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Insurance Demand for Disaster-type Risks and Attitudes towards Risk and Ambiguity : an Experimental Study

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Natural Hazards in Forest Sector

Natural hazards such as windstorms (Lothar and Martin, 1999 ; Klaus, 2009), hurricanes (Gudrun, 2005 ; Kyrill, 2007) or fire (2003) = Huge economic losses for forest owners

Observations in France :

- ▶ Few private forest owners are insured against windstorm and/or fire
- ▶ Government gives financial assistance in case of extreme disasters

Example after windstorms of 1999 : “National Plan for French Forests” forecasting an assistance of €91.5 million per year during ten years

Literature

Some articles (*Kaplow, 1991 ; Kunreuther and Pauly, 2004 ; Kim and Schlesinger, 2005 ; Raschky and Weck-Hanneman, 2007*) proved that limited liability for financial losses created by public help takes away the individuals' incentives to insure.

However, in such analysis, several points must be underlined :

- ▶ only theoretical works
- ▶ only one type of governmental assistance
- ▶ only risky situation, i.e. risks with well-known probability of occurrence (\neq ambiguity)

Objective

The aim is to examine the impact of government assistance and ambiguity on the forest owners' insurance demand for natural hazards.

We implement an experiment designed to test :

- ▶ the effects of three types of programs : Fixed Public Support (FPS), Contingent Fixed Public Support (CFPS) and Insurance Subsidy (IS).

Benchmark : No Public Support (NPS)

- ▶ the impact of ambiguity, i.e. uncertainty of probability
↪ *Schade, Kunreuther and Kaas (2004) : ambiguity is a state of mind in which the decision maker perceives difficulties to estimate the relevant probabilities.*

Theoretical predictions

We present two theoretical models :

Model 1 : Impact of public program on insurance demand

- Insurance demand is higher in NPS case than in FPS one (Pred. 1)
- Insurance demand is higher in CFPS case than in FPS one (Pred. 2)
- Insurance demand is higher in IS case than in NPS one if owner exhibits CARA or IARA. If owner exhibits DARA, the insurance demand can be higher or lower with IS (Pred. 3)

Model 2 : Impact of ambiguity on insurance demand

- Insurance demand is higher in ambiguous situation than in risky one (Pred. 4)

OBJECTIVE \Rightarrow to test experimentally these four predictions

Participants

- ▶ 42 private forest owners from Aquitaine region
(mean age : 57 years ; men : 37 ; women : 5)
→ contacted through the Aquitaine Regional Center of Private Property
- ▶ 36 students from a French Forest Engineer School
(mean age : 21.4 years ; men : 18 ; women : 17)
→ experience realized during an introductory lesson to Economics of Risk

⇒ “Paper and pencil” experience

Procedures and instructions

- ▶ The participants were asked to play the role of a forest owner having 12 hectares of maritime pines in Aquitaine and to react to short scenarios about a risk of fire destroying their entire forest.
- ▶ Each scenario contains 3 informations :
 - Type of public compensation : NPS, FPS, CFPS and IS
 - Quality of the probabilistic information : risky with 0.2% *versus* ambiguous with (0.05%, 0.15%, 0.25%, 0.35%)
 - Annual income → high : €6000/year or low : €3000/year
- ▶ Each scenario is composed with 3 questions : **WTP for insurance**, choice of an insurance contract in a menu of 5 ones and WTP for self-insurance
 - participants were asked to specify the maximum amount they would be willing to pay to be fully insured against the risk of fire.

Experimental design

- ▶ Two within-subject variables :
 - POLICY : NPS, FPS, CFPS, IS
 - INCOME : €500/hectare/year and €250/hectare/year

- ▶ Three between-subject variables :
 - POPULATION : students and forest owners
 - PROBABILITY : risky and ambiguous
 - ORDER : high-low and low-high

⇒ WTP were normalized by the expected loss (EL) and we log transformed the ratio WTP/EL

⇒ We conduct a Multivariate Analysis of Variance (MANOVA) on our main dependent variable : $\log(WTP/EL)$

Manipulation check

- ▶ Order effect : the order of presentation of incomes has no impact on the WTP for insurance ($F = 0.227$; $p = 0.63$).
- ▶ Income effect : the income has no impact on the WTP for insurance ($F = 0.399$; $p = 0.53$).
- ▶ Population effect : the WTP for insurance of owners and students are not significantly different ($F = 0.482$; $p = 0.49$).

Attitude towards risk

TAB.: Means of WTP/EL and log(WTP/EL) for insurance by Policy and Probability

		NPS	FPS	CFPS	IS
Risk (n=42)	Mean WTP/EL	2.26	1.63	1.87	2.20
	Mean log(WTP/EL)	0.06	-0.14	-0.01	-0.11
Ambiguity (n=36)	Mean WTP/EL	6.42	5.16	5.46	7.50
	Mean log(WTP/EL)	0.32	0.18	0.24	0.19
Risk + Ambiguity (n=78)	Mean WTP/EL	4.18	3.26	3.52	4.65
	Mean log(WTP/EL)	0.16	0.01	0.10	0.03

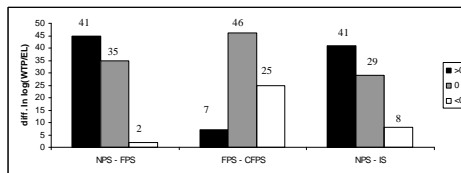
⇒ Participants are risk averse : the mean WTP/EL is always superior to the expected loss (= 1).

Impact of public policy instruments

- ▶ The main effect of variable POLICY is significant : $F = 6.924$; $p = 0.002$
→ There is an effect due to public policy instrument on insurance demand.
- ▶ The variable POLICY is composed with four modalities : NPS, FPS, CFPS and IS, so that it is interesting to performed two-by-two comparisons

Two-by-two comparisons

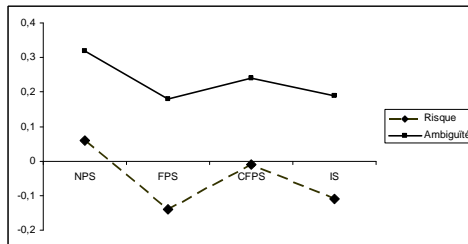
Mean $\log(WTP/EL)$: comparison by instrument



- ▶ FPS reduces ($p = 0.002$) the WTP for insurance compared to NPS → **Prediction 1 is verified.**
- ▶ FPS reduces ($p = 0.008$) the WTP for insurance compared to CFPS → **Prediction 2 is verified.**
- ▶ IS reduces ($p = 0.001$) the WTP for insurance compared to NPS → **Owners seem to exhibit DARA.**

Attitude towards ambiguity

Mean log(WTP/EL) by Policy and Probability



The main effect of PROBABILITY is significant : $F = 4.49$; $p = 0.038$

→ **Prediction 4 is verified.**

⇒ Subjects are ambiguity averse : they are willing to pay more in ambiguous context than in risky one, in order to be fully covered against the fire risk.

Conclusion

- ▶ Public policy instruments impact on the forest owners' insurance demand : compared to NPS, a FPS and a IS reduce the WTP. Moreover, compared to FPS, a CFPS increases the WTP.
- ▶ Participants are risk averse and ambiguity averse
→ our article seems to confirm the presence of a link between the two behaviors (as *Lauriola and Levin, 2001*).