

Investing when risk and ambiguity create opportunities for exploitation

Jonas Fooker

Joint Research Centre | University of Queensland

July 19th, 2017

The paper in short

Experimental set-up:

- Trust game with increasing uncertainty (transfers can get lost)
- This creates more complex riskiness of trusting decision

Experimental results:

- Trustee adapt behavior with increasing uncertainty
- Trustor adapt behavior with increasing uncertainty

Discussion: How and why?

- Trustees become more selfish (extensive margin, hide behind uncertainty [EP \approx 20%]; intensive margin, moral wiggling [EP \approx 80%])
- Trustors transfer less (several motivations for changing, risk attitudes [EP \approx 70-93%])

Basic idea I

Well-known:

- Many individuals trust others when trust can generate social surplus
- Decisions under uncertainty are different from those under certainty (risk attitudes)
- The level of uncertainty (big vs small risk) and its source (risk vs ambiguity) matter for decisions

Limited knowledge

- How do trust and risk attitudes interact
- How important are opportunistic behavior and moral wiggling for self-serving decisions

Interesting to know more?

- A Important decisions affected: Many investment decisions involve trust and are made in the presence of (non-human) uncertainty
- B Informs regulation: Opportunistic behavior can be detected as fraud, but gradual exploitation more difficult to detect and sanction

Basic idea II

Approach of this paper

- Study the interaction of trust and trustworthiness with uncertainty (risk)
- What may explain observed patterns in trustworthiness?
 - ▶ Candidates are hiding behind uncertainty or gradual self-serving
- Are reactions of trustors optimal?
 - ▶ Consider risk attitudes
 - ▶ Increasing own-regarding and compound risk aversion
 - ▶ Strategic understanding
- Any need for a regulator?

Existing literature I

No need here to review the literature on trust (Johnson and Mislin, 2011) and risk-taking (Wakker, 2010).

Looking at existing research on social preferences under risk:

- Krawczyk and Le Lec (2010); Brock et al. (2013); Krawczyk and Le Lec (2014): Dictators and donors give less under risk
- Rohde and Rohde (2011): Own risk taking little affected by risk to others; risk for self and others preferably uncorrelated
- Gaudeul (2013): Rather reduce own risk than inequality
- López-Vargas (2015): Model for social decisions under risk; points out the last two studies may not be fully valid

These papers are all mostly concerned with *ex ante* vs. *ex post* fairness

This paper is about the *trust* under uncertainty

Existing literature II

The two studies closest to the current one:

- 1 Haisley and Weber (2010) investigate giving behavior under ambiguity compared to risk; transfers are lower under ambiguity
- 2 Vranceanu et al. (2012) investigate trust and trustworthiness under risk; trustees *hide behind (probability) uncertainty*

The current study combines the two:

- Takes the ambiguity element from [1]
- Extends the probability space of [2], allowing for changes in decisions at extensive and intensive margin
- Makes [2] more clean: Efficiency remains constant; decision is gradual instead of binary; avoids reversal effect

Experimental design

Figure: Basic structure of the game

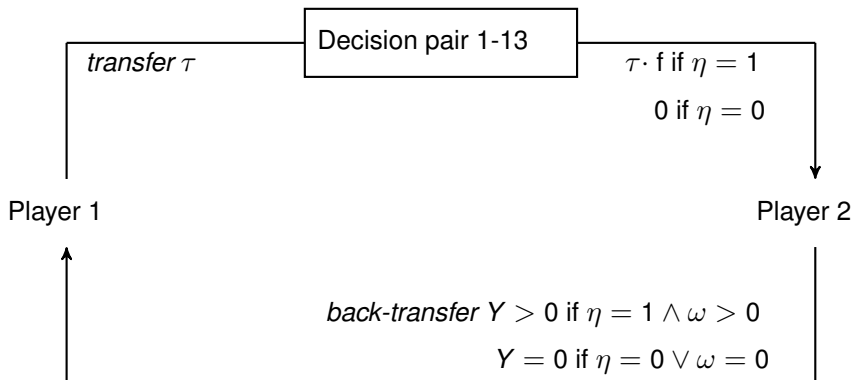


Table: Decisions pairs 1-13

Decision	1	2	3	4	5	6	7	8	9	10	11	12	13
p (in %)	100	90	80-100	80	70-90	75	65-85	60	50-70	50	40-60	20	10-30
f	3	3.5		3.75		4		5		6		15	

Experimental implementation

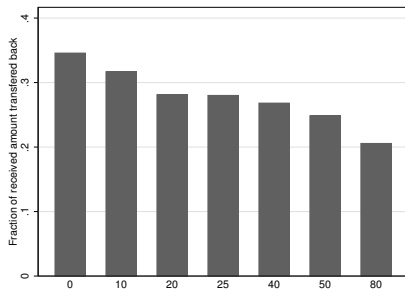
Basic experimental parameters:

- 112 students
 - ▶ 77 Bachelor, 34 Master or Engineering Diploma, 1 PhD candidate
 - ▶ Average age 22.5; 53% female
 - ▶ 6 sessions conducted in April and December 2014 in Bratislava, Slovak Republic
- 40 participants as player 1, 72 participants as player 2; roles fixed throughout experiment
- Strategy method
- 2 random choices were paid; earnings between 2 and 39.50, average 7.85 Euros

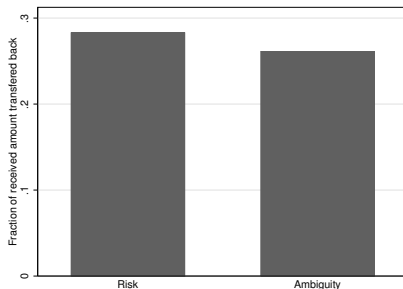
RESULTS – PLAYER 2

Results for player 2

Figure: Fraction returned by player 2



(a) by uncertainty (riskiness)



(b) by uncertainty type

Results for player 2

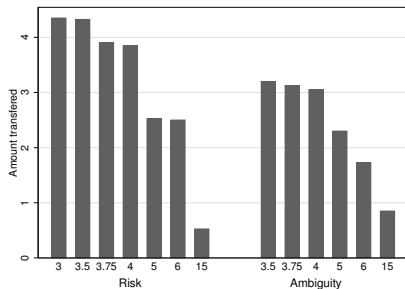
Table: Determinants of fraction back-transferred by trustees

	(P2.1)	(P2.2)	(P2.3)
Uncertainty	-0.153*** (0.029)	-0.153*** (0.029)	-0.159*** (0.028)
Ambiguity	-0.013*** (0.004)	-0.013*** (0.004)	-0.014*** (0.004)
Transferred amount		0.007** (0.003)	0.006** (0.003)
Female			-0.029 (0.037)
Age			-0.007 (0.008)
Income			0.004 (0.025)
constant	0.332*** (0.021)	0.295*** (0.026)	0.463*** (0.165)
N	9360	9360	9230

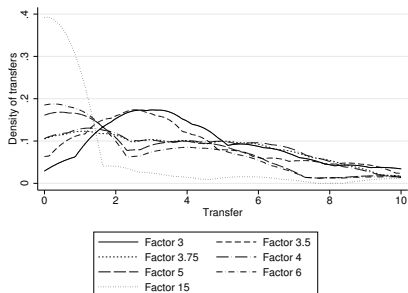
RESULTS – PLAYER 1

Results for player 1

Figure: Transfers of player 1 by uncertainty



(a) Average transfer



(b) Kernel distributions of transfers

Results for player 1

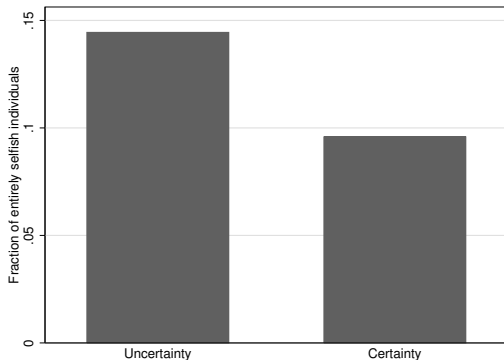
Table: Determinants of transfers by trustors

	(P1.1)	(P1.2)	(P1.3)	(P1.4)
Uncertainty	-0.045*** (0.005)	-0.046*** (0.005)	-0.045*** (0.009)	-0.049*** (0.009)
Ambiguity	-0.525*** (0.201)	-0.575*** (0.208)	-0.562*** (0.202)	-0.614*** (0.209)
Female		-1.078** (0.523)		-1.078** (0.524)
Age		0.010 (0.030)		0.010 (0.030)
Income		-0.161 (0.346)		-0.161 (0.347)
Certain			-0.289 (0.415)	-0.364 (0.433)
Very uncertain			-0.063 (0.508)	0.115 (0.504)
constant	4.573*** (0.382)	5.224*** (0.721)	4.639*** (0.490)	5.353*** (0.789)
N	520	494	520	494

DISCUSSION – TRUSTEES

Hiding behind uncertainty and the extensive margin – trustees

Figure: Fraction of decisions in which trustees transferred back zero



Moral wiggling and the intensive margin – trustees

Only hiding behind uncertainty?

Table: Determinants of the fraction transferred back by trustees who do not hide behind uncertainty

	(P2.4)	(P2.5)	(P2.6)
Uncertainty	-0.180*** (0.031)	-0.180*** (0.031)	-0.187*** (0.030)
Ambiguity	-0.011** (0.005)	-0.010** (0.005)	-0.011** (0.005)
Transferred amount		-0.001 (0.002)	-0.001 (0.002)
Female			-0.022 (0.033)
Age			0.002 (0.007)
Income			0.017 (0.022)
constant	0.370*** (0.019)	0.375*** (0.021)	0.319** (0.140)
N	8043	8043	7932

DISCUSSION – TRUSTORS

Decisions of trustors

What drives changes in transfers by trustors?

- Risk attitudes
- Trustors understand increasing selfishness of trustees?
- Trustors become more selfish (moral wiggling)?

Decisions of trustors – risk attitudes

To investigate **risk attitudes**, assume $U = X^\alpha$
Consider the following utility calculation:

$$U(\tau) = (p + (1 - p)\phi) \cdot (10 - \tau)^\alpha + (1 - p)(1 - \phi)(10 - \tau + \frac{f}{s}\tau)^\alpha + O(\tau)$$

- τ the transfer to player 2
- p the probability that the transfer is not successful
- ϕ the probability that player 2 will return nothing back
- f the factor of multiplication
- s the share of the received that player 2 will return to player 1
- $O(\tau)$ is the other-regarding element of the transfer (assumed constant or decreasing with higher risk)

Decisions of trustors – risk attitudes

Differentiating U with respect to τ and solving for $\frac{dU}{d\tau} = 0$ provides:

$$\tau^* = \frac{10(1 - Z)}{1 - Z + \frac{f \cdot Z}{(1-p)s}}$$

whereas

$$Z = \left(\frac{\left(\frac{f}{(1-p)s} - 1 \right) (1-p)(1-\phi)}{p + (1-p)\phi} \right)^{\frac{1}{\alpha-1}} \quad (1)$$

Decisions of trustors – risk attitudes

Assuming $\phi=.3$, $f=\frac{3}{p}$, $s=.5$ simplifies this term to

$$\tau^* = \frac{10 \left(\left(\frac{105-70p+70p^2}{70p^2+30p} \right)^{\frac{1}{\alpha-1}} - 1 \right)}{\left(\frac{105-70p+70p^2}{70p^2+30p} \right)^{\frac{1}{\alpha-1}} - 1 + \frac{1.5}{1-p}}$$

now identify $\frac{d\tau^*}{dp}$ and evaluate for different levels of α and p .

Table: Slope $\frac{d\tau^*}{dp}$ for different levels of α and p

p	$\alpha=0.95$	$\alpha=0.9$	$\alpha=0.85$	$\alpha=0.8$
0.1	-0.00	-0.00	-0.00	-0.00
0.2	-0.00	-0.00	-0.00	-0.00
0.25	-0.00	-0.00	-0.00	-0.02
0.4	-0.00	-0.00	-0.09	-0.66
0.5	-0.00	-0.05	-0.91	-3.58
0.8	-5.54	-42.33	-43.27	-33.79
Average	-0.92	-7.06	-7.78	-6.34
Trend	-0.29	-0.29	-0.29	-0.27
$\int_{0.1}^{0.8}$	-0.21	-3.73	-7.44	-9.56

Decisions of trustors – risk attitudes

How much explained by risk attitudes?

- Slope parameter of decisions is $\approx .05$
- Slope parameter indicated by risk attitude analysis is .21 or more for likely risk attitudes

If risk attitudes play a role, other factors have a very small influence on decisions

- Trustors do not fully anticipate increasing selfishness of player 2
- This finding even stronger if trustors also become increasingly selfish or are adverse to compound (human and non-human) risk

Conclusion

- Trustees become more selfish and exploit trustors
 - ▶ Exploitation at the extensive margin (increases selfishness by about 4%)
 - ▶ Increasing uncertainty increases this tendency at the intensive margin (increases selfishness by about 18%)
 - Moral wiggling more important than opportunistic behavior
 - ▶ Opaqueness of risk leads to further exploitation
- Trustors adapt choices (transfers less)
 - ▶ Changes of trustors could be fully driven by risk attitudes; unlikely that strategic element is understood by player 1
- Need for policy makers to regulate in case of high risk or opaque of risk than can be observed only by agents, both of which can be used to exploit investors
 - ▶ Exploitation likely to be gradual (not outright fraud)

THANK YOU!

- Brock, J. M., Lange, A., and Ozbay, E. Y. (2013). Dictating the risk: Experimental evidence on giving in risky environments. *The American Economic Review*, 103(1):415–437.
- Gaudeul, A. (2013). Social preferences under uncertainty. *Jena Economic Research Papers*, 24.
- Haisley, E. C. and Weber, R. A. (2010). Self-serving interpretations of ambiguity in other-regarding behavior. *Games and Economic Behavior*, 68(2):614–625.
- Johnson, N. D. and Mislin, A. A. (2011). Trust games: A meta-analysis. *Journal of Economic Psychology*, 32(5):865–889.
- Krawczyk, M. and Le Lec, F. (2010). 'Give me a chance!' An experiment in social decision under risk. *Experimental economics*, 13(4):500–511.
- Krawczyk, M. and Le Lec, F. (2014). Dictating the risk: Comment. *American Economic Review*.
- López-Vargas, K. (2015). Risk attitudes and fairness: Theory and experiment. *mimeo*.
- Rohde, I. M. and Rohde, K. I. (2011). Risk attitudes in a social context. *Journal of Risk and Uncertainty*, 43(3):205–225.
- Vranceanu, R., Sutan, A., and Dubart, D. (2012). Trust and financial trades: Lessons from an investment game where reciprocators can hide behind probabilities. *The Journal of Socio-Economics*, 41(1):72–78.
- Wakker, P. P. (2010). *Prospect theory: For risk and ambiguity*. Cambridge University Press.