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

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Abstract

Risk and ambiguity are pervasive in farming activities. Although agricultural economists have a long tradition of analysing risk, there is still a lack of understanding of farmers' risk and ambiguity preferences. We aim at structurally estimating these preferences. We use a model that combines a second order model for ambiguity and a model that allows for differences in utility in the gain and loss domains and probability distortion. Moreover, we allow for an endogenous reference point that we estimate. We collect responses from 197 farmers. We find (i) farmers are slightly risk averse in the gain and loss domains and have an inverse s-shaped probability weighing function for risk; (ii) farmers are slightly ambiguity averse in the gain domain and ambiguity neutral in the loss domain and have an inverse s-shaped probability weighing function in the gain domain but do not distort probabilities in the loss domain; (iii) farmers have a positive reference point.

Key words: Risk Attitudes; Ambiguity; Field Experiment; Farmer;

JEL: C93 (Field Experiments); D81 (Criteria for Decision-Making under Risk and Uncertainty); Q10 (Agriculture);

1 Background and motivation

Risk and ambiguity are pervasive in farming activities. Agricultural economists have paid a lot of attention to the impact of risk on farmers' activities and their risk management. Less attention has been paid to improving the elicitation of risk preferences. Most studies

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derive farmers' risk attitudes from deviations from a theoretically predicted optimal behavior. In such studies, risk attitudes are residuals that are not free from confounds such as anticipations for example. As for ambiguity, agricultural economists treat ambiguity as risk. In view of these limitations, there is a need to better assess farmers' risk and ambiguity attitudes. In this paper, we aim at eliciting farmers' risk and ambiguity attitudes using an artefactual field experiment. We model farmers' utility using the model of Nau (2006) that is a discrete version of the smooth ambiguity model (Klibanoff, Marinacci, and Mukerji, 2009). This model enables to disentangle ambiguity from ambiguity attitudes. Besides, as Chakravarty and Roy (2009), we use a utility specification allowing for differences in utility in the gain and the loss domains and probability distortion. Moreover, we allow for probability distortion in the ambiguous situations and for an endogenous reference point that we estimate. We design a multiple price list protocol allowing for risky choices in the gain and loss domains and for ambiguous choices in the gain and loss domains. A total of 197 farmers were face-to-face interviewed.

2 The combined model

We follow the modeling strategy of Tversky and Kahneman (1992) and Klibanoff, Marinacci, and Mukerji (2005) to enable us to identify risk and ambiguity aversion parameters for the farmers in our sample. We combine the two specifications distinguishing between the gain and the loss domains and allowing for a second order model.

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

$\mathbf{x} = (x_{11}, x_{12}, \dots, x_{JK})$ is an act, x_{jk} is an outcome, x_0 is the reference point. We define the parameters as follows: α^+ (resp. α^-) the concavity of the utility function for risk in the gain domain (resp. loss domain); ρ^+ (resp. ρ^-) the concavity of the utility function for ambiguity in the gain domain (resp. loss domain); Γ^+ (resp. Γ^-) the weighting function on probabilities in the gain domain (resp. loss domain); Φ^+ (resp. Φ^-) the weighting function on the distribution of beliefs on ambiguity in the gain domain (resp. loss domain);

With the following weighting function:

$$\begin{aligned} \Gamma^+(p) &= \frac{p^{\gamma^+}}{(p^{\gamma^+} + (1-p)^{\gamma^+})^{1/\gamma^+}} & \Gamma^-(p) &= \frac{p^{\gamma^-}}{(p^{\gamma^-} + (1-p)^{\gamma^-})^{1/\gamma^-}} \\ \Phi^+(p) &= \frac{p^{\phi^+}}{(p^{\phi^+} + (1-p)^{\phi^+})^{1/\phi^+}} & \Phi^-(p) &= \frac{p^{\phi^-}}{(p^{\phi^-} + (1-p)^{\phi^-})^{1/\phi^-}} \end{aligned}$$

3 Empirical results

We estimate the parameters of the combined model under two hypotheses for identification reasons:

- In model (1), we assume $\alpha^+ = \alpha^-$, $\rho^+ = \rho^-$, $\gamma^+ = \gamma^-$ and $\phi^+ = \phi^-$.

- In model (2a), we assume $\lambda = 1$.

In addition, we consider an exogenous reference point in models (1) and (2a) and an endogenous reference point in model (2b).

We find (i) farmers are slightly risk averse in the gain and loss domains and have an inverse s-shaped probability weighing function for risk; (ii) farmers are slightly ambiguity averse in the gain domain and ambiguity neutral in the loss domain and have an inverse s-shaped probability weighing function in the gain domain but do not distort probabilities in the loss domain; (iii) farmers have a positive reference point.

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