

FAIRNESS AND EFFICIENCY IN SMALLHOLDER FARMING: THE RELATION WITH INTRAHOUSEHOLD DECISION- MAKING

APPENDIX 1 – EXTERNAL VALIDITY CHECK WITH MASAKA DATA

The Masaka dataset includes 362 couples. Data was collected between February and April 2017. The first stage of the experiment conducted in Masaka consisted of a voluntary contribution mechanism game similar to this study but played with an endowment of 10 tokens; worth 500 UGX when kept, 750 UGX when invested. The subsequent stage for measuring sharing behaviour differed in the fact that each spouse took a share from a separate (but equally high) pool of 10 tokens, rather than a pool generated in the first stage. We classified the couples according to the following criteria: In ‘Fair Co-operator’ (FC*) couples: $I_{im}/I_{iw} > 5/10 \text{ tokens} \wedge C_{im}/C_{iw} < 5$; ‘Co-operator but not fair’ couples (NFC*): $I_{im}/I_{iw} > 5/10 \text{ tokens} \wedge C_{im} + C_{iw} < 10$; in couples with a ‘Freeriding Husband’ (FRHB*): $I_{im} \leq 5/10 \text{ tokens} \wedge C_{im} \geq 5$, with a ‘Freeriding Wife’ (FRW*): $I_{iw} \leq 5/10 \text{ tokens} \wedge C_{iw} \geq 5$ (‘Other’ couples (O*) have no clear-cut strategies) (Visualised in Figure 2 available in Supplementary Materials 1). We ran (un-matched) bivariate analyses of the relation between intrahousehold rules of the game and respectively actual investments, resource allocation and household achievements (Descriptive statistics of behaviour by type of couple in Table 6 available in Supplementary Materials 1).

Intrahousehold Rules of the Game and Actual Investments in the Common Household Farm

In the Masaka sample, as in this study in Kasese, adoption rates of trenches and terraces, pruning/desuckering, inorganic inputs (fertiliser in this case) for coffee production by FRW*couples are relatively low (Table 7 available in Supplementary Materials 1). As in this study, adoption rates by FC*, NFC* and FRHB* couples are relatively high; except that FRHB* couples have low adoption rates of compost or manure. Generally, mulch and inorganic inputs are not widely applied.ⁱ

Intrahousehold Rules of the Game and Actual Resource Allocation

In correspondence with findings in this study, few couples in the Masaka sample, regardless of type, agree that the plots on which cash crops are grown are jointly owned (Table 8 available in Supplementary Materials 1). Yet, FC* and NFC* couples are slightly (but significantly) more likely to agree they jointly own the plots on which food crops are grown than FRW* and FRHB* couples, none of which agrees upon joint ownership of food crop plots.

While the proportion of couples agreeing on jointly receiving the money from selling their most important cash crop is generally lower in the Masaka sample than in this study’s sample, in correspondence with this study, it is relatively high among FC* couples (Table 8 available in Supplementary Materials 1). Yet, in the Masaka sample, that proportion is highest among FRW* couples and lowest among NFC* couples.

In the Masaka sample, men’s share of time spent on productive activities is higher than women’s, whereas in this study men’s and women’s share of time is similar (Table 8 available in Supplementary Materials 1). The fact that, in Masaka, the data was collected during planting season, rather than during weeding season, as was the case in Kasese, could be

one of the reasons for that difference. But, in correspondence with this study's findings, there is not much difference across types of couples, except for FRW* couples in which husband and wife spend a more similar share of time on productive activities (which comes at the expense of the share of time women spend on leisure). While we did not observe this in the Kasese sample used in this study, the excess time women in FRHB* couples spend on reproductive activities is significantly longer than in FC* and NFC* couples in the Masaka sample.

The Relation between Intrahousehold Rules of the Game and Household Achievements

As compared to people in Kasese included in this study, in the Masaka sample, people are generally more pessimistic about their current household food security situation and the evolution thereof (over one year, in this case) (Table 9 available in Supplementary Materials 1). Less than one fifth of husbands and wives, regardless of the type of couple, consider their household currently food secure. In this case, husbands in FRHB* couples are more optimistic, as one quarter of them thinks their household is food secure. In correspondence with this study's findings, the proportion of husbands and wives that believe their household food security increased over time is relatively high among FC* and NFC* couples.

In correspondence with this study, husbands and wives in FC*, NFC* and FRHB* couples in the Masaka sample are most optimistic about their households' current relative wellbeing (Table 9 available in Supplementary Materials 1). Fewer husbands and wives in FRW* couples believe their household is relatively well off and few of them think their households' wellbeing improved over time (over one year). Around 35 to 40 per cent of wives and husbands in FC*, NFC* report a rising trend in wellbeing. Wives in FRHB* couples are less optimistic and husbands more. As in this study, women and men in FC* and NFC* couples perceive cooperation in the household as an important reason for improving their households' wellbeing over time.

ⁱ The data from Masaka did not allow checking adoption rates for cassava production nor adoption rates of improved seed(lings), shade trees, pesticides and herbicides for coffee production. The number of practices adopted for coffee can be maximum eight in this case.

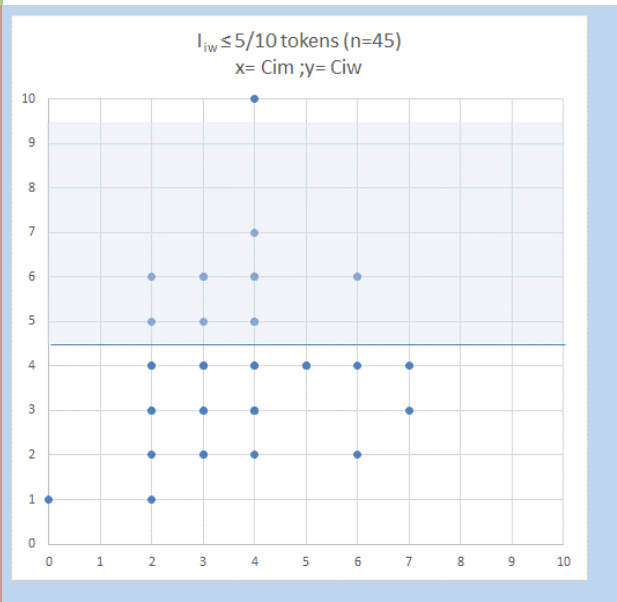
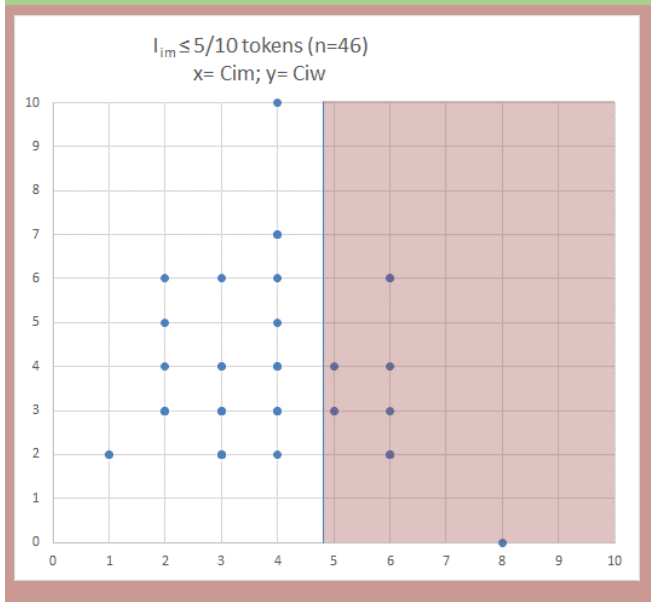
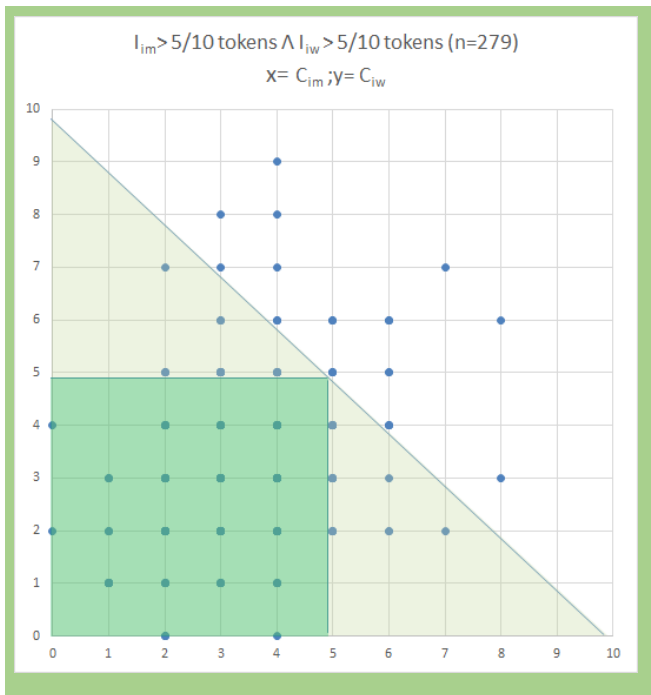


Figure 2: Classification of couples in the Masaka sample based on their behaviour in the Masaka experiment

	Type of couple	N	Avg.	St.Dev.	Sig. diff.				
					O*	FC*	NFC*	FRHB*	FRW*
I _{im} (tokens)	O*	83	5.96	1.48	-	-	-	-	-
	FC*	200	7.10	0.96	***	-	-	-	-
	NFC*	52	6.65	0.76	***	***	-	-	-
	FRHB*	12	4.17	1.03	***	***	***	-	-
	FRW*	15	6.27	1.22		***		***	-
I _{iw} (tokens)	O*	83	6.28	1.46	-	-	-	-	-
	FC*	200	7.23	0.91	***	-	-	-	-
	NFC*	52	6.87	0.86	***	***	-	-	-
	FRHB*	12	6.42	1.44		***		-	-
	FRW*	15	4.20	1.26	***	***	***	***	-
C _{im} (tokens)	O*	83	3.92	1.60	-	-	-	-	-
	FC*	200	2.80	0.97	***	-	-	-	-
	NFC*	52	4.10	1.22		***	-	-	-
	FRHB*	12	5.92	0.79	***	***	***	-	-
	FRW*	15	3.60	0.99		***	^	***	-
C _{iw} (tokens)	O*	83	4.10	1.74	-	-	-	-	-
	FC*	200	2.47	1.00	***	-	-	-	-
	NFC*	52	4.15	1.27		***	-	-	-
	FRHB*	12	3.08	1.73	**		**	-	-
	FRW*	15	6.00	1.25	***	***	***	***	-

*** significance level 1 percent; ** 5 percent; * 10 percent; ^ 15 percent; T-test for equality of means.

Type of couples: FC*= Fair Co-operator; NFC*= Co-operator but not fair; FRHB*= with Freeriding Husband; FRW*=with Freeriding Wife; O*= Other.

Table 6: Descriptive statistics of behaviour in the experiment by type of couple in the Masaka sample

		Masaka sample:				Sig. diff. O* FC* NFC* FRHB* FRW*				Kasese sample:				Sig. diff. O FC NFC FRHB FRW					
Coffee production	Effect on productivity: on longer term	Type of N couple	Adoption rate						Type of N couple	Adoption rate	St.E.	Sig.							
Labour intensive	Trenches, terraces	O*	82	0.476	-	-	-	-	-	O	58	0.948		-	-	-	-	-	
		FC*	199	0.417	***	-	-	-	-	FC	28	0.851	0.098	***	-	-	-	-	
		NFC*	52	0.547		***	-	-	-	NFC	15	0.939	0.049	***		-	-	-	
		FRHB*	12	0.500	***	***	***	-	-	FRHB	16	0.979	0.021	***			-	-	
		FRW*	15	0.200	***	***	***	-	-	FRW	13	0.956	0.040	***				-	
on shorter term																			
Cash intensive	Inorganic inputs	O*	82	0.159	-	-	-	-	-	O	58	0.207		-	-	-	-	-	
		FC*	199	0.166	***	-	-	-	-	FC	28	0.145	0.063	**	-	-	-	-	
		NFC*	52	0.170		***	-	-	-	NFC	15	0.147	0.082	*		-	-	-	
		FRHB*	12	0.083	***	***	**	-	-	FRHB	16	0.285	0.134	**			-	-	
		FRW*	15	0.067	***	***	**	-	-	FRW	13	0.009	0.010		***	**	*	**	-
	Mulch	O*	82	0.098	-	-	-	-	-	O	58	0.483		-	-	-	-	-	
		FC*	199	0.090	**	-	-	-	-	FC	28	0.563	0.114	***	-	-	-	-	
		NFC*	52	0.057	^	***	-	-	-	NFC	15	0.509	0.160	***		-	-	-	
		FRHB*	12	0.167	*	***	-	-	-	FRHB	16	0.483	0.158	***			-	-	
		FRW*	15	0.067	**	***	-	-	-	FRW	13	0.092	0.073		***	***	**	**	-
Labour intensive	Manure, compost	O*	82	0.281	-	-	-	-	-	O	58	0.190		-	-	-	-	-	
		FC*	199	0.317	***	-	-	-	-	FC	28	0.064	0.036	*	**	-	-	-	
		NFC*	52	0.359		***	-	-	-	NFC	15	0.046	0.046		**	-	-	-	
		FRHB*	12	0.083	***	***	***	-	-	FRHB	16	0.428	0.162	***		**	**	-	
		FRW*	15	0.267	***	***	***	-	-	FRW	13	0.033	0.031		**		**	-	
	Intercropping	O*	82	0.402	-	-	-	-	-	O	58	0.448		-	-	-	-	-	
		FC*	199	0.518	***	-	-	-	-	FC	28	0.537	0.113	***	-	-	-	-	
		NFC*	52	0.509		***	-	-	-	NFC	15	0.602	0.168	***		-	-	-	
		FRHB*	12	0.583	***	***	***	-	-	FRHB	16	0.692	0.109	***	**		-	-	
		FRW*	15	0.533	***	***	***	-	-	FRW	13	0.092	0.078		***	***	***	***	-
	Pruning / Desuckering	O*	82	0.817	-	-	-	-	-	O	58	0.879		-	-	-	-	-	
		FC*	199	0.779	***	-	-	-	-	FC	28	0.833	0.072	***	-	-	-	-	
		NFC*	52	0.736	***	***	-	-	-	NFC	15	0.800	0.114	***		-	-	-	
		FRHB*	12	0.750	***	***	***	-	-	FRHB	16	0.860	0.061	***			-	-	
		FRW*	15	0.733	***	***	***	-	-	FRW	13	0.189	0.139		***	***	***	***	-
Total number adopted practices ⁱ		O*	82	3.146	-	-	-	-	-	O	58	1.931			-	-	-	-	
		FC*	199	3.201		-	-	-	-	FC	28	1.824	0.297	***	-	-	-	-	
		NFC*	52	3.321			-	-	-	NFC	15	1.405	0.212	***	**		-	-	
		FRHB*	12	3.167				-	-	FRHB	16	2.615	0.716	***			^	-	
		FRW*	15	2.867					-	FRW	13	0.291	0.223		***	***	***	***	-

*** significance level 1 percent; ** 5 percent; * 10 percent; ^ 15 percent; Adjusted Wald test (Masaka); teffects IPW in STATA13 (Kasese).

Type of couples: FC*= Fair Co-operator; NFC*= Co-operator but not fair; FRHB*= with Freeriding Husband; FRW*=with Freeriding Wife; O*= Other.

Table 7: Adoption rates of sustainable intensification practices for coffee production in the Masaka sample (compared to IPW estimates in the Kasese sample)

	Masaka sample:								Kasese sample:								Sig. diff.							
	Type of couple	of N	Proportion	Sig. O*	diff. FC*	NFC*	FRHB*	FRW*	Type of couple	of N	Proportion	St.E.	Sig. O	diff. FC	NFC	FRHB	FRW							
Sharing resources																								
Agreed upon joint ownership of food crop plots	O*	82	0.012	-	-	-	-	-	O	70	0.214		-	-	-	-	-							
	FC*	199	0.030	*	-	-	-	-	FC	33	0.106	0.052	**	^	-	-	-							
	NFC*	52	0.057		-	-	-	-	NFC	18	0.060	0.050		**	-	-	-							
	FRHB*	12	0.000		**	*	-	-	FRHB	18	0.203	0.143			-	-	-							
	FRW*	15	0.000		**	*	-	-	FRW	16	0.016	0.017		***	^	-	-							
Agreed upon joint ownership of cash crop plots	O*	82	0.000	-	-	-	-	-	O	70	0.186		-	-	-	-	-							
	FC*	199	0.005		-	-	-	-	FC	33	0.049	0.032	^	**	-	-	-							
	NFC*	52	0.000			-	-	-	NFC	18	0.133	0.083	^		-	-	-							
	FRHB*	12	0.000				-	-	FRHB	18	0.029	0.028		***	-	-	-							
	FRW*	15	0.000				-	-	FRW	16	0.027	0.026		***		-	-							
Agreed upon joint reception of cash crop income	O*	82	0.074	-	-	-	-	-	O	70	0.229		-	-	-	-	-							
	FC*	199	0.091	**	-	-	-	-	FC	33	0.336	0.083	***		-	-	-							
	NFC*	52	0.059		***	-	-	-	NFC	18	0.537	0.098	***	***	^	-	-							
	FRHB*	12	0.083	*	***		-	-	FRHB	18	0.221	0.110	**			**	-							
	FRW*	15	0.133		***		-	-	FRW	16	0.060	0.058		**	***	***	-							
Time allocation																								
Avg.																								
Difference in time share allocated to agricultural activities	O*	82	0.261	-	-	-	-	-	O	70	0.047		-	-	-	-	-							
	FC*	199	0.216		-	-	-	-	FC	33	0.011	0.039			-	-	-							
	NFC*	52	0.226			-	-	-	NFC	18	0.128	0.067	*		^	-	-							
	FRHB*	12	0.302		^		-	-	FRHB	18	0.021	0.041				-	-							
	FRW*	15	0.108	**	^	^	**	-	FRW	16	0.107	0.068	^				-							
Difference in time share allocated to reproductive activities	O*	82	-0.266	-	-	-	-	-	O	70	-0.242		-	-	-	-	-							
	FC*	199	-0.257		-	-	-	-	FC	33	-0.244	0.028	***		-	-	-							
	NFC*	52	-0.260			-	-	-	NFC	18	-0.201	0.055	***			-	-							
	FRHB*	12	-0.331	*	**	*	-	-	FRHB	18	-0.175	0.030	***	*	*		-							
	FRW*	15	-0.260				-	-	FRW	16	-0.184	0.054	***				-							
Difference in time share allocated to leisure	O*	82	0.005	-	-	-	-	-	O	70	0.111		-	-	-	-	-							
	FC*	199	0.041		-	-	-	-	FC	33	0.101	0.032	***		-	-	-							
	NFC*	52	0.034			-	-	-	NFC	18	0.144	0.041	***			-	-							
	FRHB*	12	0.029				-	-	FRHB	18	0.115	0.034	***				-							
	FRW*	15	0.152	**	*	*	*	-	FRW	16	0.068	0.021	***			*	-							

*** significance level 1 percent; ** 5 percent; * 10 percent; ^ 15 percent; Adjusted Wald test (Masaka); teffects IPW in STATA13 (Kasese).

Type of couples: FC*= Fair Co-operator; NFC*= Co-operator but not fair; FRHB*= with Freeriding Husband; FRW*=with Freeriding Wife; O*= Other.

Table 8: Sharing resources and intrahousehold time allocation in the Masaka sample (compared to IPW estimates in the Kasese sample)

Household food security	Masaka sample:							Kasese sample:										
	Type of couple	N	Proportion	Sig. O*	diff. FC*	NFC*	FRHB*	FRW*	Type of couple	N	Proportion	St.E.	Sig.	Sig. O	diff. FC	NFC	FRHB	FRW
Currently food secure (reported by wife)	O*	82	0.143	-	-	-	-	-	O	70	0.300			-	-	-	-	-
	FC*	199	0.164		-	-	-	-	FC	33	0.548	0.094	***	**	-	-	-	-
	NFC*	52	0.163			-	-	-	NFC	18	0.461	0.132	***			-	-	-
	FRHB*	12	0.167				-	-	FRHB	18	0.185	0.079	**		***	*	-	-
	FRW*	15	0.133					-	FRW	16	0.046	0.037		***	***	***	*	-
Currently food secure (reported by husband)	O*	82	0.126	-	-	-	-	-	O	70	0.371			-	-	-	-	-
	FC*	199	0.179		-	-	-	-	FC	33	0.501	0.106	***		-	-	-	-
	NFC*	52	0.160			-	-	-	NFC	18	0.733	0.111	***	***	Λ	-	-	-
	FRHB*	12	0.250				-	-	FRHB	18	0.287	0.104	***		Λ	***	-	-
	FRW*	15	0.000	Λ	*	Λ	**	-	FRW	16	0.853	0.114	***	***	**		***	-
Food security improved over time (reported by wife)	O*	82	0.131	-	-	-	-	-	O	70	0.300			-	-	-	-	-
	FC*	199	0.180		-	-	-	-	FC	33	0.539	0.097	***	**	-	-	-	-
	NFC*	52	0.163			-	-	-	NFC	18	0.268	0.092	***		**	-	-	-
	FRHB*	12	0.083				-	-	FRHB	18	0.389	0.138	***				-	-
	FRW*	15	0.000	Λ	*	Λ		-	FRW	16	0.802	0.139	***	***	Λ	***	**	-
Food security improved over time (reported by husband)	O*	82	0.126	-	-	-	-	-	O	70	0.400			-	-	-	-	-
	FC*	199	0.149		-	-	-	-	FC	33	0.489	0.100	***		-	-	-	-
	NFC*	52	0.180			-	-	-	NFC	18	0.545	0.115	***			-	-	-
	FRHB*	12	0.083				-	-	FRHB	18	0.315	0.139	**				-	-
	FRW*	15	0.000	Λ	Λ	*		-	FRW	16	0.545	0.237	**					-
Subjective household wellbeing																		
Relatively well off (reported by wife)	O*	82	0.169	-	-	-	-	-	O	70	0.371			-	-	-	-	-
	FC*	199	0.348	***	-	-	-	-	FC	33	0.342	0.095	***		-	-	-	-
	NFC*	52	0.294	*		-	-	-	NFC	18	0.339	0.089	***			-	-	-
	FRHB*	12	0.375	*			-	-	FRHB	18	0.382	0.129	***				-	-
	FRW*	15	0.273					-	FRW	16	0.036	0.030		***	***	***	***	-
Relatively well off (reported by husband)	O*	82	0.226	-	-	-	-	-	O	70	0.357			-	-	-	-	-
	FC*	199	0.272		-	-	-	-	FC	33	0.591	0.089	***	**	-	-	-	-
	NFC*	52	0.316			-	-	-	NFC	18	0.352	0.098	***		*	-	-	-
	FRHB*	12	0.556	**	**	Λ		-	FRHB	18	0.376	0.122	***				-	-
	FRW*	15	0.167				**	-	FRW	16	0.008	0.009		***	***	***	***	-
Wellbeing improved over time (reported by wife)	O*	82	0.277	-	-	-	-	-	O	70	0.700			-	-	-	-	-
	FC*	199	0.429	**	-	-	-	-	FC	33	0.713	0.081	***		-	-	-	-
	NFC*	52	0.388			-	-	-	NFC	18	0.684	0.106	***			-	-	-
	FRHB*	12	0.250				-	-	FRHB	18	0.729	0.109	***				-	-
	FRW*	15	0.200		*			-	FRW	16	0.883	0.088	***	*				-
Wellbeing improved over time (reported by husband)	O*	82	0.322	-	-	-	-	-	O	70	0.757			-	-	-	-	-
	FC*	199	0.359		-	-	-	-	FC	33	0.803	0.067	***	Λ	-	-	-	-
	NFC*	52	0.400			-	-	-	NFC	18	0.819	0.087	***			-	-	-
	FRHB*	12	0.500				-	-	FRHB	18	0.705	0.120	***				-	-
	FRW*	15	0.133	Λ	*	*	**	-	FRW	16	0.899	0.078	***					-

*** significance level 1 percent; ** 5 percent; * 10 percent; ^ 15 percent; Adjusted Wald test (Masaka); teffects IPW in STATA13 (Kasese).

Type of couples: FC*= Fair Co-operator; NFC*= Co-operator but not fair; FRHB*= with Freeriding Husband; FRW*=with Freeriding Wife; O*= Other.

Table 9: (Evolution of) households food security and wellbeing in the Masaka sample (compared to IPW estimates in the Kasese sample)

