Cognitive skills in decisions under compound risk and ambiguity

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Motivation

- Three types of uncertainty: *risk*, *compound risk*, *ambiguity*
- Some theories explicitly connect behavior toward ambiguity and behavior toward compound risk (Segal, 1987; Seo 2009; Halevy and Ozdenoren, 2008)

Is relating ambiguity to RoCL a valid behavioral assumption?

- Halevy (2007): reduction of compound lotteries (RoCL) and attitudes toward ambiguity *are related* (WTP for 4 lotteries, student subject sample)
- Abdellaoui, Klibanoff, and Placido (2014, forthcoming): students, engineer and non-engineer majors. Engineers who were reducing compound lotteries exhibited less tendency to be ambiguity neutral.

How do cognitive and other background characteristics influence the relationship between attitudes to ambiguity and RoCL?

Literature and hypothesis

Strand #1

relationship between RoCL and attitudes to ambiguity (Halevy, 2007; Abdellaoui, 2013, Dean and Ortoleva, 2014): inconclusive results

Strand #2

relationship between (non-)cognitive skills and economic preferences (Anderson et al., 2011; Benjamin et al., 2013; Borghans et al., 2009; Burks et al., 2009; Dohmen et al., 2010; Eckel et al., 2012; Sutter et al. 2013)

Hypotheses

H1: Among those who exhibit ambiguity neutral preferences, higher cognitive ability leads to higher probability to exhibit RoCL.
H2: Among those who exhibit RoCL, higher cognitive ability leads to higher probability to be ambiguity neutral.
(Lahno (2014): Peer-effects in decision-making under ambiguity)

Contribution

- Further explore the relationship between attitudes to ambiguity and RoCL using a non-standard subject sample
- Test for the relationship with cognitive skills
- Should investigations of empirical validity include tests on abilities? (Abdellaoui et al., 2011; Ahn et al., 2010; Hey et al., 2010; Conte and Hey, 2013; Hey and Pace, 2012)

Experimental design

Design

Subject sample: Adolescents 11-12 yo, 11 classes
Implementation: Physical, boxes in bags
Elicitation: Multiple pricing list (MPL)
Order of tasks: 3 tasks in different order
Incentives: Everyone was paid for one random task

Two treatments

Fox and Tversky (1995): Comparative ignorance; Chow and Sarin (2001)

- Lotteries presented *In order*
- Lotteries presented *At once*

		Max lottery prize		
		100 CZK	200 CZK	Total
Lotteries presented	At once	3	2	5
	In order	3	3	6
	Total	6	5	11

Measures of preferences and abilities

Uncertainty preferences

- L_R = risky lottery
- L_C = compound lottery
- L_A = ambiguous lottery

Able to reduce compound risk: L_C=L_R
Ambiguity-neutral: L_A=L_R

Tests

- Arithmetic test (AT; CorrectGrp)
- Working memory/Operation span test (WM; OspanTotal)
- Non-cognitive abilities tests (PSY; mathanx, sensation)

Results I

- Attitudes to ambiguity and RoCL *are* related
- Several differences with other studies

Study:		H 2007			D&A 2014			A 2013			This paper		
		Reduce compound lotteries											
Ambiguity neutral		yes	no	$\sum$	yes	no	$\sum$	yes	no	$\sum$	yes	no	$\sum$
yes	Count	22	6	28	27	1	28	13	17	30	57	19	76
	Expected	(4.5)	(23.5)		(5.7)	(22.3)		(4.4)	(25.6)		(31.7)	(44.3)	
no	Count	1	113	114	3	117	120	4	81	85	18	86	104
	Expected	(18.5)	(95.5)		(24.3)	(95.7)		(12.6)	(72.4)		(43.3)	(60.7)	
	$\sum$	23	119	142	30	118	148	17	98	115	75	105	180
Fisher's exact test (2-sided)		0.000*			0.000*			0.000*			0.000*		

* = p-value
H 2007 = Halevy (2007)
D&A 2014 = Dean and Ortoleva (2014)
A 2013= Abdellaoui *et al.* (2013)

Results II, Variation with background

Dependent var	AmbN		RoCL	
	(1)	(2)	(3)	(4)
AT score	0.027*	0.020	0.038**	0.030**
	(0.015)	(0.015)	(0.015)	(0.015)
WMT score	-0.001	-0.000	0.000	0.002
	(0.003)	(0.003)	(0.003)	(0.003)
Controls				
Female		-0.161**		-0.220**
		(0.072)		(0.069)
Prague		0.166**		0.114
		(0.069)		(0.069)
Preuso-R^2	0.012	0.050	0.030	0.075
LR (p-value)	2.9(0.23)	12.1(0.016)	7.3(0.026)	18.2(0.001)
Observations	179	179	179	179

Notes: Results (marginal effects) are from probit model, standard errors are in parentheses

**Significant at the 5% level.

*Significant at the 10% level.

Results III, Variation with background by treatments

Treatment	At once				In order			
Dependent var	AmbN		RoCL		AmbN		RoCL	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
AT score	0.049**	0.053**	0.078**	0.076**	0.023	0.019	0.026	0.022
	(0.022)	(0.023)	(0.018)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
WMT score	0.009**	0.008**	0.038**	0.012**	-0.008**	-0.006*	-0.006	-0.004
	(0.004)	(0.004)	(0.014)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
Controls								
Female		-0.069		-0.190**		-0.149		-0.152
		(0.109)		(0.097)		(0.092)		(0.095)
Prague		0.313**		0.211**		0.055		0.047
		(0.000)		(0.092)		(0.097)		(0.095)
Preuso-R^2	0.085	0.183	0.209	0.292	0.028	0.045	0.020	0.039
LR (p-value)	8.7(0.013)	18.9(0.001)	22.0(0.000)	30.7(0.000)	3.9(0.139)	6.3(0.175)	2.8(0.250)	5.3(0.261)
Observations	76	76	76	76	103	103	103	103

Notes: Results (marginal effects) are from probit model, standard errors are in parentheses

**Significant at the 5% level.

*Significant at the 10% level.