Efficiency in Intrahousehold Resource Allocation and Women's Bargaining Power

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Abstract

Various models of the household assume Pareto efficiency. However, studies using data from the developing world show that there are inefficiencies in the allocation of resources within households. We advance this literature by testing for heterogeneity in Pareto efficiency along an important feature of intrahousehold dynamics: women's level of empowerment. Results show that higher levels of women's bargaining power are associated with lower degrees of inefficiency in the allocation of resources for production within households. We cannot identify the direction of causality but provide suggestive evidence that higher levels of empowerment allow women to better access resources for production.

JEL Codes:

D13 Intrahousehold allocation, J16 Gender, O12 Microeconomics of development, C9 Lab experiments

Efficiency in Intrahousehold Resource Allocation and Women's Bargaining Power

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The evaluation of any social policy aimed at helping families requires reliance on an underlying model of household behavior. The ability of the chosen model to accurately reflect decision processes within the household can have significant implications for the resulting policy recommendations (Chiappori and Mazzocco 2017). The unitary model of the household has been widely rejected by tests of income pooling (*ibid*). The collective model may offer a better fit in some contexts, but it has also been rejected in other contexts. Tests of a key assumption underlying the collective model, that of Pareto efficient outcomes, have failed to reject this assumption in many developed country contexts (for example, Browning et al. 1994, Browning and Chiappori 1998, Cherchye et al. 2009, 2011; Attanasio and Lechene 2014). However, studies that investigate consumption and production decisions in the developing world show that households are often unable to efficiently allocate resources within the household (Udry 1996, Dercon and Krishnan 2000, Duflo & Udry 2004, Goldstein and Udry 2008, Angelucci and Garlick 2017).[1] This suggests that the collective model may be missing some important elements of household decision making that are particularly important in the developing world. We advance this literature by further investigating the nature of such missing elements by testing for heterogeneity in Pareto efficiency along an important feature of household dynamics: women's empowerment.

This paper follows the empirical approach of Udry (1996). Udry used agricultural production data from Burkina Faso, a setting where spouses cultivate different plots of land, to examine whether resource allocation was efficient within households. He showed that the productivity of plots planted with the same

1 These studies examine the allocation of resources between spouses. A recent literature has started to examine the behavior of other household members, such as parents and children (see for example, Bursztyn and Coffman 2012, and Ashraf et al. 2017).

crop and in the same season in the same household is lower on average on plots cultivated by women rather than men, even after observable plot characteristics are controlled. This is due to a misallocation of resources in the household; that is, women's plots receive fewer inputs per acre than their husbands' plots planted under the same crop. Subsequent studies have documented variation in the degree to which intrahousehold resource allocation is efficient across Sub Saharan Africa (Akresh 2005, Guirkinger et al. 2015, Slavchevska 2015, Kazianga and Wahhaj 2017).[2]

We test whether the Pareto efficiency of agricultural outcomes varies according to the level of empowerment of a wife within a household. Our results show that there is a positive relationship between women's bargaining power and the degree of inefficiency observed in the allocation of resources for production. We cannot identify the direction of causality but provide suggestive evidence that bargaining power reduces inefficiencies by enabling women to better capture household resources for production. We find no evidence that assortative matching drives the relationship between women's bargaining power and productive inefficiency in our study sample.

This work makes several contributions to the literature. First, it adds to the growing body of evidence that the assumption of Pareto efficiency may not apply to all households in the developing world. Second, it empirically documents a link between the degree of inefficiency in intrahousehold resource allocation and women's bargaining power. This offers new evidence regarding what element(s) may be missing from existing models of the household. Third, our study fills a gap in the literature evaluating the effect of female empowerment programs on household outcomes. While various studies have shown that cash transfers given to women and other female empowerment programs can affect household choices (e.g. Duflo 2003, Ashraf et al. 2014, Attanasio and Lechene 2014), the link between efficiency and bargaining power has seldom been examined.[3] We provide, to the best of our knowledge, the first empirical test of this relationship within the context of agricultural production. Finally, our study provides an underlying link for some of the diverse findings documented in the literature on the efficient allocation of resources in the

2 A related literature examines gender differences in agricultural productivity across households. See, for example, Aguilar et al. (2015), Kilic et al (2015), Oseni et al (2015). Additionally, Seymour (2017) examines the role of women's empowerment for agricultural productivity, but the analysis is across, rather than within households.

3 Ashraf et al. (2017) is the exception, who examine the impact of a negotiation training program for adolescent girls in Zambia. Using a lab-in-the-field experiment, they find that treated households attain higher levels of efficiency in decisions that involve communication between the girl and her parents.

household. We discuss this contribution further in the concluding section.

I. The link between efficiency and intrahousehold bargaining power

There are two primary pathways through which the bargaining power of women can relate to (in)efficient intrahousehold resource allocation in our setting. First, in the context of this study, like that of Udry (1996), we observe underinvestment of inputs in women's plots. Higher bargaining power within the household may enable women to better capture the resources they need to invest in the plots they manage. Increases in input use such as improved seeds, fertilizer, pesticides and family labor should increase the yields of plots controlled by women and thus reduce the gender gap in yields.

A second explanation for the link between intrahousehold bargaining power and efficiency is provided by theories of assortative matching, which posit that higher levels of women's bargaining power at the time of marriage will give women a better set of partner options and will increase preference alignment between spouses. Increased alignment of preferences may ease bargaining within the household, thereby increasing the efficiency of outcomes.[4]

We first test whether there is a significant link between efficiency and women's bargaining power. We then provide suggestive evidence on which of the two pathways described above is driving the relationship. To do this, we investigate whether bargaining power enables women to better capture inputs for production, and then test whether closer levels of preference alignment are associated with lower levels of productive inefficiency.

II. Data

The data from this project was collected in 2016 and 2017, as part of the baseline survey of a randomized controlled trial conducted by the Government of Ghana, the World Bank, and IFPRI in the Upper East Region of Ghana. The survey collected disaggregated agricultural production data from husbands and wives.[5] Spouses completed a plot roster together, which asked them to indicate who was the primary cultivator of each plot of land. Each spouse was then separately asked cultivation questions about each of the plots he or she manages.[6] The survey also collected measures traditionally used as indicators of bargaining

4 Consistent with this notion, Schaner (2015) shows that spouses with heterogeneous time preferences make inefficient strategic savings decisions in Kenya, while Serra-Garcia (2017) shows that heterogeneity in risk preferences between spouses is associated with higher rates of divorce in the Netherlands.

5 In polygamous households, only one wife participated. This "designated wife" was chosen by the husband as the wife who would participate in the randomized controlled trial.

6 We defined primary cultivator as the person who makes the main decisions for the plot and is financially responsible for it. Note that only 5% of plots were reported to have someone other than the husband or designated wife as the primary cultivator. In these cases, plot information is reported by either the husband or wife, whichever is the most knowledgeable about the plot. All results are robust to excluding this 5% of plots.

power. The benchmark method for identifying sharing rules within a household relies on the relative allocations of private, assignable goods (Browning et al. 1994, Browning and Chiappori 1998). We employ the ratio of the wife's private consumption to the total private consumption of husband and wife as our primary measure of bargaining power.[7] We also collected alternative measures including questions on household decision making, the wife's freedom of movement and whether the husband trusts the wife with money.[8] In addition, we collected measures traditionally considered to be determinants of bargaining power, such as age, education, polygamy, wife rank, and wife's ownership of a house or land.[9]

Given that there is no consensus on what is the best way to measure intrahousehold bargaining power in the literature, and in order to elicit the degree of intrahousehold preference alignment, we also conducted lab-in-the-field experiments with spouses. A description of the experimental measures and procedures use to elicit these measures is provided in the Appendix. Appendix Table A1 provides additional details on the specific survey and experimental measures of bargaining power we use in our analysis.

II. Results

We have survey and experimental data for a total of 1,053 households who reside in 19 villages. Households cultivate an average of 6.4 plots of land, which are on average 1.5 acres in size each. The average number of plots cultivated by husbands is 4.6 while the average number of plots cultivated by wives is 1.76. Each plot is defined as a unique plot-crop combination, and we have cultivation data for a total of 6,713 crop-plots, henceforth referred to as plots.[10] The main crops cultivated by households include rice, maize, millet, sorghum, groundnut, soya, and beans (a disaggregation is provided in Appendix Table A2). Men and women specialize in the production of different crops, but there is overlap both across and within households, which we exploit to study the degree of productive inefficiencies observed in the household.[11]

A. Empirical strategy

7 Consumption includes personal care items, clothing and accessories, health expenses, fuel and transportation, phone credit, alcohol and other prepared food and drink, gifts to family, and other non-food, non-agriculture expenses. Each expenditure is disaggregated by amount spent on each individual.

8 Decision-making questions measured the wife's input into various decisions on a scale from 1 to 5. Decisions queried included how to spend her income, how to spend her husband's income, major household purchases, her own health care, and visiting her natal family. These are averaged into a single decision-making index. More information is provided in Appendix Table A1.

9 Wife's share of income is also a traditional determinant measure. However, in this context, cash income is so rare that this is not a meaningful measure in our sample.

10 Note that 83% of plots are pure stand and so there is no difference between the plot and the plot-crop dyad. For the 17% of plots that are intercropped we consider each plot-crop dyad as a separate plot, as it is often the case that the primary cultivator differs by crop, even within a plot.

11 Conditional on the crop planted, plots controlled by husbands are of slightly higher quality than plots cultivated by wives, and receive higher levels of family labor and non-labor inputs (such as improved seeds, fertilizer, and pesticides). This translates into higher levels of

To quantify the level of productive inefficiency observed in the household we follow the empirical strategy of Udry (1996) and estimate yield differences between plots cultivated with the same crop during the same season by different spouses in the same household, which are not explained by observable differences in plot characteristics. To examine the relationship between the degree of productive inefficiency in the household and women's bargaining power we add an interaction term to the model:

(1) $Q_{hki} = X_{hki}\beta + \gamma G_{hki} + \delta G_{hki} \times WBP_h + \lambda_{hk} + \epsilon_{hki}$

where Q_{hki} represents the natural log of the kilograms produced per acre by household *h* in a plot cultivated with crop *k*, that is cultivated by household member *i*, G is an indicator of the gender of the primary cultivator of the plot, and WBP_h is the bargaining power of the wife in the household. X is a vector of plot characteristics and λ_{hk} is a household-crop fixed effect.[12] Errors are clustered at the household level.[13] γ captures the differences in yields between plots cultivated by men and women within the same household, and δ captures the difference in the intrahousehold gender gap in yields that is associated with changes in the bargaining power of women across households.

B. Efficiency in intrahousehold resource allocation and women's bargaining power

Table 1 presents the main results of this paper. Column 1 presents estimates of equation 1, without any interaction, which replicates the results of Udry (1996) and shows that households fail to allocate resources Pareto efficiently within the household. Controlling for plot characteristics, plots cultivated by different spouses with the same crop have on average a 33.9 percent difference in yield. Columns 2-7 present estimates of equation 1 that include the interaction with the measures of women's bargaining power discussed above. They show that inefficiency in resource allocation decreases with the share of expenditures assigned to the wife, with her freedom of movement, and with her husband trusting her with the use of money. While bargaining power offsets some of the inefficiency, in none of the columns in Panel A, does it completely close the yield gap. Hence our results are consistent with a model of the household where female bargaining power

yields on average for plots controlled by husbands than for plots controlled by wives along all crop categories (see Appendix Tables A3 and A4).

12 We note that our primary source of identification are households where there is at least one crop that is cultivated by both the husband and wife. This includes 43% of households.

13 Plot characteristics included are: plot size quintile fixed effects, soil type fixed effects, 5-grade soil quality fixed effects, and 5-grade slope fixed effects.

matters (potentially a lot), but does not completely resolve inefficiencies in production. Interestingly, we find no relationship between productive inefficiency and bargaining power measured through the decision-making questions or through our experimental measures of intrahousehold bargaining power.

Panel B presents estimates of equation 1 that use instead socio-demographic determinants of women's bargaining power as the interaction term. Column 8 shows that productive inefficiency in the household increases on average with the woman's age. We believe that this captures a generational heterogeneity between households given that the same impact is exhibited by husband's age (results not shown), and younger generations have increasingly empowered women in the area.[14] Column 9 shows that households where the wife completed primary school behave efficiently, while households where the wife did not complete primary education do not on average efficiently allocate resources within the household. Column 10 shows that polygamy seems to directionally increase the degree of productive inefficiency in the household, but not significantly so. Column 11 and 12 show that households where the designated wife is the first wife and where the woman owns property or land show lower degrees of productive inefficiency.

Appendix Table A5 presents the pairwise correlation coefficients between the different measures of bargaining power included in Table 1. It shows that the measures of bargaining power which are not associated with productive efficiency (decision-making and the experimental measures) are correlated with each other. This seems to indicate that the experimental measures are capturing an element of bargaining power that is directly related to everyday decision-making, but represents a different domain than what potentially determines the allocation of resources for production. This is consistent with earlier evidence that interventions that impact measures of household resource control do not impact non-incentivized, decision-making measures of empowerment (Attanasio and Lechene 2014, Almas et al. Forthcoming).

C. Direction of causality

Appendix Table A6 shows that the allocation of inputs such as labor, improved seeds, fertilizer, and pesticides within the household is imbalanced in favor of husbands, even after household-crop fixed effects are included in the regressions and plot characteristics are

14 The age and education differences between spouses do not significantly impact productive efficiency within the household.

controlled. Appendix Table A7 shows that higher levels of bargaining power are not associated with higher levels of other family labor but do enable women to acquire higher levels of non-labor inputs such as improved seeds, fertilizer, and pesticides. The strongest empowerment predictor is the share of expenditures devoted to the wife's consumption (which excludes agricultural inputs).

An alternative possibility is that assortative matching explains our findings. To test this, we examine in Appendix Table A8 whether there is a relationship between preference alignment and productive inefficiency. In Appendix Table A9 we also investigate whether there is a positive relationship between preference alignment and women's bargaining power. We find no evidence in support of either relationship and thus conclude that the assortative matching mechanism is not driving our findings.

III. Conclusion

This paper provides, to the best of our knowledge, the first empirical test of the relationship between productive inefficiency and women's bargaining power. While many interventions seek to empower women, little is known about how such a change would impact intrahousehold efficiency and dynamics. This study provides some evidence on this question.

We cannot conclusively determine the direction of causality, nor the pathway of the relationship between bargaining power and efficiency. However, we offer suggestive evidence that increased bargaining power increases a woman's access to resources for agricultural inputs, thereby increasing her yields and reducing the gender gap.

This evidence provides an underlying link for important results documented in the literature. Kazianga and Wahhaj (2017) document higher levels of productive inefficiency in extended family households. Goldstein and Udry (2008) show that productive inefficiency is explained by the extent of fallowing. Women's bargaining power offers a link between these findings, as women are more empowered in nuclear households, and empowerment increases property rights, which increases fallowing.

Taken together, these findings suggest that increasing women's bargaining power in developing countries may have significant implications for intrahousehold efficiency, the overall productivity of agriculture, and by extension, economic development.

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Table 1. OLS fixed effect estimates of intrahousehold differences in plot yields by level of the women's bargaining power

Dependent variable: Natural log of the harvest in kg

Panel A. Contemporaneous measures of women's bargaining power

Interaction term	None	Share of expenditures	Trusted with money	Free movement	DM average score minus 3	Experimental measure 1 (DG)	Experimental measure 2 (RG)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Woman's plot	-0.339	-0.533	-0.568	-0.511	-0.338	-0.351	-0.3231
	[0.0431]	[0.0851]	[0.122]	[0.111]	[0.0432]	[0.0519]	[0.0496]
Woman's plot		0.387	0.257	0.200	0.0299	0.0359	-0.0597
x interaction term		[0.147]	[0.129]	[0.119]	[0.0599]	[0.0865]	[0.0916]
Observations	6536	6527	6530	6536	6530	6530	6530
R-squared	0.12	0.121	0.121	0.121	0.12	0.12	0.12

Panel B. Determinants of women's bargaining power

Interaction term	Wife age minus 40	Completed Primary	Polygamous	First Wife	Owns House/Land
	(8)	(9)	(10)	(11)	(12)
Woman's plot	-0.340	-0.354	-0.294	-0.470	-0.395
	[0.0431]	[0.0440]	[0.0541]	[0.0884]	[0.0533]
Woman's plot	-0.00857	0.321	-0.115	0.166	0.150
x interaction term	[0.00337]	[0.191]	[0.0831]	[0.0984]	[0.0840]
Observations	6516	6530	6530	6530	6530
R-squared	0.122	0.121	0.120	0.121	0.121

Note: Dependent variable is the natural log of the harvest in kg. Regressions control for plot size quintile, soil type, soil quality, plot slope, and household-by-crop fixed effects. DG stands for dictator game, RG for risk game. Standard errors clustered at the household level reported in brackets.

APPENDIX FOR ONLINE PUBLICATION

Efficiency in Intrahousehold Resource Allocation and Women's Bargaining Power

By M. GOLDSTEIN, K. M. JONES, T. KOROKNAY-PALICZ AND M. P. RECALDE

Appendix A. Additional tables

Table A1. Measures of women's bargaining power

Variable name	Description	N obs.	Mean	SD
Measures of WBP				
Share of expenditures	Wife's share of excludable spending	1052	0.50	0.28
Free movement	Husband trusts wife with money	1053	0.88	
Trusted with money	Wife has general freedom of movement	1054	0.86	
DM average score	Average answer to the 5 questions below	1053	2.93	0.64
	Wife's say: use of own income	1051	3.23	1.04
	Wife's say: use of husband income	1045	2.63	1.05
	Wife's say: own health care	1051	2.78	1.16
	Wife's say: major HH purchases	1035	2.69	1.03
	Wife's say: visiting own family	1052	3.09	1.10
Experimental measure 1 (DG)	Joint outcome matches wife's preference in the dictator game	0.34		
Experimental measure 2 (RG)	Joint outcome matches wife's preference in the risk game	0.29		
Determinants of WBP				
Age	Wife age	1051	39.06	12.14
Completed primary	Wife completed primary school	1053	0.06	
Polygamous	Household is polygamous	1053	0.35	
First wife	First wife	1053	0.82	
Owns property/land	Wife owns house or land	1053	0.36	

Note: The possible answers to the DM questions are: 1=husband decides alone, 2= husband and wife decide together but husband has final say, 3=husband and wife decide together and have equal say, 4=husband and wife decide together but wife has final say, 5=wife decides alone. DG stands for dictator game. RG for risk game.

Table A2. Distribution of crops across plots by gender of the primary cultivator

	Share of plots under crop		Share of crop-plots grown by men
	Men's plots	Women's plots	
Rice	8%	49%	30%
Maize	39%	14%	88%
Millet	27%	6%	92%
Sorghum	5%	1%	94%
Groundnut	2%	5%	52%
Soya bean	9%	16%	61%
Beans	6%	9%	64%
Other	4%	2%	86%
All crops	100%	100%	72%
N of all plots	4,853	1,860	

Table A3. Yields by crop and gender of the primary cultivator (in kg per acre)

	Men's plots		Women's plots		Diff.	t-stat
	mean	sd	mean	sd		
Rice	895	655	728	579	167	4.51
Maize	798	702	605	620	193	4.12
Millet	473	466	410	445	63	1.37
Sorghum	369	356	286	245	83	0.89
Groundnut	570	452	501	407	68	1.06
Soya bean	364	353	303	267	61	2.51
Beans	328	325	259	291	69	2.23

Table A4. Inputs by gender of the primary cultivator

	Husband's plots		Wife's plots		Diff.	t-stat	N
	mean	sd	mean	sd			
# Plots per person	4.60	1.94	1.76	1.31	2.8	39.37	2,108
Plot quality*	3.80	0.69	3.71	0.70	0.1	5.03	6,702
Value of inputs**	187.2	228.2	101.4	115.4	85.9	14.10	6,860
Labor hours per season							
by Husband	56.0	59.2	29.0	46.0	27.0	17.56	6,685
by Wife	38.4	45.4	78.1	76.0	-39.7	-26.32	6,689
by Family	52.5	79.4	61.8	93.2	-9.2	-4.00	6,688

Note: * 1 = very poor; 5=very good. **Includes seeds, seedlings, fertilizers, herbicide, fungicide, insecticide. Inputs value and labor hours are winsorized at the top 1%.

Table A5. Piecewise correlation between measures of bargaining power

Panel A: Measures of WBP	Share of expenditures	Free movement	Trusted with money	DM average	Exp. measure 1 (DG)	Exp. measure 2 (RG)
Measures of WBP						
Share of expenditures	1.0000					
Free movement	-0.0023	1.0000				
Trusted with money	0.0026	0.1658***	1.0000			
DM average	-0.0182	-0.0507+	0.0055	1.0000		
Experimental measure 1 (DG)	0.0258	0.0236	-0.006	0.0699**	1.0000	
Experimental measure 2 (Risk)	0.0429	-0.0411	-0.0059	0.0510*	0.0331	1.0000
Determinants of WBP						
Age	0.1983***	0.1053***	0.0497+	0.0814***	0.0187	0.0283
Completed primary	-0.0459	-0.0814***	-0.0532*	0.0275	0.0154	0.0155
Polygamous	-0.0341	0.0388	-0.0824***	0.009	-0.0002	0.0175
First wife	0.0448	-0.0185	0.0391	-0.0203	-0.0147	-0.0303
Owns property/land	0.0487+	-0.0816***	0.0731**	0.0288	-0.0059	-0.0296

Panel B: Determinants of WBP	Age	Completed primary	Polygamous	First wife	Owns property / land
Determinants of WBP					
Age	1.0000				
Completed primary	-0.2274***	1.0000			
Polygamous	0.1659***	-0.0916***	1.0000		
First wife	-0.049	0.0444	-0.6387***	1.0000	
Owns property/land	0.0543*	-0.0056	-0.028	0.0603*	1.0000

Note: + p<0.12, *p<0.10, **p<0.05, ***p<0.01.

Table A6. OLS fixed effects estimates of intrahousehold input allocation

Dependent variable:	Husband Labor Hours (1)	Wife Labor Hours (2)	Other family Labor Hours (3)	Non-Labor Inputs Value (4)
Woman's plot	-33.36***	32.14***	-10.15***	-49.41***
	[1.611]	[1.659]	[2.282]	[7.462]
Observations	6659	6665	6662	6687
R-squared	0.238	0.325	0.138	0.104
Mean of Dep Var in omitted category	48.57	49.44	55.12	165.9

Note: Dependent variable is noted in column header. Non-labor inputs include seeds, seedlings, fertilizers, herbicide, fungicide, insecticide. Value is the sum of the paid amount and the value of free inputs. Regressions control for plot size quintile, soil type, soil quality, plot slope, and household-by-crop fixed effects Standard errors clustered at the household level reported in brackets. *p<0.10, **p<0.05, ***p<0.01.

Table A7. OLS fixed effects estimates of intrahousehold input allocation by level of the women's bargaining power

Interaction term	Share of expenditures	Trusted with money	Free movement
Panel A. Dep. Var.: Family labor hours	(1)	(2)	(3)
Woman's plot	-12.78***	-2.593	-8.684
	[4.529]	[6.318]	[5.838]
Woman's plot x interaction term	5.199	-8.59	-1.713
	[7.793]	[6.684]	[6.261]
Observations	6653	6656	6662
R-squared	0.138	0.138	0.138
Mean of Dep Var	55.16	55.14	55.12
Panel B. Dep. Var.: Value of non-labor inputs	(4)	(5)	(6)
Woman's plot	-85.50***	-40.80**	-80.25***
	[14.79]	[20.70]	[19.10]
Woman's plot x interaction term	72.06***	-9.721	35.93*
	[25.48]	[21.89]	[20.48]
Observations	6678	6681	6687
R-squared	0.106	0.104	0.104
Mean of Dep Var	165.9	165.9	165.9

Note: Regressions control for plot size quintile, soil type, soil quality, plot slope, and household-by-crop fixed effects. Standard errors clustered at the household level reported in brackets. *p<0.10, **p<0.05, ***p<0.01.

Table A8. OLS fixed effect estimates of intrahousehold differences in plot yields by level of preference alignment

Interaction term	Dictator game (DG)		Risk game (RG)	
	Perfect alignment	Near alignment	Perfect alignment	Near alignment
	(1)	(2)	(3)	(4)
Woman's plot	-0.349***	-0.379***	-0.350***	-0.311***
	[0.0474]	[0.0616]	[0.0447]	[0.0502]
Woman's plot x interaction term	0.0497	0.0749	0.140	-0.0985
	[0.105]	[0.0817]	[0.150]	[0.0896]
Observations	6530	6530	6530	6530
R-squared	0.120	0.120	0.120	0.120

Note: The share of households with aligned preferences is 18 percent in the dictator game, and 9 percent in the risk game. The share of households with nearly aligned preferences is 55 percent in dictator game and 30 percent in the risk game. Near alignment considers a 1-choice difference between spouses aligned preferences.*p<0.10, **p<0.05, ***p<0.01.

Table A9. Piecewise correlation between measures of preference alignment and women's bargaining power

	Determinants of women's bargaining power				
	Age	Completed primary	Polygamous	First wife	Owns property/land
Aligned preferences DG	0.0209	0.0157	0.0272	-0.0111	-0.0005
Aligned preferences RG	-0.0363	-0.0072	0.0284	-0.0138	-0.0148
Near alignment DG	-0.0345	0.0852***	0.0446	-0.0366	-0.0276
Near alignment RG	-0.0728**	-0.0172	-0.0399	0.0303	-0.022
	Survey measures of women's bargaining power				
		Share of expenditures	Free movement	Trusted with money	DM average
Aligned preferences DG		-0.0029	-0.0059	0.0251	0.0472
Aligned preferences RG		0.0143	-0.0577*	0.0225	0.0468
Near alignment DG		-0.0257	-0.0035	-0.0006	0.0012
Near alignment RG		-0.0021	-0.0543*	0.0477	-0.0012

Note: We do not present the correlation between our experimental measures of bargaining power and preference alignment because they are correlated by design given that the experimental measures acquire the value of 1 when the wife's private and joint decisions coincide (which happens when spouses have perfectly aligned preferences and make the same choice in private and in public when they make joint decisions after discussing with each other). Near alignment allows a 1-choice deviation in choices between spouses.

Appendix B. Experimental measures of bargaining power

I. Experimental design

To measure the preference alignment and bargaining power of spouses we conducted a lab-in-the-field experiment with spouses that elicited incentivized choices from individuals privately and then jointly with their spouse.[15]

The lab-in-the-field experiment administered the same treatment to all spouses. The session structure used in all villages was composed of 3 parts. Participants knew at the time they were making their decisions that one part would be randomly selected to count for payment, and that if the task had multiple decisions made by spouses, one decision would be randomly selected to be paid. Data from part 2 is not used in this paper, so we skip its discussion. No feedback was provided to participants between decisions throughout the duration of the session. The specific script used to elicit decisions is provided in section C.

Part 1

Part 1 consisted of a lottery. The lottery was implemented by asking participants to select a card from a deck that contained cards with pre-assigned random values between 0 and 21 GHC. The card chosen by each person determined the payoff of their spouse if part 1 was selected to be paid. No feedback was given to respondents about the value of the card randomly selected by themselves or their spouse. The objective of Part 1 was to ensure the privacy of decisions made by spouses, given that the outcome of any choice from Part 2 and 3 could have resulted from the lottery outcome of part 1. It was conducted first to be able to explain to participants throughout the rest of the session that privacy was always ensured in the experiment through the lottery selected in part 1.

Part 3

Part 3 had subjects make 5 decisions, 3 were elicited privately from each spouse and 2 were elicited jointly from both spouses together. Decision 1 was a private dictator game decision. Subjects were asked to divide 14 GHC given to the household between themselves and their spouse. Allocations had to be done in 2 GHC increments, so the 50-50 split was not an option. Decision 2, was a private risk decision game, constructed following Gneezy and Potters (1997). We gave subjects a 7 GHC endowment and asked them to decide how much if any of it they wished to invest in an account that paid 3 times the amount invested half of the time and 0 half of the time. Investments could be done in 1 GHC increments. The outcome was determined by flip of a coin, and all earnings from the decision were paid to the decision-maker if this choice was randomly selected to be paid. Decision 3 was instead a private household risk decision. It was similar to decision 2 in all aspects except that now the 7 GHC were for the household not for the individual, and earnings from the decision were equally split between the two spouses. The order of decision 2 and 3 was randomized.

[15] The design is similar to that employed by Schaner (2017), but adds decisions within the domain of risk-taking.

For decisions 4 and 5 spouses were brought together to the same interview booth, where one enumerator elicited both decisions. Decision 4 was a joint dictator game decision, made by both spouses together. Decision 5 was a joint household risk game decision. Decision 4 and 5 explained choices exactly in the same manner as in the private decision scenario but now allowed spouses to decide jointly. Spouses were given time to talk in private, and had to call the enumerator to finalize their decision.

Payment

After spouses made all incentivized decisions they were privately paid by different enumerators. At the time of payment, they were asked a few additional non-incentivized questions about the decisions they made.

II. Experimental procedures

All spouses who expressed interest in being part of the randomized control trial were invited to participate in a "meeting". This meeting was the lab experiment where incentivized decisions were elicited. Invitations were made in person by an enumerator 1 or 2 days before the date of the session. Spouses were informed at the time of invitation that they could earn money by attending the meeting, and that the two spouses invited had to be the ones attending to be able to participate. A minimum show-up fee of 3 GHC was guaranteed for each person for attending the meeting.

Meetings were conducted in a central location in each village. Various sessions were administered in a village if necessary at different times. Upon arrival to a session, participants were asked to wait to be privately interviewed. The waiting area was separate from the interview area, and from the payment area. We prevented communication between participants waiting to be interviewed and those who already participated in the one on one meeting at all times.

Private decisions were elicited from both spouses by two enumerators who privately interviewed spouses at the same time. Each interview was conducted in an interview booth that ensured privacy. Twelve enumerators simultaneously conducted interviews in each meeting. Enumerators were matched in pairs for the duration of data collection and were randomly assigned to couples in each village. Which enumerator interviewed the husband or the wife was rotated within each enumerator pair. We had a total of 3 female and 9 male enumerators eliciting incentivized decisions in the lab-in-the-field experiment. A complete interview with two spouses took approximately 30 minutes to complete.

III. Script

Hello. My name is _____, I am a representative from _____ and am here to assist in this data collection exercise which is part of the research project being conducted with _____.

Today's meeting will be divided in 3 tasks. In each task you will have to make one or more decisions in exchange for money. At the end of the meeting one of the 3 tasks will be randomly selected to count for payment. Which task counts for payment will be determined by the computer. We use a computer to determine which task is paid to ensure that everything is done in a fair and

unbiased manner. Which task is paid will not be revealed to you or your ${spouse} to ensure that the choices that you make are private.

Any additional money that you earn will be will be paid to you in cash and in private at the end of the meeting. It is up to you whether you decide to tell your ${spouse} how much you earn or not. Even if you do choose to tell your ${spouse} how much you earned, there is no way that he/she will be able to know what decisions you made. This is because only one of the 3 tasks will be randomly chosen for payment, and one of these tasks is a lottery.

We will now proceed with task 1.

Task 1

Your task is to select a card from this set. The card that you select will determine the earnings that your ${spouse} will receive if this task is paid. Your ${spouse} will be asked to make a similar choice, and the card that he or she draws will determine the payment that you will receive.

These are the cards: << Show them >>. They have a value between 0 and 21GHC.

Each card is associated with a unique value. We will not reveal to you the value of the card that you draw. Likewise, we will not reveal to your ${spouse} the value of the card that your ${spouse} draws.

For example:

- This card may have a value of 21 GHC << show the card >>
- This card may have a value of 20.5 GHC << show the card >>
- This card may have a value of 20 GHC << show the card >>
- This card may have a value of 19.5 GHC << show the card >>
- And so on.

Since all values between 0 and 21 are equally likely to be selected, you and your ${spouse} can each receive any sum between 0 GHC and 21 GHC if this task is paid.

For example:

- You may both receive 0 GHC.
- You may both receive 0.5 GHC.
- You may both receive 1 GHC, and so on.

It is also possible that:

- You receive 0 GHC while your ${spouse} receives 0.5 GHC
- You receive 0 GHC while your ${spouse} receives 1 GHC.
- You receive 0 GHC while your ${spouse} receives 1.5 GHC.
- You receive 0 GHC while your ${spouse} receives 21 GHC

- OR
- You receive 21 GHC while your ${spouse} receives 0 GHC.

Any combination of values between 0 and 21 GHC is thus possible.

Please select a card, by pointing to it. Please do not flip it or look at its letter value.

<< Record choice, but do NOT show value to participant >>

Remember that this may be the task that is randomly selected for your payment. Therefore, when all tasks are completed, even if your ${spouse} knows how much you earn, he/she will still not know what decisions you have made in tasks 2 and 3.

For example, if a wife receives a high payment at the end, her husband cannot think this means that the wife mostly chose to keep money for herself. It could simply be the case that task 1 was chosen for payment and she got a high-value card draw. The same would apply to a husband, who receives a high payment in the end. The wife cannot think that the husband mostly chose to keep money for himself. It could simply be the case that task 1 was chosen for payment and he got a high value card draw.

We will now proceed with task 2.

Task 2 (omitted)

Task 3

In this task you and your ${spouse} will make a total of 8 decisions. Each time you will have to decide how much money you would like to keep and how much you would like to allocate to another option. One of the 8 decisions that you and your ${spouse} make will be randomly selected to determine payments if this task is paid. All of the decisions are equally likely to be paid.

Do you have any questions? << Answer questions >>

We will now proceed with decision 1.

Decision 1 – Individual allocation decision

We would like to give 14 GHC to your household and would like to know how you would like divide this money between you and your ${spouse}. You can divide the money in 2 GHC increments.

For example, you can choose…

<< Show choices on visual aid booklet. Start at the top for husband and at the bottom for wife.>>

- 14 GHC for you and 0 GHC for your ${spouse}

- 12 GHC for you and 2 GHC for your ${spouse}
- 10 GHC for you and 4 GHC for your ${spouse}
- And so on…
- You can also choose 0 GHC for you and 14 GHC for your ${spouse}

If you give your ${spouse} 2GHC, how much would you get? << Check understanding and repeat explanation if necessary >>

Remember, there are no right or wrong decisions. Any allocation decision that you make is acceptable and is private. Privacy is ensured by the fact that any possible allocation that you can make could also have resulted if task 1 was paid. You and your ${spouse} will not know which task was paid.

Do you have any questions before we proceed? << Answer questions >>

Now please tell me, if this decision is the only one paid, what decision you would like to make? Please point to it on the menu.

<< Record decision >>

We will now proceed with decision 2.

Decision 2 (form A) – Individual investment decision, self[16]

We have 7 GHC to give YOU and would like to give you the opportunity to invest all, part, or none of the 7 GHC in account that multiplies your investment by 3 half of the time and by 0 half of the time. Whether the money you invest is multiplied by a factor of 3 will be determined by the flip of a coin. If the outcome is HEADS then your investment will be multiplied by 3. If it is TAILS you will lose your money. The flip of the coin will be done by the computer to ensure that everything is done in a fair an unbiased manner.

Your investment can be made in increments of 1 GHC. All earnings from this decision will be paid to YOU exclusively. << Show individual icon >>

These are your possible investment choices: << Show visual aid page 1 >>

- You could invest 0 GHC and keep all 7 GHC. Then YOU would get nothing from your investment decision.
- You could invest 1 GHC and keep 6 GHC. Then YOU would get 0 GHC from your investment decision if it the outcome of the coin flip is TAILS, and 3 if it is HEADS. This in addition to the money you kept.
- You could invest 2 GHC and keep 5 GHC. Then YOU would get 0 GHC from your investment decision if it the outcome of the coin flip is TAILS, and 6 GHC if it is HEADS. This in addition to the money you kept.

[16] Form B reversed the order of decision 2 and 3. Forms A and B were randomized across respondents.

- And so on…
- You could also invest 7 GHC and keep 0 GHC. Then YOU would get 0 GHC from your investment if the outcome of the coin flip is TAILS, and 21 GHC if it is HEADS.

Adding what you keep and what you get from each possible investment opportunity we have the following table. << Show visual aid page 2 >>

It shows the total earnings associated with all possible investment scenarios.

- You could invest 0 GHC and keep all 7 GHC. Then YOU would earn 7 GHC if the outcome of the coin flip is TAILS or HEADS.
- You could invest 1 GHC and keep 6 GHC. Then YOU would earn 6 GHC if the outcome of the coin flip is TAILS, and 9 GHC if it is HEADS.
- You could invest 2 GHC and keep 5 GHC. Then YOU would earn 5 GHC if the outcome of the coin flip is TAILS and 11 GHC if it is HEADS.
- And so on…
- You could also invest all 7 GHC and keep 0 GHC. Then YOU would earn 0 GHC if the outcome of the coin flip is TAILS and 21 GHC if it is HEADS.

If you invest 2GHC, how much would you get if the outcome of the coin flip is TAILS? If the outcome of the coin flip is HEADS? << Check understanding and repeat explanation if necessary >>

If you invest 5GHC, how much would you get if the outcome of the coin flip is TAILS? If the outcome of the coin flip is HEADS? << Check understanding and repeat explanation if necessary >>

As I said before, all of the earnings from this decision would be paid to YOU. << Show individual icon >>

Do you have any questions? << Answer questions >>

Remember, there are no right or wrong decisions. Any amount that you want to invest is acceptable and is private. Privacy is ensured by the fact that any possible outcome of your decision could also have resulted if task 1 was paid. You and your ${spouse} will not know which task is paid.

Now please tell me, if this decision is the only one paid, what amount, if any, would you like to invest? Please point to the choice on the menu.

<< Record choice >>

Decision 3 (form A) – Individual investment decision, household

Now I am going to give you the same investment opportunity as before, but now all earnings from the decision will be equally split between YOU AND YOUR ${SPOUSE}. << Should household icon >>

We have 7 GHC to give to your household and would like to give you the opportunity to invest all, part, or none of the 7 GHC in account that multiplies your investment by 3 half of the time and by 0 half of the time.

The possible choices and associated returns are the same as before << Show visual aid page 1 >>

The total payoffs associated with each choice are also the same << Show visual aid page 2 >>

The only difference is that the earnings from this decision would be equally split between YOU AND YOUR ${SPOUSE}. << Show household icon >>

Remember, there are no right or wrong decisions. Any amount that you want to invest is acceptable and is private. Privacy is ensured by the fact that any possible outcome of your decision could also have resulted if task 1 was paid. You and your ${spouse} will not know which task is paid.

Now please tell me, if this decision is the only one paid, what amount, if any, would you like to invest? Please point to the choice on the menu.

<< Record choice >>

We will now proceed with decisions 4 and 5, which will be jointly made by you and your ${spouse}. Your ${spouse} will have made the same decisions that you have made but will NOT know the choices you have made.

Please wait / follow me.

<< Send participant to the booth of the enumerator who will be eliciting the joint decisions,
or wait for both spouses to come to you if you are eliciting the joint decisions. >>

Decision 4 – Joint allocation decision

We are now going to ask you to make the same allocation decision you did before. << Show visual aid >>

We have 14 GHC to give to your household and would like to know how you would like divide this money between the both of you. The division will be made in increments of 2 GHC.

Do you have any questions? << Answer questions >>

I am now going to give you some privacy so that you can make your decision. Here is the menu of possible choices. Please take it with you and consider how you would like to divide the money if this was the only decision paid. The decision that you make together will be private, we will not reveal it to anyone else.

<< Leave spouses alone for a few minutes so that they can make a private choice and keep track of the time they take to reach a decision. >>

Please tell me, if this decision is the only one paid, what choice did you make? Please point to it on the menu.

<< Record decision >>

Decision 5 – Joint investment decision

We are now going to ask you to make the same investment decision you did before. << Show visual aid >>

We have 7 GHC to give to YOUR HOUSEHOLD and would like to give you the opportunity to invest all, part, or none of the 7 GHC in account that multiplies your investment by 3 half of the time and by 0 half of the time.

The possible choices and associated returns are the same as before << Show visual aid page 1 >>

The total payoffs associated with each choice are also the same << Show visual aid page 2 >>

The earnings from this decision would be equally split between YOU AND YOUR ${SPOUSE}. << Show household icon >>

Do you have any questions? << Answer questions >>

I am now going to give you some privacy so that you can make your decision. Here is the menu of possible choices. Please take it with you and consider how much you would like to invest if this decision is the only one paid. The decision that you make together will be private, we will not reveal it to anyone else.

<< Leave spouses alone for a few minutes so that they can make a private choice and keep track of the time they take to reach a decision. >>

Now please tell me, if this decision is the only one paid, what amount, if any, would you like to invest? Please point to the choice on the menu.

<< Record decision >>

Thank you. I will now ask that you wait for a few minutes in _____ << Indicate place >> until we calculate the payment that each of you should receive. We are going to pay you separately and in private. You can leave once we pay you.

<< Give payment enumerator the payment forms and inform registration desk that they can start eliciting the consent of a new set of respondents. >>

Payment

<<To be read once data from the decision forms has been entered into the tablet and the payment questionnaire for the respondent is pulled up >>

Ok. Please come with me.

<< Take participant to a private setting >>

This is your 3 GHC show-up fee. << Pay participant the show up fee >>

These are your decision earnings << Pay participant his or her decision earnings >>.

We are giving them to you separately because we want to make sure that you can keep your choices private. You can put it away now. << Encourage participant to put away the money>>

Remember that all the choices you made today are private. Your ${spouse} does not know what individual choices you made or how much money you have earned. Likewise, you do not know what individual choices your ${spouse} has made or how much money your ${spouse} has earned. Your ${spouse}, just like you, may have received as little as 3 GHC or as much as 24 GHC (including the show-up fee) due to task 1.

Please sign this receipt.