HOUSEHOLD DECISION MAKING AND TECHNOLOGICAL ADOPTION

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INTRODUCTION

- **Previous project** conducted in Mali: what are the effects of technological adoption (or growing land pressure) on **household structure and composition**? (WIDER paper 2011/11)

→ Punchline: technological adoption fosters the individualization of agricultural production (within large and complex households) by raising the efficiency losses associated with collective production.

- The (very) new project I focus on today takes the household structure as given and asks **how individual members interact to take decisions** related to technological adoption. (Joint project with **Jean-Marie Baland, Ludovic Bequet et Clarice Ronas**)

INTRODUCTION

- There is a large literature on **household determinants** of technological adoption, **risk preferences** in particular (Feder, 1980, Feder, Just and Zilberman, 1985, Liu 2013).
- **Intra-household decision making processes are largely ignored**, only the head's risk preferences are typically considered (Magnan et. al., 2014, is an exception) .
- This is at odd with level of sophistication of models of inter-household relationship (**network** analysis) used to explain adoption (recent review of the large literature on agricultural extension by DeJanvry et al. 2016, recent experiment by Beaman et. al. 2018)
- **The focus** of the literature is on "**who** to target **in the village** to boost adoption?" rather than **"who** to target **in the household?"**

CONTEXT

- We investigate **experimentally** how **couples take agricultural decisions** involving risk-return trade-off.
- The experiments and surveys were conducted in the Philippines (Mindanao), one of the main corn producing region of the country.
  - GMOs were introduced in the early 2000s and now sige-sige corn is widespread (variety result of a crossing between local white corn and stolen mother seeds from Monsanto).
  - Corn production is risky (droughts, floods, storms, rats, landslides…)
- Women are generally in charge of management of household budget.
- Men are generally in charge of agricultural decisions.

DATA

- We surveyed a total of 447 households in 14 villages and asked **detailed questions about adoption / disadoption** of glyphosate tolerant corn.
- 221 couples played **lab-in-the-field games individually and in couples**. We focus here on the results of two games, framed as choice over corn varieties with risk-return trade-offs.

DATA

- **Experimental measures of risk aversion (for ag decisions):**
  - Spouses individually chose a crop from a menu of crops involving risk-return trade-offs

  → Elicitation of individual risk aversion

  - The couple was then asked to choose from the same menu

  → Elicitation of couple risk aversion

Corn variety	Good rain (p=0.5)	Bad rain (p=0.5)	Expected payoff
A	10000	10000	10000
B	14000	8000	11000
C	18000	6000	12000
D	22000	4000	13000
E	26000	2000	14000
F	30000	0	15000

DATA

- **Experimental measure of trust for taking appropriate investment decision:**
  - Investment choices implied a risky technology or a safe option (with positive return).
  - Spouses had an endowment of 2000 and chose to send 0, 1000 or 2000 to their spouse for her/him to make this choice.
  - The total income obtained (amount kept + sent and invested) is divided equally between spouses.

→ Trust and trustworthiness in agricultural decisions, link with individual risk preferences

	Investment : 1000	
Corn variety	**Good rain**	**Bad rain**
A	**1500**	**1500**
B	**4000**	**0**

	Investment : 2000	
Corn variety	**Good rain**	**Bad rain**
A	**3000**	**3000**
B	**8000**	**0**

COUPLE RISK AVERSION VERSUS INDIVIDUAL RISK AVERSION

- **Past investment behavior** appears to correlated more with **couple risk aversion** than with husband's level of risk aversion.

- Dependent variables: adoption of GMO in the past 10 years and use of external finance for high value GMO.
- Risk aversion: categorical variable, omitted category = lowest risk aversion
- Adoption decisions are negatively correlated with the **couple's risk aversion** and the **wife's risk aversion**.
- They are not influenced by the risk aversion of the husband (supposedly the primary decision maker)

VARIABLES	(1) ever_gmo	(2) ever_gmo	(3) ever_gmo	(4) everfin	(5) everfin	(6) everfin
2.ra_couple	-0.204*			-0.276***		
	(-1.663)			(-2.705)		
3.ra_couple	-0.0997			-0.181**		
	(-1.033)			(-2.273)		
owner_both	0.0465	0.0810	0.0634	0.0258	0.0592	0.0499
	(0.587)	(1.037)	(0.814)	(0.389)	(0.890)	(0.754)
2.ra_husband		-0.116			-0.130	
		(-1.065)			(-1.419)	
3.ra_husband		-0.115			-0.0864	
		(-1.338)			(-1.190)	
2.ra_wife			-0.243**			-0.271***
			(-2.101)			(-2.777)
3.ra_wife			-0.0669			-0.166**
			(-0.734)			(-2.177)
Constant	0.324***	0.304***	0.308***	0.315***	0.215***	0.300***
	(3.663)	(4.035)	(3.754)	(4.334)	(3.393)	(4.379)
Observations	153	152	154	155	154	156
R-squared	0.021	0.019	0.037	0.051	0.019	0.054

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

- It is in couples where the (game elicited) bargaining power of the wife is especially high that the couple's risk aversion matters most.
- Surprisingly, in the same couple the husband's risk aversion is also negatively correlated with adoption, but not the wife's….

VARIABLES	(1) GMO	(2) GMO	(3) GMO	(4) Finance	(5) Finance	(6) Finance
2.ra_couple	0.185			-0.153		
	(1.037)			(-1.008)		
3.ra_couple	0.0937			0.0418		
	(0.683)			(0.358)		
1.bargain_dummy	0.303*	0.291**	-0.0122	0.184	0.173	0.0622
	(1.897)	(2.220)	(-0.0875)	(1.374)	(1.548)	(0.529)
2.ra_couple#1.bargain_dummy	-0.540**			-0.121		
	(-2.408)			(-0.636)		
3.ra_couple#1.bargain_dummy	-0.287*			-0.211		
	(-1.656)			(-1.459)		
2.ra_husband		0.166			-0.0415	
		(1.090)			(-0.318)	
3.ra_husband		0.119			0.101	
		(1.002)			(0.987)	
2.ra_husband#1.bargain_dummy		-0.423**			-0.105	
		(-2.156)			(-0.627)	
3.ra_husband#1.bargain_dummy		-0.317**			-0.227*	
		(-2.115)			(-1.777)	
2.ra_wife			0.0394			-0.100
			(0.250)			(-0.736)
3.ra_wife			-0.0449			-0.0492
			(-0.377)			(-0.478)
2.ra_wife#1.bargain_dummy			-0.211			-0.0483
			(-1.021)			(-0.273)
3.ra_wife#1.bargain_dummy			0.101			-0.0492
			(0.637)			(-0.369)
Constant	0.0539	0.118	0.0843	0.287	0.143	0.225
	(0.132)	(0.299)	(0.219)	(0.841)	(0.427)	(0.687)
Observations	204	203	205	207	206	208
R-squared	0.330	0.335	0.324	0.295	0.288	0.277

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

DETERMINANTS OF COUPLE RISK AVERSION

- In the literature (reviewed by Munro, 2017) "No evidence that individual risk preference are aligned within couple and no particular pattern in the way differences in preferences are resolved". "**The 'couple' is not simply a weighted average of two individuals**, but has its own decision-making procedures"
- We find:
  - On average **couples are more risk averse than individuals** (as in Munro, 2005, 2008 but in contrast to He et al, 2012).
  - The couple level of risk aversion is closer to that of the more risk-averse of the spouses (as in Braaten and Martinsson, 2015)
  - **The husband has more weight in the decision** (as in Carlsson et al. 2013), despite the fact that women manage the household finance and have systematically greater "shares" in other games.

COMPARING INDIVIDUAL AND COUPLE'S CHOICES

- In 44% of couple, husband and wife make the same variety choice in the risk aversion game
- In the couples where choices differ, 56% of couples jointly choose a variety closer to the husband's choice.
- In the couples where choices differ, 67% of couples jointly choose a variety closer to the choice of the most risk averse spouse.

ON AVERAGE COUPLES ARE MORE RISK AVERSE THAN INDIVIDUALS

	Husband		Wife		Couple	
Corn variety	Distrib. (%)	Cum. Distrib.	Distrib. (%)	Cum. Distrib.	Distrib. (%)	Cum. Distrib.
A	62.5	62.5	66.5	66.5	69.9	69.9
B	15.9	78.4	14.8	81.3	14.4	84.2
C	7.7	86.1	10.5	91.9	4.8	89.0
D	5.3	91.4	3.4	95.2	3.8	92.8
E	3.4	94.8	2.4	97.6	3.4	96.2
F	5.3	100	2.4	100	3.8	100
Average CRRA	1.77		1.86		1.92	

- **Dependent variable: couple's risk aversion (CRRA)**
- The husband's CRRA is a stronger determinant of the couple's CRRA than the wife's CRRA

crra_husband	0.408***	0.380***	0.346***	0.414***	0.441***	0.367	0.303***
	(7.206)	(4.691)	(4.524)	(6.602)	(7.123)	(1.516)	(3.344)
crra_wife	0.260***	0.333***	0.336***	0.270***	0.293***	0.397	0.281***
	(4.420)	(4.053)	(4.351)	(4.087)	(4.541)	(1.629)	(3.012)
1.dec_crop		0.169					
		(0.552)					
1.dec_crop#c.crra_husband		0.0454					
		(0.399)					
1.dec_crop#c.crra_wife		-0.148					
		(-1.239)					
1.dec_loan			0.0130				
			(0.0390)				
1.dec_loan#c.crra_husband			0.119				
			(1.030)				
1.dec_loan#c.crra_wife			-0.155				
			(-1.240)				
1.dec_cropcouple				0.132			
				(0.333)			
1.dec_cropcouple#c.crra_husband				-0.0406			
				(-0.270)			
1.dec_cropcouple#c.crra_wife				-0.0537			
				(-0.356)			
1.dec_loancouple					1.090**		
					(2.451)		
1.dec_loancouple#c.crra_husband					-0.256*		
					(-1.697)		
1.dec_loancouple#c.crra_wife					-0.258		
					(-1.646)		
bargain_wife						0.172	
						(0.178)	
c.crra_husband#c.bargain_wife						0.0601	
						(0.165)	
c.crra_wife#c.bargain_wife						-0.212	
						(-0.573)	
1.bargain_dummy							-0.333
							(-1.077)
1.bargain_dummy#c.crra_husband							0.169
							(1.458)
1.bargain_dummy#c.crra_wife							-0.0303
							(-0.252)
Constant	0.706***	0.639***	0.713***	0.684***	0.562***	0.599	0.908***
	(4.662)	(3.165)	(3.940)	(4.059)	(3.487)	(0.940)	(3.809)
Observations	205	205	205	205	205	205	205
R-squared	0.277	0.283	0.288	0.278	0.298	0.279	0.287

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

LARGE LEVELS OF UNDERINVESTMENT IN "TRUST AND INVESTMENT GAME"

- Alone, a rational **individual would always invest 2000** (outcomes with both varieties dominate investment of 1000).
- **Yet**, when the choice of investment is **delegated to the spouse**, **many only invest 1000**, **despite large alignment** of individual choices…
- Individuals appear to **systematically over-estimate** risk-taking behavior of their spouse (in this game, as well as in previous game).
- **As if ambiguity** regarding the spouse variety choice largely **discourages investment**.

Husband

Amount sent		
	Distrib (%)	cum dist
0	0.9	0.9
1000	67.6	68.5
2000	31.5	100

Variety choice	
A	76.3
B	23.7

Belief over spouse's choice	
A	59.3
B	40.7

Wife

Amount sent		
	Distrib (%)	cum dist
0	7.0	7.0
1000	64.0	71.0
2000	29.0	100

Variety choice	
A	77.6
B	22.4

Belief over spouse's choice	
A	54.4
B	45.6

- The amount sent is **negatively correlated with risk aversion of the sender** (not significant), but is **not correlated with the belief regarding the other's choice**…

crra_indiv	-0.0361		
	(-1.298)		
1.least_ra	0.148	-0.0244	
	(1.042)	(-0.206)	
1.least_ra#c.crra_indiv	-0.0427		
	(-0.657)		
2.risk_av		-0.144	
		(-1.290)	
3.risk_av		-0.101	
		(-1.189)	
2.risk_av#1.least_ra		0.204	
		(1.206)	
3.risk_av#1.least_ra		0.0315	
		(0.231)	
1.chose_safe			-0.109
			(-1.196)
1.belief_risky			0.0492
			(0.488)
1.chose_safe#1.belief_risky			-0.0127
			(-0.110)
Constant	0.303*	0.337*	0.325*
	(1.751)	(1.811)	(1.779)
Observations	410	408	404
R-squared	0.068	0.069	0.080

CONCLUSIONS

- Couple's risk aversion is better correlated with real-life behavior than the household head's risk aversion.
- Joint decisions over risky prospects are not simple averages of individual decisions (for ex: income/expenditure shares do not have the expected effect, the more risk averse seems to have more influence in the process…).

→ **Reducing a household technological adoption decision to the choice of the household head is wrong.**

- Individuals do not trust their spouse to take appropriate agricultural investment decisions and are thus foregoing profitable investment.

→ **Should extension effort target the couple and insist on having both spouses present?**