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Measuring Attitudes toward Uncertainty: Experimental Evidence on Group Selection Effects

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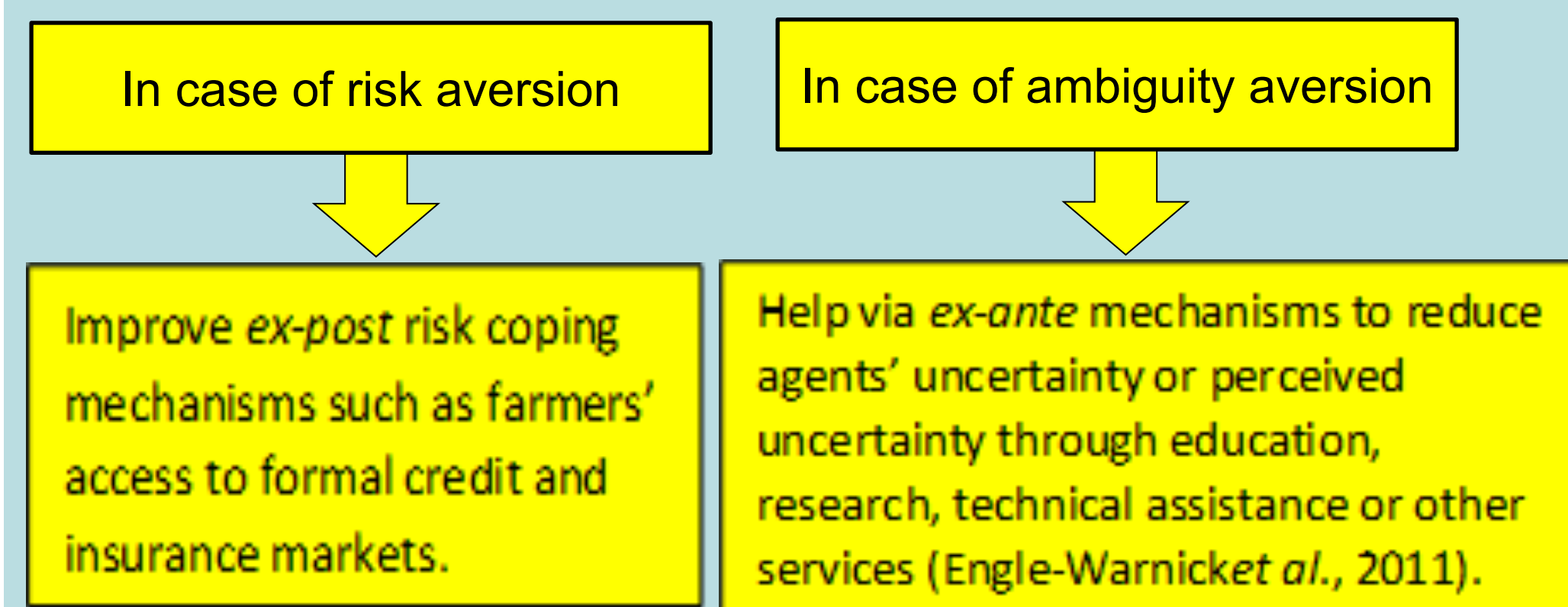
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Introduction

- There is a rich literature focusing on the role of *risk aversion* as an important behavioral factor in choices such as technology adoption (Ahsanuzzaman and Norton, 2014; Liu, 2013; Ward and Singh, 2014; Barham *et al.*, 2013; Alpizar *et al.*, 2011; Feder *et al.*, 1985; Feder, 1980; Srinivasan, 1972).
- The role of *ambiguity aversion*, that implies that an agent has a preference for a known risk over an unknown risk, in individuals' decision-making is less studied in literature.
- The literature also demonstrates that subjects' communication among themselves prior to decision-making changes their risk and ambiguity aversions on choices over uncertain prospects (Fershtman and Segal, 2018; Ahsanuzzaman and Norton, 2016; Alpizar *et al.*, 2011; Engle *et al.*, 2013; Chung *et al.*, 2014). Sometimes, the behavior of others influences own decisions (Fershtman and Segal, 2018; Jackson, 2014; Brunette *et al.*, 2014) due to, among other factors, whom the agents choose to communicate to, leading to *Group Selection Effects*. It is important to examine both the extent and the direction, if any, of effects of communication among agents on their attitudes toward uncertainty.
- The policy implication: If group selection affects choices over uncertain prospects in an opposite direction from what was expected, then an appropriate policy formulation is required to address such undesired direction of choices.

Policy implication of the study On attitudes toward uncertainty



Objectives

- In this study we measure the coefficients of risk and ambiguity aversion of farmers in Bangladesh using data from a series of experiments.
- We also investigate whether subjects' attitudes change due to communication. To do so, subjects were allowed to communicate in groups of 3 before making choices over uncertain prospects in separate rounds of the experiments.
- More importantly, we also measure the effect of group selection on risk and ambiguity aversions through choices under uncertain prospects i.e., **Group Selection Effects**.

Experimental Design and the Data

- In order to elicit the farmers' attitudes toward uncertainty, 206 farmers were chosen from Jessore districts of Bangladesh to participate in a series of behavioral field experiments.
- A typical experimental lottery on a risky prospect is shown in the following table. For ambiguity experiments, probability, p , is unknown.

Turn	Option One: Urn (P(Payoffs))	Option Two: Certain amount (BDT)	Switching-Point from 1 to 2	CE at Switching-Point (BDT)
1	$p(0), (1-p)(1000)$	0		0
2	$p(0), (1-p)(1000)$	50	1 to 2	25
3	$p(0), (1-p)(1000)$	100	2 to 3	75
4	$p(0), (1-p)(1000)$	150	3 to 4	125
5	$p(0), (1-p)(1000)$	200	4 to 5	175
6	$p(0), (1-p)(1000)$	250	5 to 6	225
7	$p(0), (1-p)(1000)$	300	6 to 7	275
8	$p(0), (1-p)(1000)$	350	7 to 8	325
9	$p(0), (1-p)(1000)$	400	8 to 9	375
10	$p(0), (1-p)(1000)$	450	9 to 10	425
11	$p(0), (1-p)(1000)$	500	10 to 11	475
12	$p(0), (1-p)(1000)$	550	11 to 12	525
13	$p(0), (1-p)(1000)$	600	12 to 13	575
14	$p(0), (1-p)(1000)$	650	13 to 14	625
15	$p(0), (1-p)(1000)$	700	14 to 15	675
16	$p(0), (1-p)(1000)$	750	15 to 16	725
17	$p(0), (1-p)(1000)$	800	16 to 17	775
18	$p(0), (1-p)(1000)$	850	17 to 18	825
19	$p(0), (1-p)(1000)$	900	18 to 19	875
20	$p(0), (1-p)(1000)$	950	19 to 20	925
21	$p(0), (1-p)(1000)$	1000	20 to 21	975

p is the probability of winning 0 BDT which is 0.3, 0.5, or 0.7 in different risk experiments.

- The design of the experiment is similar to a multiple price list (MPL), following Barham *et al.*, (2013) and Akay *et al.*, (2012), which is a slightly modified version of the original MPL of Holt and Laury (2002). This approach makes the subjects reveal *certainty equivalents* (CE) for the lotteries.
- The elicited CEs are then used to compare risk preferences across respondents as well as to measure the coefficients of relative risk aversion. Furthermore, following Alpizar *et al.*, (2011), Engle *et al* (2013), we conduct the same exercise with subject groups of 3 to investigate the behavioral pattern when the subjects faced uncertain prospects alone versus being with peer farmers.
- Groups were formed in two ways: Half of participants were paired in groups of 3 randomly and the remaining participants chose their peers in groups. Doing this help us measure the *group selection effects* on risk preferences.
- Sensitivity in attitudes was checked by varying probabilities.
- We assume constant relative risk aversion utility function to measure risk aversion: $U(x) = x^{1-\rho}$
- The following formula was used to calculate ambiguity aversion: $Ambiguity\ aversion\ (\theta) = \frac{CE_R - CE_A}{CE_R + CE_A}$ where subscripts R and A indicate Risk and Ambiguity experiments, respectively.
- Group effects on (risk and ambiguity) attitudes can be divided into:

$$\text{Total group effect} = \text{Aversion in group} - \text{aversion in alone}$$
$$\text{Selection effects} = \text{Aversion in non-random group} - \text{aversion in random group}$$

Results

Risk aversion

- Farmers are risk averse in general (Table 2).
- However, when deciding alone, they tend to exhibit extreme behavior more than when deciding in groups of 3. This explains the mean risk aversion to be negative.

Table 2: Risk aversion coefficient - Gain domain

		Alone		Group	
		p=0.3	p=0.5	p=0.3	p=0.5
Whole sample	Mean	-0.64	-1.8	-1.77	0.89
	Median	0.81	0.73	0.73	0.5
	Min.	-26.37	-26.37	-26.37	-1.41
	Max.	0.81	0.81	4.11	4.11
Female	Mean	0.65	0.34	-0.49	0.75
	Median	0.81	0.81	0.81	0.5
	Min.	-0.76	-2.6	-26.38	0.5
	Max.	0.81	0.81	0.81	1.69

Note: p denotes probability of winning

- The risk preferences change with the presence of communication with other farmers.
- Farmers tend to be less risk averse communicating with two other peers, with more well-behaved giving rise to a smaller range of risk aversion.
- Female participants are also risk averse with less extreme choices both alone and in groups.
- In all cases, risk aversion decreases with probability.

Table 3: Risk aversion in Groups: Random vs. Non-Random group formation (p is the probability of winning the lottery)

		Alone		Group	
		p=0.3	p=0.5	p=0.3	p=0.5
Whole sample	Group-overall	Mean	0.89	0.93	0.88
	Group-overall	Median	0.5	0.5	0.5
	Group-Random	Mean	0.96	0.96	0.96
	Group-Random	Median	0.5	0.5	0.5
Female	Group-Non-random	Mean	0.84	0.89	0.78
	Group-Non-random	Median	0.5	0.5	0.5
	Group-overall	Mean	0.75	0.82	0.74
	Group-overall	Median	0.5	0.5	0.5
Female	Group-Random	Mean	0.74	0.88	0.79
	Group-Random	Median	0.5	0.5	0.5
	Group-Non-random	Mean	0.76	0.76	0.67
	Group-Non-random	Median	0.5	0.5	0.5

Table 4: Group effects and group selection effects on risk aversion

		Whole sample		Female	
		Mean	Median	Mean	Median
p=0.3	Total group effect*	1.54	0.31	0.1	-0.31
	Selection effect**	-0.12	0	0.02	0
	All other effect***	1.66	0.31	0.08	-0.31
p=0.5	Total group effect	2.73	0.04	0.48	-0.31
	Selection effect	-0.07	0	-0.12	0
	All other effect	2.8	0.04	0.6	-0.31
p=0.7	Total group effect	2.65	-0.04	1.23	-0.31
	Selection effect	-0.18	0	-0.12	0
	All other effect	2.83	-0.04	1.35	-0.31

*Total group effect=Risk/Am. Aversion in group - Risk/Am. Aversion in alone

**Selection effects= Risk/Am. Aversion in non-random group - Risk/Am. Aversion in random group

***All other effects=Remaining effects=Total group effects - selection effects.

Effects of group member selections on Risk aversion (Table 3 & 4):

- Participants become more risk averse in group than alone leading to a positive group effects and increasing with probability of winning the lottery.
- Farmers exhibit higher risk aversion if decided in groups formed randomly than if formed by themselves leading to a risk taking behavior for *group selection*.
- Female farmers exhibit the similar pattern with much lower extent, compared to the whole sample.

Ambiguity aversion

- Farmers exhibit ambiguity averse to mostly neutral behavior both while deciding alone and in groups (Table 5) that is consistent with studies investigating ambiguity aversion such as Engle-Warnick *et al.*, 2007; Alpizar *et al.*, 2011, Akay *et al.*, 2012; Ross *et al.*, 2012, and Ahsanuzzaman and Norton, 2016.

Table 5: Ambiguity aversion coefficient

		Alone			Group		
		p=0.3	p=0.5	p=0.7	p=0.3	p=0.5	p=0.7
Whole sample	Mean	0.1	0.08	-0.005	0.1	0.11	0.02
Female	Mean	0.13	0.1	-0.09	0.04	0.09	-0.03

- Both men and women exhibit a similar ambiguity neutral behavior in both cases: deciding alone and in groups.

Table 6: Group effects and group selection effects on ambiguity aversion

		Whole sample		Female	
		Mean	Median	Mean	Median
p=0.3	Total group effect	0	0	-0.09	0
	Selection effect	0.04	0	-0.04	0
	All other effect	-0.04	0	-0.05	0
p=0.5	Total group effect	0.03	0	-0.01	0
	Selection effect	-0.09	0	0.02	0
	All other effect	0.12	0	-0.03	0
p=0.7	Total group effect	0.02	0	0.06	0
	Selection effect	0.15	0	0.06	0
	All other effect	-0.13	0	0	0

Total group effect=Am. Aversion in group - am. Aversion in alone

Selection effects= Risk/Am. Aversion in non-random group - Risk/Am. Aversion in random group

All other effects=Remaining effects=Total group effects - selection effects.

Effects of group member selections on Ambiguity aversion (Table 6):

- Similar to risk aversion, farmers tend to show more ambiguity aversion in groups than in deciding alone. However, there is no clear trend whether this behavior increases or decrease with probability of winning the lottery.
- For women, group effects in fact are negative when probabilities of winning are 30% and 50% while group effect is positive when winning probability is 70%.
- Selection effects in the case of ambiguity aversion for both men and women are mostly positive – the effects overall being larger for men.
- This implies that farmers become more ambiguity averse when making decisions in consultation with self-selected peers compared to when making decisions in consultation with randomly assigned group members.

Conclusions

We provide the following conclusions.

- Most Bangladeshi farmers are moderately to highly risk averse but ambiguity-neutral to mildly-ambiguity averse.
- Women generally tend to be more risk and ambiguity averse than men.
- Farmers exhibit substantially higher risk and slightly higher ambiguity aversions when they make choices in groups compared to when they choose alone.
- Farmers are less risk averse when group members are self-selected relative to when they are randomly assigned.
- Farmers are more ambiguity averse when making decisions in consultation with self-selected peers compared to when making decisions in consultation with randomly assigned group members.
- The opposite selection effects suggest that Bangladeshi farmers in general view and act differently when probability distribution of uncertain prospect is known compared to a scenario when the probability distribution is unknown.