

Risk Aversion: Experimental Evidence from South African Fishing Communities

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Introduction

- While law enforcement capacity has been increased, non-compliance remains a concern
- Despite growing recognition that diverse factors influence fishers' behaviour, strengthening of law enforcement is often the primary strategy to achieve compliance
- Greater understanding of the factors affecting non-compliance is needed for a more inclusive management strategy
- Analyse the role of **risk attitudes** in resource usage by relating risk attitudes to non-compliance

Introduction (2)

- Risk attitudes:
 - Estimate the risk attitudes of a large sample of individuals from various fishing communities along the west coast of South Africa
 - Use subjects' choices over lotteries with real monetary prizes
 - Average participant is moderately risk averse
 - Risk attitudes vary with several important socio-demographic variables
 - Specifically: females more risk averse while rights holders more risk loving
 - Assess the extent to which results have implications for resource management and compliance
 - Preliminary: Risk attitudes serve as a crude proxy for non-compliance: females, female fishers and female rights holders more likely to comply with regulation
 - Facilitating greater industry access to females has positive implications for achieving compliance

Sample description

- 569 individuals filled out a detailed questionnaire and participated in risk experiments
- 52 individuals excluded → leaving a sample of 517 subjects
- Recruitment: community leaders, fishers associations, local newspapers, and flyers and adverts in community centres and harbours
- Of the whole sample:
 - On average, participants were 40 years old and had lived in their respective communities for most of their lives
 - Around 60% were male
 - 66% of participants classified themselves as Coloured, while the remaining majority classified themselves as Black or "Other"

Sample description (2)

- Educational attainments were low, with
 - 14% having completed their primary schooling,
 - 9% having completed high school
 - 3% having some form of tertiary qualification
- 48% were employed at the time of the survey:
 - of those employed, 69% reported fishing activities to be their primary source of income
- Mean monthly household per capita income for the sample was R361 compared with mean monthly household per capita expenditures of R376

Sample description (3)

- 37% are quota holders, 45% are permit holders
 - 60% of quota holders are male
 - 71% of permit holders are male
- 50% of subjects have a quota and/or a permit (rights)
- 78% perceive officials allocating rights as corrupt
- 83% perceive allocation process to be unfair

Elicitation procedure: Risk Experiment

(Binswanger, 1980; Holt and Laury, 2002 and Harrison, Lau, Rustrom and Sullivan, 2005)

- Employ a multiple price list (MPL) design to elicit risk attitudes
 - Each subject was presented with 8 pairs of lotteries (Lottery A and B)
 - For each pair, respondents choose between Lottery A (sure bet) or B

Task	Lottery A				Lottery B				EVA	EV ^B	Diff
	P	Prize	P	Prize	P	Prize	P	Prize			
1	1	20	0	0	0.5	20	0.5	0	20	10	10
2	1	15	0	0	0.5	20	0.5	0	15	10	5
3	1	12	0	0	0.5	20	0.5	0	12	10	2
4	1	10	0	0	0.5	20	0.5	0	10	10	0
5	1	8	0	0	0.5	20	0.5	0	8	10	-2
6	1	6	0	0	0.5	20	0.5	0	6	10	-4
7	1	4	0	0	0.5	20	0.5	0	4	10	-6
8	1	2	0	0	0.5	20	0.5	0	2	10	-8

- Subjects also completed a detailed questionnaire that elicited information on their socio-economic background, employment activities, fishing experience and also included a range of attitudinal questions

Estimating Risk Attitudes

- Harrison and Rustrom (2008); Harrison et al. (2008); Harrison et al. (2006)
- Expected utility theory specification which assumes a CRRA utility function
- The CRRA utility function is defined as:

$$u(x) = \frac{x^{1-r}}{(1-r)} \quad (1)$$

- x represents the lottery prize and
- r is the CRRA coefficient yet to be estimated.
- With this CRRA specification:
 - $r = 0$ denotes risk neutrality
 - $r > 0$ denotes risk aversion
 - $r < 0$ indicates risk loving

Estimating Risk Attitudes(2)

- There are k possible outcomes in a lottery
- Probabilities for each outcome, $p(k)$, are determined by the experimenter
- Expected Utility – weighted utility of “each outcome in each lottery”

$$EU_i = \sum_{k=1}^k (p_k \times U_k) \quad (2)$$

- The EU for each lottery pair is calculated for a candidate estimate of r and the following index calculated:

$$\nabla EU = EU_B - EU_A \quad (3)$$

- where EU_B is the right lottery (Lottery B), and EU_A is the left lottery (Lottery A)

Estimating Risk Attitudes(3)

- This index (3) is then linked to the subjects' observed choices using a standard cumulative probability distribution function $\Phi(\nabla EU)$
- The conditional log-likelihood is:

$$\ln L^{cond}(r; y, X) = \sum_i y_i \ln \Phi(\nabla EU) - \sum_i [y_i \ln \Phi(\nabla EU) + (1 - y_i) \ln (1 - \Phi(\nabla EU))] \quad (4)$$

- where $y_i = \mathbf{1}(0)$ denotes the choice of the right (left) lottery in task i , and X is a vector of individual characteristics.

Estimating Risk Attitudes(4)

- Independent variables:
 - Age
 - Age squared
 - Education
 - Education squared
 - Bread winner
 - Gender
 - Race
 - Employment
 - Income
 - Fisher
 - Rights
 - Fishers association

ML Estimates for the EUT model

	A	B	C	D
	Full sample excl covariates	Full sample incl. covariates	Directly in the fishing industry	Directly in the fishing industry with rights
	N=517	N=517	N=288	N=239
Constant	0.394*** (0.029)	-0.445 (0.600)	0.673 (1.053)	0.546 (0.539)
Female	-	0.284*** (0.089)	0.202* (0.112)	0.268*** (0.089)
Breadwinner	-	-0.018 (0.095)	0.039 (0.110)	0.082 (0.074)
Income	-	0.003 (0.020)	-0.069 (0.063)	-0.078*** (0.025)
Fisher	-	0.216*** (0.068)	-	-
Rights	-	-0.114* (0.063)	-0.039 (0.105)	-
Fishers assoc.	-	0.047 (0.073)	0.158* (0.095)	0.188** (0.079)

Discussion: implications for compliance

- Risk analysis indicates (i) female fishers are more risk averse, (ii) female fishers with rights are more risk averse and (iii) rights holders are more risk loving
- Assess the implication of this for resource usage by analysing subjects' responses to **questions of compliance**
- Participants were asked:
 - Whether they have caught more than their quota states or fished without a permit or quota
 - The number of times they had been charged or arrested for violating fisheries regulation over the past 12 months
 - Whether it was right that they were charged or arrested
 - Whether they stopped violating regulations after being charged or arrested

Discussion: implications for compliance (2)

- Used this information to identify subjects who catch illegally
- Find that 37% of the sample have caught illegally
- Likely that this is an *under-estimation* of the extent of illegal activities

Breakdown of subjects who catch illegally

Variables	% of those who catch illegally (N=165)
Male	0.82
Female	0.18
Employed	0.54
Unemployed	0.45
Full-time fisher	0.65
Not a full-time fisher	0.35
Fishing rights	0.70
No fishing rights	0.16
Directly in the industry with rights	0.51
Indirectly in the fishing industry with rights	0.19
Allocation process corrupt	0.79
Allocation process unfair	0.87

Discussion: implications for compliance (3)

- Relationship between risk attitudes and compliance is more formally assessed with the use of logistic regression analysis
- Dependent variable: *catch illegally*
- Given the large proportion of subjects who feel the rights allocation process is corrupt and unfair – add **corrupt and unfair** as independent variables

Logistic regression estimates: illegal catch

	(A)		(B)		(C)			(D)			
	Full sample	Fisher	Fisher with rights	Full sample	Fisher	Fisher with rights	Process corrupt	Full sample	Fisher	Fisher with rights	Process unfair
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Exp. risk	0.174***										
Female		0.138***	0.113***	0.121***	0.152***	0.124***	0.139***	0.140***	0.147***	0.111***	0.157***
Breadwinner		1.450	2.822	2.508	2.822	2.822	2.822	1.762	1.868	2.561	2.822
Income		0.944	1.071	1.003	0.996	1.182	1.120	0.954	0.955	1.078	0.974
Fisher		1.061	0.210	1.051	0.160	0.251	0.263	0.174	0.251	0.225	0.227
Rights		-0.568	-0.374	-0.374	-0.374	-0.374	-0.374	-0.374	-0.374	-0.374	-0.374
Fisher assoc.		1.957**	1.880	1.674	1.943*	1.863	1.634	2.091*	1.979**	1.919	1.730
Corrupt		-	-	-	-	-	-	-	-	-	-
Unfair		-	-	-	-	-	-	-	-	-	-

Logistic regression estimates: illegal catch (2)

- Results:
 - Experimental risk parameter: signify a clear link between risk aversion and non-compliance:
 - An increase in the experimental risk measure (as participants become risk averse) is associated with a decrease in the odds of catching illegally
 - Females, female fishers and female fishers with rights are less likely to catch illegally
 - Females are also less likely to catch illegally when the officials allocating rights are perceived to be corrupt and when the allocation process is considered unfair
 - Rights holders are more likely to catch illegally
 - Rights holders are more likely to catch illegally when the officials allocating quotas are perceived to be corrupt
 - Rights holders are more likely to catch illegally when the allocation process is perceived to be unfair

Conclusion

- Female fishers and female fishers with rights are more risk averse
- Rights holders are more risk loving
- We analyse the implications of this for compliance with fisheries regulation:
 - We find that risk attitudes serve as a proxy for non-compliance: individuals who are more risk averse are more likely to comply with fisheries regulation while risk loving subjects are more likely to catch illegally
 - Female fishers and female fishers with rights are found to be less likely to catch illegally while quota holders are more likely to catch illegally
- Aside: the widespread perception that the allocation process is fraught with corruption increases the incidence of regulatory non-compliance in rights holders

*Thank You
The End*

