 23 percent of women reckoned they could be better off unmarried, only 4 percent of men entertained similar thoughts. Marital failure has very dramatic consequences for men, and may be fatal, since bachelors and divorced men are socially ridiculed, suspected of sorcery and theft, and ultimately sanctioned with violence (Heald 1998).

## Implementation of the experiments

The experiments in Sironko took place on consecutive days with experiments implemented in Bufumbo on the following day in March 2005. The venues were a multi-purpose village hall (Sironko) and the headquarters of the sub-county (Bufumbo). LC1 chairmen (leaders of a village council) were approached two weeks

[6] See Whitehead (1985). Elements of agricultural production may be gendered at the level of the whole crop, i.e. sex segregated, or through interdigitated processes in a single enterprise, i.e. sex sequential (e.g. maize where men plough, women plant, women weed, both sexes harvest, women process and men market).

beforehand and asked to recruit, by advertising widely through word-of-mouth, between 225 and 270 married couples (25 to 30 per game times the number of games). If the required number was exceeded (it was), they were instructed to give preference to those who took part in a previous survey, and to first-comers – in that order. Survey participants had at the time been randomly selected.

One game was played at the time and the only people present in the hall were couples playing that game and the game organisers. Instructions and examples took approximately 30 minutes on average. The local game organisers are well-qualified for implementing experiments even of considerably greater complexity than the one on which we report here (Humphrey and Verschoor 2004; Mosley and Verschoor 2005) and were satisfied with subjects' understanding of the game. Indeed, in spontaneously offered feedback immediately after the game and in the follow-up interviews, no respondent said they had found the game unclear or confusing.

Each spouse received an envelope after the game had been explained and demonstrated. The contents of the envelope were such that any multiple of 100 shillings could be left in it. At the time of the experiment, the exchange rate to the pound was approximately 2,850 Ugandan shillings, and to the US dollar 1,730. A typical agricultural daily wage was between 1,000 and 1,500 shillings for women and between 1,500 and 2,000 for men. The range of possible couples' total payoffs of between 4,000 and 6,000 shillings thus provided substantial incentives.

Secrecy was ensured by calling one couple at a time with the husband going to one corner of the hall and his wife to the other; each spouse removed from their envelope what they wanted to keep for themselves, with the remainder left for the common account. A helper collected their envelopes and recorded the decisions. Collusion within a single game was avoided by a threat of exclusion (which proved to

be highly effective); collusion between games on the same day was avoided by keeping waiting groups apart in a school (Sironko) or separately on the grass (Bufumbo). Collusion across days (relevant for Sironko only) was mitigated by playing the unequal-endowment games on the first day and the equal-endowment games the next day.

The main empirical results are reported in the next section.

## *4. Results*

This section presents the main results that come from two types of analysis. First, bivariate tests examine the experimental results. These tests are followed by multivariate analysis which conditions the results on experimental behaviour on spousal socio-economic attributes extracted from the post-game questionnaires. The results reported here focus on the contribution behaviour of spouses rather than allocation behaviour, since the latter can be reversed at no pecuniary loss once the experiment is over. By contrast, efficiency losses to the household resulting from contribution behaviour cannot be recovered after the experiment.

Table 2 summarises the hypotheses tested with the following sub-sections reporting the main empirical results corresponding to each hypothesis.

(TABLE 2 ABOUT HERE)

*Finding 1: Surplus maximisation is rejected and there is significant difference between the two study villages*

Table 3 and Figure 1 give an overview of the results from the 240 couples (49 from Bufumbo, 191 from Sironko). In the table, the columns under contribution rate (x/E) give the mean fraction of endowments invested by women and men. Mean

y/max y is the fraction of the total available surplus which is generated by the household with the accompanying sample standard deviation in the adjoining column. The final column reports a t-test for the null hypothesis that households maximize total surplus (total = 1). This null hypothesis is decisively rejected in all variants.

(TABLE 3 ABOUT HERE)

(FIGURE 1 ABOUT HERE)

Figure 1 shows the distribution of total (i.e. male plus female) contributions, measured as a fraction of the potential total for the nine different variants. Reinforcing the message of Table 3, there are compelling contrasts between the variants, but in a narrow majority of observations the total surplus is not realised. However, in all variants except 8 and 9 (the Bufumbo variants) the modal surplus is 1, and in variants 1, 2, 4, 5 and 7 the median surplus is 1. Overall, in Sironko a clear majority of couples (56.5%) maximize total surplus, but in Bufumbo no couple realises more than 90% of the total surplus.

Using a two-sided, unequal variances t-test we examine the null hypothesis that location makes no difference to the surplus generated, by comparing outcomes in games 8 and 9 with 3 and 5 respectively. In both comparisons the null hypothesis is rejected with p-values of 0.0050 and 0.0004 respectively. In short, the realisation of cooperative potential and thus the size of efficiency losses in the two locations are very different. Thus, there is a startling contrast in the cooperative success of couples in two villages that are not only geographically close but are also similar in many other respects.

*Finding 2: A fixed sharing rule does not alter contribution levels*

We test in two ways whether control of the allocation of the common pool

makes a difference to contribution levels. First we compare variants with a 50:50 split to ones where one partner controls the allocation. There are four comparisons of this kind (see Table 4) and the tests are two-sided since there are arguments on both sides about how control (decision-making power) might impact on contributions. In this table 'Mean y/max y' is the fraction of the total available surplus realised in the game. Results for the test are given in the final column of the table. Generally the null is not rejected.[7]

(TABLE 4 ABOUT HERE)

*Finding 3: When women control allocation both male and female contributions are higher*

Secondly, we compare levels of contribution in the variants where the man controls the allocation of the common pool to levels of contribution in variants where the woman makes the allocation decision (see the second part of Table 4). Again the test is two-sided. The null is rejected at the 5% level in Sironko and rejected at the 10% level in Bufumbo. In both sites, total surplus is higher when women control the allocation (games 5 and 9).

Total contribution is the sum of the contributions by the two partners, so we dig deeper by analysing the impact of control on individual contributions. Table 5 summarises the comparisons, which involve variants in which both partners received endowments. The column headed 'Mean x' shows mean contribution levels, x, by gender for the relevant variants. The adjacent column shows the t statistic for a two tailed independent samples test that the mean values of x are the same in each variant in the pair of variants being compared.

For each comparison, wives control the allocation for the second variant listed and in each case female control leads to higher contribution by both sexes. In short, both men and women invest more when women are in charge of the allocation. In one case (women in Bufumbo) the difference between games is significant at the 1% level. In two other cases it is significant at the 10% level with a two sided test.

(TABLE 5 ABOUT HERE)

*Finding 4: There is no evidence that women contribute more to the common pool than men*

For the variants in which the sharing rule is fixed, so that contributions cannot be interpreted as being influenced by expectations of the spouse's generosity, we find no statistically significant differences in contribution levels (Table 6).

(TABLE 6 ABOUT HERE)

In Sironko, male allocators contribute more than their wives, while female allocators contribute less than their husbands. In other comparisons using observations on female and male contributions, the results are more nuanced. Again we do not find support for the unconditional hypothesis of greater female contributions. In game 3 where men control the allocation, women contribute less than men ($p=0.04$, one tailed t-test). In game 5, when Sironko women have control, women continue to contribute less than men – this difference is again statistically significant ($p=0.049$, one-tailed t-test).

In Bufumbo, male allocators contribute the same as their wives, while female allocators contribute more than their husbands. Women contribute slightly less when men are in control, but the difference is not statistically significant. With female control, men contribute less and the difference is statistically significant ($p=0.035$,

one-tailed t-test). It would thus seem that Sen's (1990) concept of perceived interests, that would have women identify more closely than men with the household as a whole, performs rather poorly, especially in Sironko but also in Bufumbo.

*Finding 5: The null of no opportunism is rejected*

We can also use Table 5 to test for opportunism. If there is no opportunism, the value of mean x for male players in games 3 and 8 should equal 2000, as should the value of mean x for female players in games 5 and 9. In all cases the null hypothesis is rejected, with p values of 0.000. In other words, participants routinely keep back some of their endowments even when they control the allocation.

Socio-economic correlates of experimental behaviour

We next present the results from the multivariate analysis: we first explore the correlates of total contribution rates and then the contribution rates of males and females. Occupation, education, age and other characteristics of the players are used as right hand side variables along with site and games dummy variables. Since these contribution rates are censored at 1, we use a tobit specification. The Breusch-Pagan/Cook-Weisberg test indicate the presence of heteroskedasticity in all three cases (for total contribution rates: chi2(1) = 7.57; prob = 0.0059; for male contribution rates: chi2(1) = 18.71; prob = 0.0000; for female contribution rates: chi2(1) = 2.71; prob = 0.0998), hence robust standard errors are used. The mean variance inflating factors are only 2.14, 2.21 and 2.25 respectively for total, male and female contribution rates indicating that multicollinearity is not a problem. The Ramsey RESET tests with the null hypotheses of no omitted variables are accepted at 5% (F (3,207) = 0.82; p = 0.4820; F (3,151) = 2.60; p = 0.0540; F (3,158) = 0.86; p = 0.4651 respectively for total, male and female contribution rates).

(TABLE 7 ABOUT HERE)

The variation in contribution rates by games was discussed above and the dummy variables in the regressions support those conclusions. As the univariate analysis indicated, total as well as male and female contribution rates are lower in Bufumbo than in Sironko, captured by the negative and significant coefficients on the Bufumbo dummy variable. Generally, the individual occupations of spouses do not appear to significantly correlate with contribution rates with the exception of female teachers (and males with own businesses for male contributions). Both for total and female contribution rates, coefficients indicate that households where wives are teachers have higher contribution rates. There is also evidence that husbands with own businesses contribute more. Even though generally, keeping the above exceptions in mind, the occupation of individual spouses does not seem to be significantly correlated to contribution rates, spouses with the same occupation tend to contribute more; the coefficients on 'same occupation' are all significant and positive. These results suggest that rather than individual occupations, what matters for cooperation is whether spouses have the same occupation, in turn suggesting that assortative matching affects cooperative success.

The next set of variables capture the education of spouses. Generally, education is not correlated with contribution rates. Similar to occupation, the coefficients on same education are positive and significant in two cases (for total and male contributions). This further reinforces the suggestion that assortative matching improves household efficiency.

While age is not generally linked to contribution rates, male contributions fall (but only at 10% significance) with the age of the wife. Similarly, while the number of children is not generally linked to male contribution rates, it is weakly and

negatively correlated with female contributions.

We next examine correlates of opportunism, spouses hiding resources from each other even when they control allocation. The amounts set aside by the allocator spouse in the relevant games are regressed on the socio-economic variables used above. These results are reported in Table 8.

(TABLE 8 ABOUT HERE)

It is interesting to observe that the variables that matter for male and female opportunism often are different. Both male and female opportunism are higher in Bufumbo (for female opportunism the coefficient becomes significant at only 10%). Even though total contribution rates tend to rise in households where the female spouse is a teacher, wives who are teachers hide more of their endowments than others. In contrast, male opportunism is significantly lower if the husband is a teacher. Having a teacher spouse does not affect own opportunism; coefficients on teacher-female in the male opportunism regression and teacher-male in the female opportunism regression are both insignificant. Male wage workers are less opportunistic. While husbands married to females in other occupations hide less money, wives do the opposite. Male opportunism significantly drops when spouses are in the same occupation but female opportunism does not. Further, male opportunism is not correlated with own educational level; however, if the wife has primary school education, male opportunism drops compared to wives with no education. If husbands and wives have the same level of education, male opportunism (weakly) decreases while having similar education is not correlated to female opportunism. Age and number of children are not correlated with either male or female opportunism.

## *5. Implications of the results*

We have sought to illustrate that experimental games add value to the intra-household literature by complementing the information available from survey data with information on actual choices. To sum up our results: although surplus maximization is the most common outcome in the experiment, the majority of partners do not contribute their full endowment to the common pool. The behaviour of this majority would not be accurately predicted by unitary models, and underlines the importance of making explicit the assumption of cooperative models that Pareto efficiency in outcomes requires (among others) enforceable contracts, which in turn may be hindered by asymmetric information. Findings that no formal household model we are aware explicitly predicts are that female control leads to greater contribution rates for both sexes, and that spouses do not contribute everything to the common pool even when they are in charge of its allocation, which we term "opportunism". Moreoever, the patterns of contribution rates reported in Finding 4 do not support Sen's (1990) conjecture that women identify more closely than men with household interests, which would lead them to contribute more to the common pool than men do. Strikingly, even in cases where females are in control of allocation they contribute less than their husbands.

The significant differences between the two study villages of Sironko and Bufumbo are instructive. These are villages located near to each other with many shared socio-economic and cultural characteristics, as well as some different ones, most notably in terms of cropping patterns, with implications for the gender division of labour (more sex segregated in Bufumbo). Whereas in Sironko a clear majority of couples maximise total surplus, in Bufumbo no couple does so. Such a stark

difference in household behaviour when contextual variation is relatively small sharply undermines the case for universally applicable economic models, and calls for more sensitivity to context-specificity, and thus for ethnographically informed economic models of the household.

More generally, our results call for an understanding that intra-household allocation behaviour is heterogeneous: cooperative gains are often not realised, but less often so in one village than in another, when women are in charge, and as far as male contributions are concerned, with no suggestion that these patterns would prevail in settings not studied here. That this heterogeneity is to some extent predictable is suggested by the statistical significance in the multivariate analysis of a number of socio-economic conditions, most notably spousal similarity, which points to the possible influence of assortative matching. Intra-household allocation models that allow for non-enforceable contracts and other sources of non-cooperation, as well as for the context-specificity of gender relations, would seem to be most suitable for capturing the nature of the heterogeneity that we obtained experimentally.

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**Table 1: Variants of the games**

| | | Control of allocation | | |
|---|---|---|---|---|
| | | **Male** | **50:50** | **Female** |
| **Endowment to woman (total = 4000)** | **0** | | 1 (zero-50:50) | 2 (zero-female) |
| | **2000** | 3, 8 (equal-male) | 4 (equal-50:50) | 5, 9 (equal-female) |
| | **4000** | 6 (4000-male) | 7 (4000-50:50) | |

Note: Games 8 and 9 are variants played in Bufumbo. The short names of the games given in brackets have the endowment to females as a first entry and the person controlling allocation as a second.

**Table 2: Hypotheses**

| No. | Null Hypothesis | Formal statement. |
|---|---|---|
| I | Total surplus is maximized (spouses contribute all endowment) | $x_i = E_i$ |
| II | Household efficiency is independent of the identity of allocator | $x_1 + x_2$ is identical under male and female control |
| III | Women do not contribute more to the common pool | $x_i$ no higher for i = female |
| IV | No opportunism | $E_i - x_i = 0$ for spouse controlling allocation |

**Table 3: Sample size and contributions by game variants**

| Game no. | Short names | Sample size | Contribution rate (x/E) | | Mean y/max y | Std. Dev. | t-test: Total = 1 p-value |
|---|---|---|---|---|---|---|---|
| | | | Female | Male | | | |
| 1 | Zero-50:50 | 26 | - | 0.904 | 0.904 | 0.201 | -2.440 0.022** |
| 2 | Zero-female | 25 | - | 0.940 | 0.940 | 0.109 | -2.753 0.011** |
| 3 | Equal-male | 27 | 0.648 | 0.787 | 0.718 | 0.242 | -6.072 0.000*** |
| 4 | Equal-50:50 | 30 | 0.755 | 0.783 | 0.769 | 0.255 | -4.955 0.000*** |
| 5 | Equal-female | 25 | 0.790 | 0.900 | 0.845 | 0.202 | -3.840 0.001*** |
| 6 | 4000-male | 26 | 0.833 | - | 0.833 | 0.193 | -4.412 0.000*** |
| 7 | 4000-50:50 | 32 | 0.887 | - | 0.887 | 0.189 | -3.394 0.002*** |
| 8 | Equal-male | 24 | 0.510 | 0.558 | 0.534 | 0.199 | -11.469 0.000*** |
| 9 | Equal-female | 25 | 0.676 | 0.596 | 0.639 | 0.188 | -9.608 0.000*** |
| Total | | 240 | 0.788 | 0.790 | | | |

Note: *** significant at 1%; ** significant at 5%;following Godfrey (1988) and Moffat and Peters (2001), the p-values reported and critical values used for this test are for a 2-sided test even though the test itself is one-sided. This is because the null is on the boundary of the possible parameter distribution (i.e., efficiency cannot be greater than 1).

**Table 4: Control of allocation and total contribution levels**

| Comparison | Variant | N | Mean y/max y | Std. Deviation | t-statistic |
|---|---|---|---|---|---|
| 50:50 split (first variant) versus control by an individual (second variant) | | | | | |
| 1 (0) | 1 | 26 | 0.904 | 0.201 | -0.794 |
| | 2 (F) | 25 | 0.940 | 0.109 | 0.431 |
| 2 (2) | 4 | 30 | 0.769 | 0.255 | -0.781 |
| | 3 (M) | 27 | 0.718 | 0.242 | 0.438 |
| 3 (2) | 4 | 30 | 0.769 | 0.255 | -1.204 |
| | 5 (F) | 25 | 0.845 | 0.202 | 0.234 |
| 4 (4) | 7 | 32 | 0.887 | 0.189 | -1.072 |
| | 6 (M) | 26 | 0.833 | 0.193 | 0.288 |
| Control by husband (first variant) versus control by wife (second variant) | | | | | |
| Comparison | Variant | N | Mean y/max y | Std. Deviation | t-statistic |
| 1 (2) | 3 (M) | 27 | 0.718 | 0.242 | -2.054** |
| | 5 (F) | 25 | 0.845 | 0.202 | 0.045 |
| 2 (2) | 8 (M) | 24 | 0.534 | 0.199 | -1.910* |
| | 9 (F) | 25 | 0.639 | 0.188 | 0.065 |

Note: ** significant at 5% level; * significant at 10% level; M denotes male control, F female control, and (FE) female endowments in thousands of shillings (male endowments are 4000 minus FE)

**Table 5: Control and individual contribution levels**

| Comparison | Gender of recipient /investor | Variant | N | Mean x | t-stats |
|---|---|---|---|---|---|
| | | **Sironko** | | | |
| 1 (2) | Female | 3 (M) | 27 | 1296 | -1.863* |
| | | 5 (F) | 25 | 1584 | |
| 2 (2) | Male | 3 (M) | 27 | 1574 | -1.708* |
| | | 5 (F) | 25 | 1800 | |
| | | **Bufumbo** | | | |
| 3 (2) | Female | 8 (M) | 24 | 1021 | -2.97*** |
| | | 9 (F) | 25 | 1352 | |
| 4 (2) | Male | 8 (M) | 24 | 1117 | -0.602 |
| | | 9 (F) | 25 | 1204 | |

Note: * significant at 10%; ** significant at 5%; *** significant at 1%; M denotes male control, F female control, and (FE) female endowments in thousands of shillings (male endowments are 4000 minus FE)

**Table 6: Male and female contributions when sharing rule is 50:50**

| Comparison | Gender of contributor | Variant | N | Contributions | p-value |
|---|---|---|---|---|---|
| 1 | Male | 1 (0) | 26 | 3615 | 0.614 |
| | Female | 7 (4) | 32 | 3547 | |
| 2 | Male | 4 (2) | 30 | 1567 | 0.552 |
| | Female | 4 (2) | 30 | 1510 | |

Note: p-values from a 2-tailed t-test with unequal variances. (FE) are female endowments in thousands of shillings (male endowments are 4000 minus FE)

**Table 7: Tobit estimates of contribution rates on socio-economic characteristics of spouses (with robust standard errors)**

| | Total | | Male | | Female | |
|---|---|---|---|---|---|---|
| | **Coefficient** | **Robust s.e.** | **Coefficient** | **Robust s.e.** | **Coefficient** | **Robust s.e.** |
| Game 2 | 0.140 | 0.127 | 0.104 | 0.148 | | |
| Game 3 | -0.348*** | 0.107 | -0.245* | 0.130 | -0.251*** | 0.0942 |
| Game 4 | -0.254** | 0.114 | -0.286** | 0.138 | -0.0601 | 0.0997 |
| Game 5 | -0.213* | 0.111 | -0.131 | 0.136 | -0.0769 | 0.102 |
| Game 6 | -0.211* | 0.110 | | | | |
| Game 7 | -0.0763 | 0.122 | | | 0.0908 | 0.108 |
| Bufumbo | -0.207*** | 0.0601 | -0.417*** | 0.0901 | -0.136** | 0.0682 |
| Wage work-male | 0.0725 | 0.0854 | -0.0349 | 0.118 | 0.183 | 0.122 |
| Own business-male | 0.0717 | 0.122 | 0.333** | 0.148 | 0.0649 | 0.163 |
| Teacher-male | 0.0591 | 0.144 | 0.122 | 0.273 | 0.174 | 0.178 |
| Others-male | -0.0596 | 0.110 | -0.0226 | 0.164 | -0.136 | 0.156 |
| Wage work-female | -0.153 | 0.102 | -0.166 | 0.120 | -0.206 | 0.146 |
| Own bus.-female | 0.0241 | 0.177 | 0.0435 | 0.225 | -0.0588 | 0.235 |
| Teacher-female | 0.489*** | 0.179 | 2.429 | 0 | 0.464** | 0.235 |
| Others-female | 0.00856 | 0.0815 | 0.122 | 0.133 | 0.0111 | 0.102 |
| Same occupation | 0.145* | 0.0760 | 0.193* | 0.102 | 0.216** | 0.105 |
| Primary-male | -0.0119 | 0.0586 | -0.0982 | 0.0869 | 0.0609 | 0.0713 |
| Middle school-male | 0.0896 | 0.0761 | 0.0807 | 0.120 | 0.120 | 0.0875 |
| High school-male | 0.0327 | 0.0799 | 0.0603 | 0.118 | 0.152 | 0.0992 |
| Higher edu.-male | -0.122 | 0.122 | -0.162 | 0.180 | -0.116 | 0.151 |
| Primary sch.-female | -0.00862 | 0.0559 | 0.0142 | 0.0811 | -0.0271 | 0.0692 |
| Middle sch.-female | -0.0553 | 0.0769 | -0.0728 | 0.105 | -0.00195 | 0.0889 |
| High sch.-female | 0.0368 | 0.0804 | 0.138 | 0.126 | -0.0694 | 0.0965 |
| Higher edu.-female | 1.871 | . | 2.138 | . | 1.984 | . |
| Same education | 0.0918** | 0.0466 | 0.145** | 0.0715 | 0.0174 | 0.0539 |
| Male age (log) | -0.158 | 0.139 | 0.0795 | 0.192 | -0.268 | 0.166 |
| Female age (log) | -0.0411 | 0.145 | -0.357* | 0.196 | 0.0396 | 0.170 |
| No. of children | -0.0254 | 0.0177 | -0.0347 | 0.0265 | -0.0359* | 0.0191 |
| Constant | 1.703*** | 0.309 | 2.005*** | 0.460 | 1.602*** | 0.385 |
| Sigma | 0.289*** | 0.0164 | 0.349*** | 0.0206 | 0.310*** | 0.0189 |
| Observations | 239 | | 181 | | 188 | |

**Table 8: Tobit estimates of male and female opportunism**

| | Male | | Female | |
|---|---|---|---|---|
| | **Coefficient** | **Robust s.e.** | **Coefficient** | **Robust s.e.** |
| Bufumbo | 839.2*** | 216.1 | 283.8* | 161.0 |
| Wage work-male | -948.3** | 348.6 | 22.23 | 218.3 |
| Own business-male | -3443 | 0 | -274.7 | 343.8 |
| Teacher-male | -1040*** | 348.9 | | |
| Others-male | 374.1 | 459.9 | 1227*** | 289.8 |
| Wage work-female | 667.9** | 272.9 | 461.9* | 248.0 |
| Own bus.-female | 815.7* | 418.2 | -3618 | 0 |
| Teacher-female | -1716 | 0 | 1411*** | 408.9 |
| Others-female | -868.3*** | 295.3 | 597.1 | 363.8 |
| Same occupation | -995.8*** | 210.8 | 98.40 | 230.4 |
| Primary-male | 253.2 | 306.2 | 317.9 | 367.2 |
| Middle school-male | -68.39 | 394.9 | 275.2 | 478.4 |
| High school-male | 163.8 | 299.7 | -494.4 | 339.7 |
| Higher edu.-male | 485.5 | 298.1 | 89.05 | 365.8 |
| Primary sch.-female | -684.1** | 268.1 | -45.07 | 234.3 |
| Middle sch.-female | -90.98 | 270.9 | 647.6 | 403.0 |
| High sch.-female | -463.6 | 344.5 | 98.40 | 218.5 |
| Higher edu.-female | -525.4 | 0 | -3133 | 0 |
| Same education | -467.4* | 238.9 | 348.7 | 261.7 |
| Male age (log) | -37.95 | 495.1 | 950.8 | 677.7 |
| Female age (log) | 3.767 | 450.3 | -482.5 | 685.9 |
| No. of children | 134.5 | 82.10 | 79.79 | 61.64 |
| Constant | 1450 | 1266 | -2126* | 1131 |
| Sigma | 437.2*** | 54.78 | 400.7*** | 44.41 |
| Observations | 51 | | 49 | |

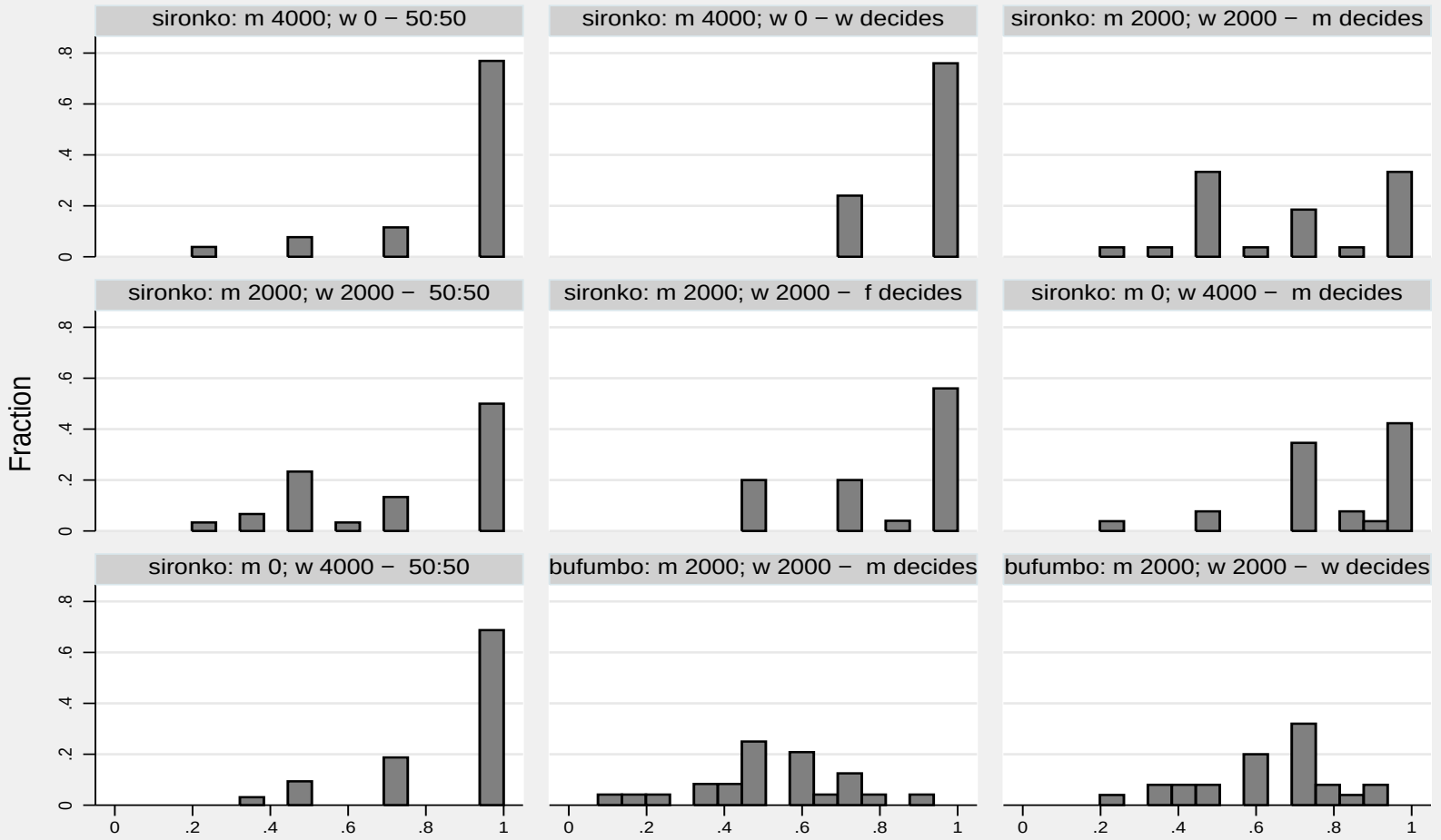


Figure 1: Total contribution rates by men and women