

Eliciting farmers risk and ambiguity preferences in the loss and gain domain

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ESA 2012, New York

22 June 2012

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1.1. Motivations

- Few studies using experimental economics on farmers of developed countries.
- Fewer on risk and ambiguity on same sample.
- Usually paper set very strong assumption.
- **Estimating farmer's preference for both risk and ambiguity with distinction of losses and gains domain.**

1.2. Model

We based our experiment on the *Multiple Prior* (KMM 2005) model, we add distinction between gain and loss domain like a *Cumulative Prospect Theory* model (Tversky and Kahneman 1992).

CPT model

$$u(x) = \begin{cases} (x - x_0)^\alpha & \text{if } x \geq x_0 \\ -\lambda \cdot [(-x + x_0)^\alpha] & \text{if } x < x_0 \end{cases}$$

$$\pi(p) = \frac{p^\gamma}{[p^\gamma + (1 - p)^\gamma]^{1/\gamma}}$$

1.2. Model

Multiple Prior

$$u(\mathbf{x}) = \sum_{j=1}^J (p_j) u\left(\sum_{k=1}^K q_{jk} v(x_{jk})\right) \quad (1)$$

- $\mathcal{A} \times \mathcal{R}$ where \mathcal{A} are the finites set of J ambiguous elements and \mathcal{A} is a set of K risky elements.
- $x_{jk} \in \mathbb{R}$ are the payoff in state $A_j R_k$

1.3. Utility function

$$u(\mathbf{x}) = \begin{cases} \sum_{j=1}^J \Phi^+(p_j) \left(\sum_{k=1}^K \Gamma^+(q_{jk}) (x_{jk}^{\alpha^+} - x_0) \right)^{\rho^+} & \text{if } x_{jk} \geq x_0 \\ \sum_{j=1}^J \Phi^-(p_j) \left(\sum_{k=1}^K \Gamma^-(q_{jk}) (-\lambda(-x_{jk} + x_0)^{\alpha^-}) \right)^{\rho^-} & \text{if } x_{jk} < x_0 \end{cases}$$

With the following weighting function :

$$\Gamma^+(p) = \frac{p^{\gamma^+}}{(p^{\gamma^+} + (1-p)^{\gamma^+})^{1/\gamma^+}} \quad \Gamma^-(p) = \frac{p^{\gamma^-}}{(p^{\gamma^-} + (1-p)^{\gamma^-})^{1/\gamma^-}}$$

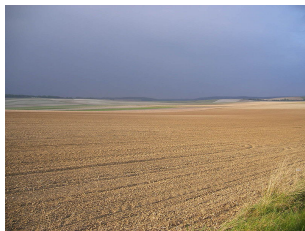
$$\Phi^+(p) = \frac{p^{\phi^+}}{(p^{\phi^+} + (1-p)^{\phi^+})^{1/\phi^+}} \quad \Phi^-(p) = \frac{p^{\phi^-}}{(p^{\phi^-} + (1-p)^{\phi^-})^{1/\phi^-}}$$

1.3. Utility function

For taking into account loss aversion, two commonly used hypothesis can be made.

- $\alpha^+ = \alpha^-$, $\rho^+ = \rho^-$, $\gamma^+ = \gamma^-$ and $\phi^+ = \phi^-$ but λ is supposed to be different from 1. In other words, all the loss aversion phenomena is represented by a single parameter λ . In this case λ perfectly describes how much "losses loom larger than gains".
- $\lambda = 1$ in this case we suppose that both domains are separate and require two sets of preference functions.

2.1. Description sample



- Winter 2011. Champagne Ardennes (France).
- Access to a sample of 1,658 farmers
- Randomly \Rightarrow send 848 letters.
- 197 interviews completed
- 9 series *Multiple Price List* (119 choices ! 23,245 observations ! 4 orders !), individuals characteristics and farms characteristics.

2.2. Description experiment

Modality A ("risk and gain first") order :

- **1** and **2** : 14 choices gains \oplus risk \neq probabilities
- **3** : 7 choices gains and losses + risk.
- **4** and **5** : 14 choices losses + risk \neq probabilities
- **6** and **7** : 14 choices gains + ambiguity \neq distributions
- **8** and **9** : 14 choices losses + ambiguity \neq distributions

The five first series are a variation of the protocol of Tanaka and al. (2010) and the four last series (**6,7,8** and **9**) are a variation of the protocol of Chakravarty and Roy (2009) for eliciting ambiguity preferences.

2.3. Incentives

- Homogeneous incentives : All farmers are payed.
- At the end of the experiment we randomly draw one of the 119 choices and play the chosen lottery.
- 20 € show-up fee.

Earnings are range from 8.80 € to 80 € (mean. 21.21 € and sd. 6.69 €)

Choose which color you want to bet on : (circle you choice) WHITE RED

Condition	Urn A 5 WHITES + 5 REDS		Urn B 10 Balls of same color (10 WHITES or 10 REDS)		Choice
	If you don't pick a ball of the colors you bet on	If you pick a ball of the color you bet on	If you don't pick a ball of the colors you bet on	If you pick a ball of the color you bet on	
1	0€	1,000€	0€	100€	A B
2	0€	750€	0€	100€	A B
3	0€	500€	0€	100€	A B
4	0€	250€	0€	100€	A B
5	0€	150€	0€	100€	A B
6	0€	110€	0€	100€	A B
7	0€	100€	0€	100€	A B
8	0€	90€	0€	100€	A B
9	0€	70€	0€	100€	A B
10	0€	50€	0€	100€	A B
11	0€	40€	0€	100€	A B
12	0€	30€	0€	100€	A B
13	0€	20€	0€	100€	A B
14	0€	10€	0€	100€	A B

Considering urn B, according to you what is the probability of appearance of the color you bet on ?

TABLE: Example of serie **6** for ambiguity in gain domain

3.1. Characteristics of our sample

Variables	Description	#Obs	Moyenne	SD
<i>Describing farmers</i>				
AGE	Age (in years)	197	48.56	10.16
GENDER	=1 if farmer is a man =0 otherwise	197	0.97	0.15
HOUSEHOLD	Household size	197	2.89	1.35
EDUC	=1 if "baccalaureat" diploma or higher =0 otherwise	197	0.65	0.48
<i>Describing farms</i>				
UAA	Utilized Agricultural Area(hec)	197	159.04	97.75
COMPANY	=1 if company and 0 otherwise	197	0.69	0.46
PARTNERSHIP	=1 if partnership and 0 otherwise	197	0.07	0.25
CROP	=1 Cereal, Oleaginous plant, Beets	197	0.67	0.61
<i>Describing farmers' risk perception*</i>				
RISKPPROD	Perception of output price risk	197	4.58	0.59
RISKPINT	Perception of input price risk	197	4.53	0.71
RISKCLIM	Perception of climatic risk (yield)	197	4.26	0.86
RISKCOM	Perception of output marketing risk	197	3.22	1.12
RISKPOL	Perception of risk related to policies	197	3.99	0.92
RISKTECH	Perception of technological risk	197	3.42	1.07

* Farmers were asked to grade their perception of the 6 types of risks related to their activity on a 5-level scale, from 1 ("not risky") to 5 ("very risky").

3.2. ML estimation

Hypothesis	(1a)	(1b)	(2a)	(2b)
Estimated parameters	Coefficient (Robust SE)	Coefficient (Robust SE)	Coefficient (Robust SE)	Coefficient (Robust SE)
σ				
constant	0.355*** (0.123)	0.469 (0.427)	0.415 (0.514)	0.729* (0.399)
Risk	both domains		gain domain	
α^+				
constant	0.003 (0.009)	0.453*** (0.035)	0.442*** (0.048)	0.472*** (0.044)
γ^+				
constant	1.003*** (0.007)	0.348*** (0.027)	0.334*** (0.032)	0.329*** (0.031)
			loss domain	
α^-				
constant			0.463*** (0.039)	0.499*** (0.029)
γ^-				
constant			0.384*** (0.031)	0.409*** (0.024)
λ				
constant	1.369*** (0.202)	1.381*** (0.127)		

3.2. ML estimation

Hypothesis	(1a)	(1b)	(2a)	(2b)
Estimated parameters	Coefficient (Robust SE)	Coefficient (Robust SE)	Coefficient (Robust SE)	Coefficient (Robust SE)
Ambiguity	both domains		gain domain	
ρ^+				
constant	0.102* (0.056)	0.371*** (0.028)	0.365*** (0.037)	0.389*** (0.030)
ϕ^+				
constant	0.270 (0.238)	0.641*** (0.043)	0.623*** (0.039)	0.598*** (0.047)
			loss domain	
ρ^-				
constant			0.307*** (0.036)	0.353*** (0.034)
ϕ^-				
constant			1.049*** (0.250)	1.435*** (0.263)
x_0 : reference point				
constant		7.73*** (1.107)		9.053*** (0.418)
Log likelihood	-12335.03 (N/A)	-11487.12 (N/A)	-11411.40 (N/A)	-11363.75 (N/A)

3.3. Post-estimation

We run ML estimation and post-estimation test :

- **Farmers are risk and ambiguity averse in both domain.**
- Loss aversion.
- Probabilities and distributions distortion are in "inverse-s" shape (except ambiguity under losses).
- Behavior \neq gains/losses.
- Behavior \neq risk/ambiguity.
- The reference point \neq 0 around 9.

3.4. Extensions

- **How to explain the reference point formation ?**
[Schmidt and Zank, 2011 ; Apesteguia and Ballester, 2009 ; Köszegi and Rabin, 2006]
- **The reference point is dependent of individual characteristics.**
Age +, UAA -, EDUC -, HOUSEHOLD -.
- **The reference point is also dependent of the presentation order.**
Hyp : Presenting losses before gains lower the reference point.
Results : Only in case of ambiguity first. The reference point is dependent of order for risk/ambiguity and loss/gain

3.5. Limitations

- One structural form.
- Multiple Prior ? Machina 2009
- The losses in an experiment : show-up fee as an insurance ?
- Multiple switching point.
- More variables. Convergence ?
- Revealed preference : data on the farm ?

Conclusion

Thank you for your attention !