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What's love got to do with it ? An experimental test of household models in East Uganda.

by

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Abstract:

We test core theories of the household using variants of a public good game and experimental data from 240 couples in rural Uganda. Spouses do not maximise surplus from cooperation and realise a greater surplus when women are in charge. This violates assumptions of unitary and cooperative models. When women control the common account, they receive less than when men control it; this contradicts standard bargaining models. Women contribute less than men and are rewarded more generously by men than vice versa. This casts doubt on postulates in Sen (1990). While the absence of altruism is rejected, we find evidence for opportunism. The results are put in a socioeconomic context using quantitative and qualitative survey data. Assortative matching and correlates of bargaining power influence behaviour within the experiments. Our findings suggest that a 'one-size fits all' model of the household is unlikely to be satisfactory.

Keywords: experiment; household theories; Uganda; unitary model; cooperative model.

JEL codes: D13; O01; C92; C93.

1. Introduction

Experimental economics has acquired a reputation for testing directly the assumptions of economic models. Yet while aspects of the subject, such as individual choice have been the subject of a steady stream of experiments, there is a scarcity of experimental work within economics on household decision making.[1] This is all the more surprising given that most humans live and make decisions within the context of a shared household.

The paucity of experimental research on household decision-making is not compensated by a profusion of insightful market or survey data. Much information is only available at the household level, making inference about intra-household behaviour problematic, though not impossible. For instance, results on aggregate data typically repudiate the unitary model in which household members act as if maximizing a single set of preferences (e.g. Alderman et al, 1995, Browning and Chiappori, 1998, Lundberg et al, 1997). However, such aggregate data are much less useful for identifying the more appropriate among competing household models and clarifying the micro-structure of household decisions.

Experiments offer novel opportunities to test the causes of the failure of the unitary model and for comparing the performance of alternative household theories. In short, experimental data provides a way around the problem that different household models frequently produce identical reduced form expressions and predictions, making the models indistinguishable using available non-experimental

[1] Two exceptions discussed below are Peters et al (2004) and Bateman and Munro (2003).

data.[2]

At the same time, experiments involving married couples are fundamentally different from those with anonymous play between strangers, since couples care more for each other's well-being, interact repeatedly and are better placed for making conjectures about each other's behaviour. Experiments involving spouses therefore have their own methodological hazards, created by differences between actual contexts and formal household theories.[3] While the former is characterised by repeated interaction, uncertainty and asymmetric information, the latter, necessarily simplifications of reality, are generally static and abstract from issues of uncertainty and asymmetric information.[4]

As Pahl (1990) and Woolley (2000) amongst others, have documented, asymmetric information about resources is a feature of many domestic relationships. Husbands and wives routinely hide income and expenditure from one another. It follows that to be accurate predictors of real-world behaviour, standard models of the household need to be robust to the presence of asymmetric information.

We tackle these methodological issues using a suite of variants on classical

[2] There is a shortage of empirical work testing the performance of *alternative* theories of the household. See Folbre (1984) and Rosenzweig and Schultz (1982) for an early debate on predictions, and Senauer et al (1988) on the issue of identical reduced form expressions. See also Haddad et al (1997).

[3] The repeated nature of real-world interactions implies that actions within the experiment may be undone by subsequent behaviour. To make robust inferences it is therefore important to have acts which cannot be wholly undone by subsequent and unobserved transfers between partners. Furthermore, since decisions within the experiment are likely to be influenced by equilibrium household behaviour outside the laboratory, it is valuable to have socio-economic data on likely correlates of the actions that do take place under the gaze of the experimenters.

[4] In a world of certainty, a game played between husband and wife may generate an allocation as its equilibrium prediction. When uncertainty is present, this household equilibrium may be a *sharing rule* – a mapping from the set of possible incomes for each partner to the allocation of that income to its different uses (Ligon 2002). Different sharing rules may support or undermine efficiency in the household. Farmer and Tiefenthaler (1995) review the limited evidence on sharing rules, suggesting that alongside efficiency concerns, norms of fairness and equity play a role in their determination.

public good games and a sample of married couples from Uganda to conduct the first experimental test of the assumptions and predictions of several classes of household models. Our experiment, discussed in more detail below, generates tests of surplus maximization, the influence of endowments and control on individual payoffs, altruism and opportunism. Furthermore we obtain evidence on the sharing rules that female and male spouses implement.

Our main results can be summarized thus: surplus maximization is decisively rejected, while the identity of the decision-maker matters for efficiency - a greater proportion of the surplus is realised when women are in charge of the common account. These findings violate crucial assumptions of unitary models and cooperative models. Moreover, when women control the common account, they receive less than when men control it. This contradicts all standard bargaining models. Intriguingly, women's contributions are rewarded more generously by men than vice versa, and women contribute less to the household account than men do. This casts doubt on Sen's (1990) postulates of the undervaluation of female contributions and a female tendency to identify more closely with household interests, although to be fair he does not claim that these would hold in all contexts. The absence of altruism is rejected as decisively as surplus maximization. Love may indeed have got 'something to do with it', but at the same time we find plenty of evidence for opportunism – the tendency to hide initial endowments from one's partner even when one is in charge of the common account.

We place our results in a socioeconomic context using three additional sources of information: first we use data from an exit survey that covered all couples who

participated in the experiment. Second, we take advantage of the fact that a minority of subjects had taken part in a previous and more extensive survey of household economic activities (Humphrey and Verschoor 2004, Mosley and Verschoor 2005). Using the former, we find strong support for a positive impact of assortative matching on household efficiency. From the latter we obtain some evidence that correlates of bargaining power affect behaviour within the experiment. Finally, some of our subjects were also participants in a follow-up study and we use the results of the qualitative interviews to cast some light on our results.

In Section 2 the main classes of household models tested are introduced and the predictions that we focus on spelt out. Section 3 presents our experimental design in terms of tests of hypotheses implied by these models. Section 4 reports on the research sites, and on the implementation of the experiments. Section 5 presents univariate and bivariate tests of our hypotheses and Section 6 examines the socio-economic context and reflects on the implications of the findings of the qualitative follow-up survey. Section 7 concludes.

2. Background and motivation

Most formal models of household behaviour can be 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 1965), the household is modelled as a single agent with a unified set of preferences: all income is therefore pooled and the identity of the income recipient does not affect household decisions. The key feature of cooperative models (McElroy and Horney 1981, Manser and Brown 1980) is the assumption of Pareto efficiency,

usually within a context of bargaining where power depends on 'threat-points' and control of the allocation. Empirically, therefore a key difference between unitary and cooperative models is that in the latter, the identity of the individual controlling resources affects decisions, with individual rewards increasing in the share of household resources. Meanwhile, in non-cooperative models (Ulph 1988, Woolley 1988), household members make their contributions to household public goods separately in the standard format of a non-cooperative game. Efficiency is not a prediction of static, non-cooperative models, but income pooling can be - so that individual rewards may or may not be increasing in the individual shares of household income.

A number of models step beyond this simple classification, such as Lundberg and Pollak (1993)'s separate-spheres theory and Sen's (1990) cooperative conflict model, an influential hybrid theory tailored for developing country contexts. In the latter, the *perceived interests* and *perceived contributions* of a household member also affect intra-household distribution. In particular he postulates that women identify more closely than men with the household's interests and should be expected to invest more, but these female contributions also tend to be undervalued. This undervaluation will 'vary from one society to another' with its effect being 'more regressive for women in some societies' (1990: 137).

Early empirical tests focused on the income pooling assumption in unitary models and the notion that intrahousehold allocations are 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 and on the health outcomes of children,

thus rejecting the pooling assumption. Meanwhile, Phipps et al. (1998) suggest that husbands and wives pool incomes for some but not other categories of consumption. While the evidence against the unitary model is fairly consistent, that for cooperative models is less clear-cut. Browning and Chiappori (1998) conclude in favour of Pareto efficiency, while Jones' (1983) research and Cameroon and Udry's (1996) analysis of the multi-plot farming systems cultivated by rural households in Burkina Faso cast doubt on the empirical soundness of the Pareto efficiency assumption.

There are a small number of recognisably economic experiments on household decision-making. In common with the non-experimental literature, the results of these papers reject the unitary model. Using a common pool game with a voluntary contribution mechanism, Peters et al. (2004) compare free-riding behaviour among household members with a control group of strangers in the USA and find contributions within family groups to be higher and reductions over time weaker.[5] One problem with these results is that in Peters et al's samples, many family groups were missing one or more of their adult members. Moreover, using UK couples and a series of incentivised choices, Bateman and Munro (2003) test for Pareto-efficiency, income pooling and the unitary model, but do not quantify the inefficiency they observe. In Ashraf's (2005) study of saving and consumption decisions in the Philippines, spouses receive an endowment that is invested or consumed subject to alternative experimental conditions. She finds men's saving behaviour to be strategic and responsive to whether information about endowments, payoffs and behaviour is private or public, and to whether communication is allowed. Women's behaviour, in contrast, is invariant to changes in the experimental conditions. However, the random

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

lottery device she deploys means that the opportunities for risk sharing differ across treatments, making it difficult to draw firm conclusions.

In short, therefore, none of the preceding experiments provide a quantitative test of household efficiency on a proper sample of couples using an incentive compatible design. Our design overcomes these deficiencies, examines hypotheses associated with Sen's theory and tests for household sharing rules. More precisely, we provide the first experimental tests of the following hypotheses:

I. Husbands and wives maximise the total resources available for distribution – predicted by the unitary model

II. Household efficiency is independent of the identity of the allocator – predicted by the unitary model

III. Holding total endowments constant, individual payoffs are increasing in endowment levels – which distinguishes unitary from cooperative models

IV. Control of the allocation raises an individual's payoff – which again distinguishes unitary from cooperative models

V. Allocation to an individual is increasing in that individual's contributions – a test for the existence of sharing rules/reciprocity

VI. Female contributions are undervalued – a possibility implied by the cooperative conflict model

VII. Controlling for valuation of contributions, women want to contribute more to the common pool than men – another expectation in the cooperative conflict model

In addition, we test the hypotheses that altruism (VIII) and opportunism[6] (IX) are absent, the former because it is natural to do so, the latter to see in the light of the evidence that married partners routinely hide assets from each other.

3. Design

The vehicle for our hypothesis tests is the following set of variants of a two-person game with four stages. At stage 1, each spouse i is endowed with endowment N_i, where $N_1+N_2 = 4000$ and $N_i \in \{0,2000,4000\}$. In the second stage she or he makes a contribution of x_i ($0 \leq x_i \leq N_i$) to a common pool. In the third stage total contributions are multiplied by 1.5 and in the final stage either one individual decides on the allocation of the common pool or the pool is split 50:50. The payout to individual i is z_i so that an individual's monetary payoff is $N_i - x_i + z_i$ while the total value of the pool is y ($= 1.5(x_1+x_2) = z_1 + z_2$).

There are nine possible variants of the game and they are summarised in Table 1. Cells lower in the table represent variants with larger female endowments; cells to the right represent variants with greater female control over the division of the common pool. The 50:50 variants are common pool games. Variants where one person has the entire endowment while also controlling the allocation are dictator games, whereas variants where the identity of the investing individual and the allocating individual differ are games of trust.

TABLE 1 ABOUT HERE

In table 1, two of the variant cells do not contain numbers. These are dictator

[6] Oliver E. Williamson, 1975, p 6 defines opportunism as a "a condition of self-interest seeking with guile." We define our measure of it in the next section.

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 locations.

TABLE 2 ABOUT HERE

Let us now consider predictions in Table 2 where the numbering corresponds with the tests announced in Section 2. In all variants of the game, total surplus maximization (I) implies that each player should set $x_i = N_i$. The null hypothesis that efficiency is independent of the identity of the allocator (II) can be tested for by comparing total contributions, i.e. $x_1 + x_2$, in games 3 with 5 and 8 with 9, respectively. Moreover, the hypothesis that endowment raises payoffs (III) implies that $N_i - x_i + z_i$ should increase with N_i and can be tested by comparing behaviour in variant 2 with 5 and behaviour in 3 with 6. The hypothesis that control raises payoffs (IV) implies that $N_i - x_i + z_i$ should be higher with control than without. Alternatively, since one agent has no control over their partner's contribution we can test the hypothesis that z_i/y is higher with control by comparing behaviour in variant 2 with 6, 3 with 5 and 8 with 9.

We define the degree of reciprocity, or contribution-based sharing, as the responsiveness of the allocation of the common account by one spouse to the contribution made by the partner. We are able to test the null hypothesis that reciprocity is zero (V) in variants 2, 3, 5, 6, 8 and 9. In the same variants gender differences in contribution-based rewards, and in particular a potential undervaluation of female contributions (VI), may be detected. Meanwhile if a household sharing rule exists then the responsiveness of men to female contributions should be equal to the responsiveness of women to male contributions.

If women anticipate, correctly or not, that their contributions will be undervalued, they may contribute less to the common pool than men even if they would have contributed more than men had they anticipated that their contributions would be valued equally. The only clear indication of a relatively strong intrinsic female preference for contributing to the common pool (VII) is therefore provided in the variants in which the sharing rule is fixed, by comparing male with female behaviour in variants 1 and 7, respectively, as well as in variant 4.

The null hypothesis in the test for altruism (VIII) is that $z_{-i} = 0$, where z_{-i} is the allocation to the other partner, when i is in control of the allocation.

In all the games, the private endowment N_i was revealed 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. Meanwhile, in the {2,000: 2,000} both partners were told that they received some, potentially different amount between 100 shillings and 4,000 shillings.

We did not reveal full information about each individual's endowment, in part as a response to ethical concerns about the creation of family disputes if all information was revealed. As we mentioned above, theories of household behaviour have had little to say on the impact of asymmetric information on outcomes, despite the widespread evidence of its presence within the household. A total surplus maximizer has no incentive to withhold contributions, even with 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 placing it in the common pool, but because there are other motives for not investing which would

apply even if endowments were common knowledge, we cannot simply interpret all failures to invest as evidence of attempted deception. For instance a selfish player in variants 1, 4 or 7 may not invest any sum because the net private return is negative. The clearest evidence of attempts to deceive is therefore provided in variants where the potential investor also controls the allocation. In this context we measure *opportunism* as the difference $N_i - x_i$ in games where player i has $N_i > 0$ and is the allocator. In variants 3, 5, 8, 9, we test the null hypothesis that opportunism is zero (IX).

4. 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 1186mm (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.

We chose to locate the experiments in these two areas partly because of the expectation that we would see distinctive forms of conjugality determined by the

predominantly Christian nature of Sironko and the Muslim character of Bufumbo. However, other differences such as in cropping patterns, and therefore gender divisions of labour, are possibly more likely to explain the variations between the two sites that emerge in our experimental results (see Section 7).

Most residents of Sironko and Bufumbo are Bagisu, a group known for very high levels of violence which is predominantly within kin groups, perpetrated by men on other men, and closely linked to accusations of thieving and witchcraft (Heald 1998, Roscoe 1924, La Fontaine 1959). According to Heald (1998), this is driven by intense conflict over access to resources, and gender ideals of male provider roles which are increasingly difficult for men to fulfil. Her emphasis on the absence of trust between male kin is echoed in broader research on comparative social capital, in which the district emerges as having extremely low levels of expressed trust, low levels of voluntary activity, and a low social capital index compared to seven other Ugandan locations (Widner and Mundt 1998).

If kinship, for men, is infused with mistrust, marriage is a comparative haven of trust despite the instability of marriage amongst the Gisu. Gender relations between men and women are expressed formally in terms of absolute male control, but in reality women have considerable freedom to marry who 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 element of adult masculinity. 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).

The experiments in Sironko took place on consecutive days in March 2005

with experiments implemented in Bufumbo on the following day. Venues were a Roman Catholic church (Sironko) and the headquarters of the sub-county (Bufumbo). LC1 chairmen (leaders of a village council) were approached two weeks beforehand and asked to mobilise the couples that took part in the previous survey (see Section 1). In addition they were asked to recruit additional (co-habiting) married couples to make up the required number for the experiments

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.

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 then 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.

5. Results

We first present an overview of the basic results, with simple univariate and bivariate hypotheses tests. In the following section we use data from the exit survey for more in-depth examination of household and spousal characteristics that impact on efficiency and therefore team performance, i.e. household capacity to realise cooperative gains.

Tests of surplus maximisation (I)

Finding 1: Surplus maximisation is rejected

Table 3 and the accompanying figure 1 give an overview of the results from the 240 couples (49 from Bufumbo, 191 from Sironko). In the table, the columns headed 'Female x' and 'Male x' give the mean fraction of endowments invested by women and men respectively. The next two columns show mean payoffs (including the portion of the endowment not invested). 'Total x' is the fraction of the 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. This null hypothesis is decisively rejected in all variants.

TABLE 3 ABOUT HERE

FIGURE 1 ABOUT HERE

Finding 2: For the equivalent variants, total contributions are higher in

Sironko than in Bufumbo.

Figure 1 shows the distribution of total surplus, measured as a fraction of the potential total for the 9 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 0.005 and 0.0004 respectively. In short therefore, the realisation of cooperative potential and thus the size of efficiency losses in the two locations is very different and this is one of the major lessons of our paper.

Finding 3: A fixed sharing rule does not alter contribution levels

We test whether control of the allocation of the common pool makes a difference to contribution levels in two ways. 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 transferring control (decision-making power) might impact on contributions. In this table 'Mean y' is the fraction of the total available surplus realised in the game. Results for the test (the t-statistic and below it the associated probability value) are given in the final column of the table. In general the null is not

rejected.[7]

TABLE 4 ABOUT HERE

Finding 4: 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 decision (see the second part of Table 4). Again the test is two-sided. The null (hypothesis II) 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).

Obviously total contribution is the sum of the contributions by the two partners, so we can dig deeper by analysing the impact of control on individual contributions. Table 5 summarises the six comparisons, four of which involve variants in which both partners received endowments and two where one partner received the entire endowment.

The column headed 'Mean x' shows mean contribution levels, x, by gender for the relevant variants. The adjacent column shows respectively the t statistic and probability value for a two tailed independent samples test that the mean values of x are the same in each variant 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 genders invest more when women are in

[7] The issue of whether a fixed sharing outperforms the discretionary allocations of spouses with regard to efficiency is likely to depend on the chosen sharing rule. With regard to incentive provision, the adopted 50/50 split is a primitive rule; even so Sironko spouses fail to outperform the 50/50 split.

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. The final two columns depict the fraction of the final payoff received by each gender and then the mean payoff. The asterisks indicate significant differences, but to save space the values of the t-statistic and associated p values are not reported. A common pattern emerges: contrary to predictions of standard bargaining models, *greater* control is associated with the receipt of a *lower* fraction of total payoffs and simultaneously a lower absolute level of payoff.

TABLE 5 HERE.

Test of opportunism (IX)

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.

Tests of the impacts of endowments on payouts (III)

Finding 6: While male allocators respond to changes in endowments in accordance with theoretical predictions, female allocators do not

Above we found that decision-making power or control was not associated with higher payoffs. We now turn the attention to another potential source of power, namely that associated with resource control or endowments. To identify the effect of initial endowments on receipts from the common pool when the same spouse decides

the split, receipts in games 2 and 5 are compared with those of games 3 and 6. In games 5 and 2 the allocation is decided by the wife while the wife's endowment falls from 2000 to 0. The mean receipts for women now increase slightly from 2416 to 2532. In games 3 and 6 control of allocation is in the hands of husbands while the endowment of the men decreases from 2000 to 0. Here the mean receipts for men fall from 3108 to 1164. The observed difference is significant only for husbands in games 3 and 6 (p-value 0.01). Hence, while male allocators respond to endowment changes in accordance with theoretical predictions, female allocators do not (tested in Sironko only).

Tests of contribution-based sharing (reciprocity) (V)

Finding 7: We find evidence for male reciprocity in Sironko, but not in Bufumbo and no evidence for female reciprocity

For the relevant variants figure 2 summarises the extent to which spouses repay the contribution of their partners. It plots the allocation to the non-controlling spouse against individual contribution levels together with lines of best fit.

FIGURE 2 ABOUT HERE

The fitted lines, estimated using OLS, are summarised in table 6. While the lines are upwards sloping (suggesting positive responses to the partner's contribution), the statistical conclusions are weaker. In general, we conclude in favour of male reciprocity in Sironko (i.e. games 3 and 6), but find no evidence of similar behaviour among female allocators. It is also unclear whether there is a net return for the investors, i.e. whether the slopes are greater than 1. The implications for theories of household behaviour are intriguing: suggesting the absence of household-level

contribution-based sharing rules.

TABLE 6 ABOUT HERE

Tests of gender differences in contributions and relative valuations of contributions (VII and VI)

Finding 8: We find no evidence that women contribute more to the common pool than men do

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 7).

TABLE 7 ABOUT HERE

Finding 9a): In Sironko, male allocators contribute more and award themselves less than their wives, while female allocators contribute less and award themselves the same as their husbands.

In other comparisons using observations on female and male contributions and payoffs in table 5, 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 receive more than men ($p=0.07$, one tailed t-test) while contributing less ($p=0.04$, 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). At the same time the receipts from the game for the two spouses are indistinguishable.

Finding 9 b) In Bufumbo, male allocators contribute the same and award

themselves the same as their wives, while female allocators contribute more and award themselves the same as their husbands.

Turning to Bufumbo, women contribute slightly less and receive more than men when men are in control, but neither of these differences is statistically significant. With female control men receive more from the game than women and contribute less, with only the latter being statistically significant (p=0.035, one-tailed t-test). It would thus seem that Sen's concepts of perceived interests and contributions perform rather poorly. Inequality in these variants is driven not by exploitation of the spouse by the party in control – but rather by generosity by the spouse in control vis-à-vis the partner. Where inequality in receipts emerges, more power thus has the opposite effect of what most theories would predict.

Tests of altruism (VIII)

Finding 10: The null of no altruism is rejected

The data can be used to test for the absence of altruism. In all cases the absence is decisively rejected at any recognised significance levels.

To sum up: 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. In Bufumbo no couple achieves the maximum available surplus. We find clear evidence of opportunism and that, contrary to the predictions of standard bargaining models, having control of the allocation reduces the payoff. On the other hand, higher endowment does not necessarily lead to higher payoffs but there is again a noted gendered difference in whether this prediction holds or not. There is evidence that female control leads to greater contribution in both sexes. We find no evidence

that women want to contribute more to the common pool than men nor that their contributions are undervalued by men.

6. Socio-economic effects

In this section we contextualise the results presented in Section 5 by relating them to the socio-economic characteristics of spouses and households. First, let us focus on contributions to the common pool. To examine if surplus maximisation is affected by the characteristics of spouses, the ratio of total contributions to total endowments is regressed on socio-economic variables while controlling for location and games. The unconditional expected values from a Tobit are given in Table 8. Three variants of the equation are presented: first the data pooled across all participants and then husbands and wives estimated separately.

TABLE 8 ABOUT HERE

As reported previously, contributions are significantly lower in Bufumbo than in Sironko. Spouses with the same employment and educational levels contribute significantly more. In short, spouses with similar characteristics seem to do better in terms of generating cooperative surplus, underlining the importance of assortative matching for efficiency and household team performance. For instance, teacher spouses contribute more compared to other occupations.[8] Possibly, there is something different about teachers compared to all other occupations, but given the available information it is difficult to know what exactly that difference is.

In the pooled equation, the total contribution is negatively affected by the age

of the wife (a quadratic term on age is not statistically significant). This is a result of two forces. First, older women contribute less to the common pool than younger women. Second, husbands with older wives contribute less. Both these effects operate in the same direction and hence contributions drop with age of wife.[9]

The above results capture the overall contribution behaviour of the couples. To examine for possible heterogeneity in the behaviour of spouses similar regressions for husbands and wives are separately estimated and results reported in subsequent columns. The results supporting the importance of assortative matching come out less strongly in these regressions, but the difference in male and female contribution behaviour is interesting. Men married to women with the same level of education contribute significantly more; but matching in education is not significant for female contributions. Women married to men with the same occupation as their own contribute significantly more; but matching in employment is not a significant determinant of men's contributions. Hence, the influence of assortative matching seen in the pooled regressions is mainly a result of the effect of educational matching for men and occupational matching for women. The contribution of men to the common pool increases if they are married to women of similar education as theirs and the contribution of women increases if they are married to men with the same occupation as theirs. In both cases spouses married to teachers contribute more (at least at 10% level of significance). In addition, the negative effect on contribution of the age of the other spouse holds in both cases; both men and women with older spouses contribute less.

[8] If the dummy for 'wife is a teacher' is dropped and 'husband is a teacher' is included the latter will be significant (but at lesser level of significance); due to collinearity, both cannot be included in the regression.
[9] This is also true for husbands' age; due to collinearity both husband and wife age cannot be included in the regression.

We now turn to the behaviour of spouses when distributing the common pool. The reciprocity of husbands (wives) to their wives (husbands) can be measured by examining how much money husbands allocate to their wives (husbands) in games where they decide the allocation – games 3, 6 and 8 for husbands and games 2, 5 and 9 for wives. For games 3, 6 and 8 the amount wives receive and for games 2, 5 and 9 the amount husbands receive are regressed on the same socio-economic variables as before. The results are given in Table 9.

TABLE 9 ABOUT HERE

As indicated in previous sections, husbands reciprocate to their wives more than wives do. For a shilling contribution from wives, husbands give them 1.5 shillings – the contribution plus the surplus – but wives give their husbands less than that.[10] The socio-economic variables in the tobit for males are not significant. But in the regression for females, 'same education' and 'husband's age' are significant. The two contrasting results would seem to suggest that while husbands' distributional behaviour is determined by some fixed rule independent of the socio-economic characteristics of spouses, female behaviour is influenced by male characteristics. It is also interesting to note that the coefficients on 'same occupation' and 'husband's age' are of opposite signs to those in the contribution regressions. Wives invest more when married to young husbands with the same occupation as their own; but they allocate more of the common pool to older husbands with a different occupation. Different sets of factors thus seem to influence contribution and allocation decisions.

In the sample, a subset of 68 couples had taken part in the previously

mentioned survey. Information on whether women keep receipts from crop sales was gathered in the survey; this can be used as a reflection of 'bargaining power' of women. Table 10 shows the results for an OLS regression with robust standard errors. Female receipts in the games are regressed on dummy variables for Bufumbo ("Bufumbo"), for games where men control the allocation ("Male control"), for games with the 50:50 rule ("Equal") and for whether women keep receipts from crop sales ("Keep"); in addition, the initial endowment of males in the games is included. As the coefficient for 'keep' indicates, women with stronger 'bargaining power' receive more in the games (the coefficient is statistically significant at 5% level).

TABLE 10 HERE.

The follow-up qualitative survey found that subjects, interviewed separately and simultaneously as couples, were positive about their experience of the experiment. The retention of the money used in the game was obviously popular, but many spontaneously mentioned that the game had taught them about saving and sharing. Respondents were asked what was in their minds when they decided on how much to retain and to allocate to the common pool and some responses suggest that particular needs at the time of the games were uppermost in some women's minds, such as getting money to buy seeds for personal plots, thus raising the possibility that allocation behaviour may be seasonally varied.

Corfman and Lehmann (1987) found that couples use experiments to further relationship goals, and something of this may be going on here as well. Some responses indicated that the games were seen as occasions to demonstrate generosity

[10] The test for the coefficient on husband's contribution to be one is accepted with F- and p-values of 0.37 and 0.5471 respectively. Hence, females give back approximately 1 shilling for 1 shilling contribution of husbands.

towards a partner, or indeed to show the game managers that they had complied with what they saw as the 'lesson' of the game - pooling is a good thing and thus rewarded. To the extent that these responses were indicative of the whole sample it would suggest that greater co-operation was observed in the experiment than might be true of routine household decision-making.

8. Some thoughts on the findings

We began this paper by noting the widespread field evidence against the unitary model. Our results confirm this evidence: on average 21% of the surplus available remains unclaimed, suggesting that spouses are willing to pay a significant price to retain control over their own endowments. At the same time, subjects were publicly generous, with the typical controller of the allocation receiving less than 50% of the payout.

Sen's perceived interest hypothesis would suggest that women would be inclined to allocate most, or even all of their endowment to the household pool, but the experiments showed this not to be the case. There was no evidence of women wanting to contribute more to the common pool than men. This may mean that they do not see their wellbeing as spouse-dependent in this way or that they do but chose to behave differently in the context of the game, or that they articulate relational well-being as a cultural convention whilst actually behaving differently. There is little evidence thus far that the female participants in these games, as Sen suggested, have a lower sense of their personal welfare than men.

Our examination of allocation behaviour in relation to socio-economic characteristics of spouses also suggests that the allocation behaviour of husbands is more rule bound and independent of the socio-economic characteristics of wives –

whilst that of wives seems to be affected by the socioeconomic characteristics of husbands. Supporting this idea, male behaviour was more sensitive to the level of female contributions than vice versa. These features of the data suggest that there are no agreed sharing rules at the household level, possibly pointing to different norms of reciprocity and fairness across men and women. Adding further ammunition to these indications of systematic differences in male and female behaviour, male allocators were found to behave in accordance with theoretical predictions by responding to changes in endowments, while no similar response was observed for female allocators.

Conjugal contracts are not static but vary both historically and over the course of a marriage and we see this reflected in our findings on the behaviour of spouses in relation to individual characteristics: older women contribute less compared to younger ones, and husbands contribute less when wives are older. This may conceal a historical effect – since both spouses contribute less when they are older it may speak of an earlier more individualised conjugal contract in the past which continues to govern norms for older couples. Or it may be an aspect of a domestic development cycle whereby younger couples who are building families with younger children are engaged in a kind of 'reproductive cooperation' which induces a greater commitment to joint ventures (eg in relation to education costs) than in later stages when the imperatives for cooperation are weaker. The factors that shape the intensity and character of cooperation between spouses are likely to produce age specific effects.

Contributions to the pooled fund are higher in the Christian Sironko than in the Muslim Bufumbo. We had originally thought that we may find two very distinctive forms of conjugality in Sironko and Bufumbo, but the qualitative fieldwork

failed to identify clearly distinctive religious identities.[11] A more likely explanation may lie in the different cropping patterns of the two areas. Bananas and coffee dominate the upland Bufumbo farming system, and maize and beans the lowland Sironko farming system. The gender division of labour is likely to be very 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.[12] Whatever the sources of the differences in behaviour, their pronounced nature strongly suggests that a 'one-size fits all' model of the household is unlikely to be satisfactory.

[11] There was no veiling or seclusion of Muslim women, only a minority of Muslim men marking their identity with caps, the response was blank incomprehension when asked about religious identity in relation to marriage, and indeed a number of marriages were between Muslims and Christians.

[12] 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).

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Table 1. Variants of the game played.

Endowment to woman (given total endowment of 4000) ↓	How pool is split→	Male controls allocation	50:50	Female controls allocation
0			1	2
2000		3, 8	4	5, 9
4000		6	7	

Table 2. Predictions.

I. Total surplus maximization	$x_i = N_i$	All variants
II. Household efficiency is independent of the identity of allocator	x_1+x_2 is identical under male and female control	3 with 5, 8 with 9
III. Endowment raises payoffs	$N_i - x_i + z_i$ increases in N_i	2 with 5, 3 with 6
IV. Control raises payouts	z_i / y higher with control	2 with 6, 3 with 5, 8 with 9
V. Contribution-based sharing	z_i / y increases in x_i	2, 3, 5, 6, 8, 9
VI. Undervaluation of female contributions	z_i / y increases less in x_i for i = female than for i = male	2, 3, 5, 6, 8, 9
VII. Women contribute more to the common pool	x_i higher for i = female	1 with 7, 4
VIII. No altruism	$z_{-i} = 0$	2, 3, 5, 6, 8, 9
IX. No opportunism	$N_i - x_i = 0$	3, 5, 8, 9

Table 3. Sample size, contribution and payoffs for the 9 variants.

Game	Sample size	Female x	Male x	Female payoff	Male payoff	Total x	Total Std. Dev.	t-test for *H0: Total = 1* p-value
1	26	-	0.904	2711	3096	0.904	0.201	-2.440 0.022**
2	25	-	0.940	2532	3348	0.940	0.109	-2.753 0.011**
3	27	0.648	0.787	3122	2318	0.718	0.242	-6.072 0.000***
4	30	0.755	0.783	2797	2740	0.769	0.255	-4.955 0.000***
5	25	0.790	0.900	2832	2860	0.845	0.202	-3.840 0.001***
6	26	0.833	-	4553	1119	0.833	0.193	-4.412 0.000***
7	32	0.887	-	3113	2660	0.887	0.189	-3.394 0.002***
8	24	0.510	0.558	2675	2458	0.534	0.199	-11.469 0.000***
9	25	0.676	0.596	2436	2860	0.639	0.188	-9.608 0.000***
	240	0.788	0.790	2978	2605			

*** indicates significant at 1% level

** indicates significant at 5% level

Note: 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 the allocation and total contribution levels.

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

** indicates significant at 5% level, 2 tailed test

* indicates significant at 10% level, 2 tailed test

Table 5. Control, individual contribution levels and payoffs.

Comparison	Gender	Variant	N	Mean x	T p-value	Payoff fraction	Mean payoff
1	Female	3	27	1296	-1.863*	0.570	3122
		5	25	1584	0.068	0.491	2833
2	Male	3	27	1574	-1.708*	0.430	2318
		5	25	1800	0.094	0.509	2860
3	Female	8	24	1021	-2.97***	0.523	2675
		9	25	1352	0.005	0.458	2436
4	Male	8	24	1117	-0.602	0.477	2458
		9	25	1204	0.550	0.542	2860
5	Female	6	26	3331	-	0.800***	4554***
		2	25	-	-	0.420	2532
6	Male	6	26	-	-	0.200***	1119***
		2	25	3760	-	0.580	3348

In all cases females control the allocation in the second of the variants in each comparison. Males control allocation in the first variant.

* indicates significant at 10% level, 2 tailed test

** indicates significant at 5% level, 2 tailed test

*** indicates significant at 1% level, 2 tailed test

Table 6. Evidence on reciprocity in 6 variants.

Variant	Gender	Constant t-stat	Slope t-statistic	R^2	Slope = 0?	Slope = 1?
Sironko						
3	Male	702	1.324	0.295	No	Yes
		1.202	3.238			
6	Male	-1808	1.709	0.617	No	No
		-1.927	6.220			
2	Female	2491	0.164	0.001	Yes	Yes
		0.705	0.176			
5	Female	950	0.950	0.088	Yes	Yes
		0.810	1.493			
Bufumbo						
8	Male	1056	0.606	0.087	Yes	Yes
		2.269	1.448			
9	Female	1127	0.785	0.092	Yes	Yes
		2.065	1.851			

'No' =hypothesis rejected at 95% level; 'Yes' = hypothesis not rejected at 95% level.

Table 7. Male and female contributions when sharing rule is 50:50.

Comparison	Gender	Variant	N	Contributions	p-value
1	Male	1	26	3615	0.614
	Female	7	32	3547	
2	Male	4	30	1567	0.552
	Female	4	30	1510	

p-values from a 2-tailed t-test with unequal variances

Table 8. Tobit regression of contribution rates and socio-economic characteristics of spouses.

	Pooled		Husbands		Wives	
Variables	Unconditional expected value	Standard error	Unconditional expected value	Standard error	Unconditional expected value	Standard error
Bufumbo	-0.3463***	0.0594	-0.3093***	0.0513	-0.1841***	0.0677
Same occupation	0.0552*	0.0289	0.0377	0.0295	0.0861**	0.0394
Spouse is teacher	0.1708*	0.0975	0.1736	0.0000	0.1609*	0.0965
Same education	0.0602**	0.0272	0.0607**	0.0274	0.0211	0.0368
Spouse's age (log)	-0.0931**	0.0448	-0.1019**	0.0467	-0.1592**	0.0644
Constant	0.9353***	0.1581	0.7894***	0.1635	-0.1841***	0.0677
Number of observations	240		182		189	
LR chi^2	105.08		87.51		57.32	
Prob > chi^2	0.0000		0.0000		0.0000;	
Log likelihood	-92.7415		83.6888;		93.5648;	
Pseudo R^2	0.3616		0.3433		0.2364	

Notes:

1. Coefficients on controls (dummy variables) for each game omitted from table

2. For the pooled equation, wife is used for the age and teacher variables.

* indicates significant at 10% level, 2 tailed test

** indicates significant at 5% level, 2 tailed test

*** indicates significant at 1% level, 2 tailed test

Table 9. Reciprocity of spouses to their partners' contributions estimated using Tobit regression.

	Husbands		Wives	
Variables	Unconditional expected value	Standard error	Unconditional expected value	Standard error
Spouse's contribution	1.4698***	0.223	0.730**	0.369
Same occupation	177.530	316.315	-726.600**	349.628
Same education	408.921	282.450	-304.583	334.182
Spouse's age (log)	-512.488	401.092	1454.176**	577.146
Constant	1677.465	1483.044	-4496.246*	2629.102
Number of observations	77		75	
LR chi^2	66.68		18.35	
Prob > chi^2	0.0000		0.0054	
Log likelihood	579.956		604.303	
Pseudo R^2	0.0544		$R^2 = 0.0150$	

Notes:

1. Coefficients on controls (dummy variables) for each variant omitted from table

* indicates significant at 10% level, 2 tailed test

** indicates significant at 5% level, 2 tailed test

*** indicates significant at 1% level, 2 tailed test

Table 10. External bargaining power and female receipts.

Dependent variable: female receipts	Coefficient	t-statistic	Probability
Constant	425.28	0.47	0.641
Bufumbo	-781.17	-2.80	0.007
Male control	188.08	0.76	0.449
Equal	-712.43	-1.80	0.077
Male endowment	0.889	2.23	0.029
Keep	593.52	2.19	0.032

N=68, F(5,62)=4.52, prob> F = 0.0007. R^2=0.250,

Figure 1. Proportion of total surplus realised in each of the games.

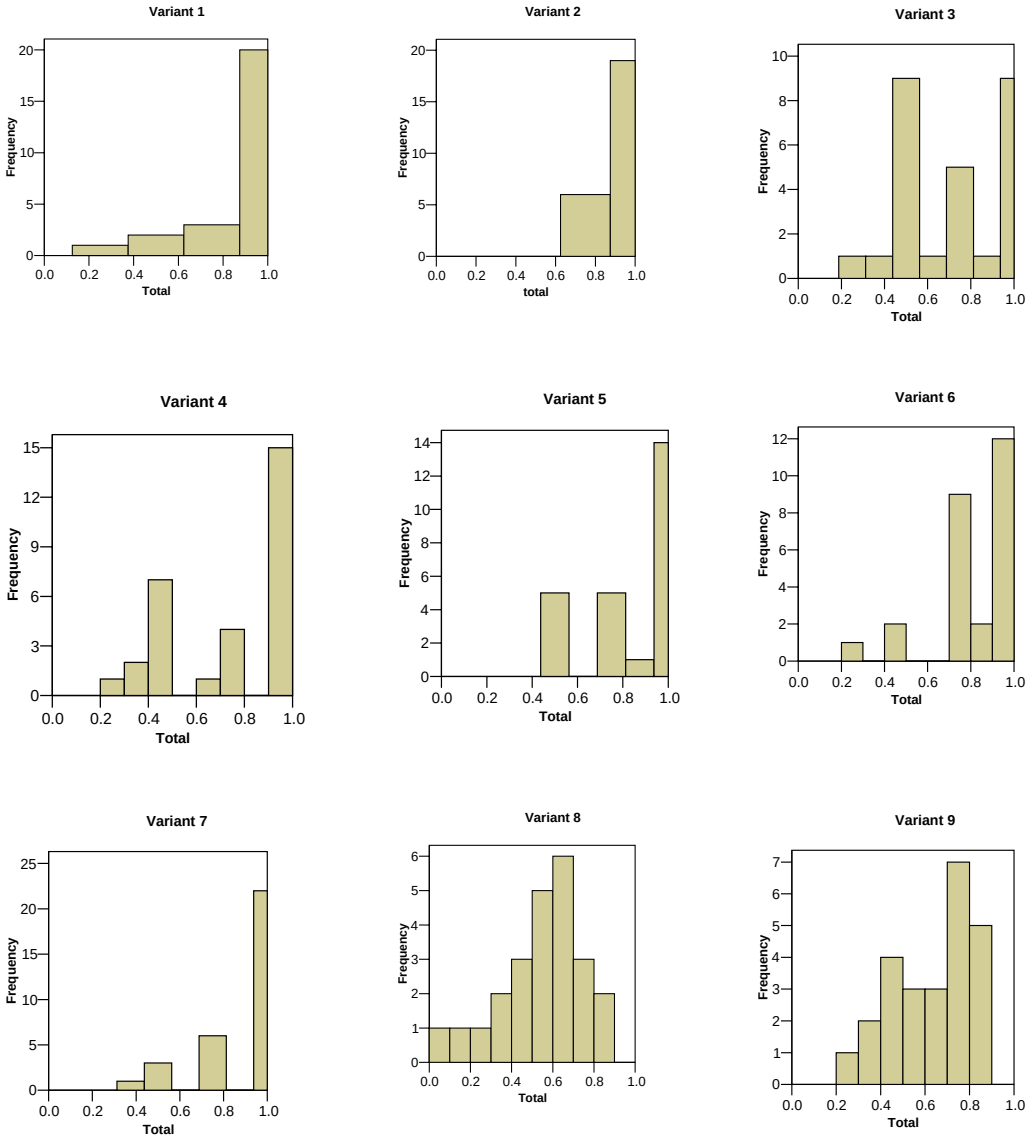

Figure 2. Rewards and Contributions