How risk-averse are small-scale cattle farmers in West Africa?
- First insights from an experimental study in West Africa using panel data -

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Motivation

This study combines household survey panel data and experimental data to investigate the risk attitude of 98 smallholder cattle farmers in Mali and Burkina Faso. All respondents face the same problem, i.e. managing African animal trypanosomosis (AAT), a major livestock disease in cattle and its widespread resistance to commonly available drugs. Inefficient disease management is one reason why the problem of AAT persists. Farmers' attitude to risk and myopic behavior are assumed to be factors that contribute to inefficient disease management. Therefore, the objective of this study is to assess farmers' attitudes towards risk.

Conceptual framework

We follow Tversky and Kahneman's (1992) cumulative prospect theory in combination with the one-parameter probability function derived by Prelec (1998). A subject's utility of prospects ($x,p:y,q$) is then defined as:

$$PT(x,p;y,q)=\begin{cases} v(y)+w(p)((v(x)-v(y)), & x>y>0 \quad or\ x<y<0 \\ w(p)v(x)+w(q)(v(y)), & x<0<y \end{cases}$$

A piecewise power function assigns a value (v) for gains and losses separately:

$$v(x)=\begin{cases} x^{\sigma}, & for \quad x>0 \\ -\lambda(-x^{\sigma}), & for \quad x<0 \end{cases}$$

and Prelec's (1998) probability weighting function is:

$$w(p)=\frac{1}{\exp(\ln(1/p))^{\alpha}} \quad , \quad 0<\alpha<1$$

The parameters to be estimated are:

- α - proxy for probability weighting
- σ - concavity of the value function
- λ - degree of loss aversion

Hypotheses

1. Farmers are expected to overweight small probabilities and underweight large probabilities (α<1).
2. Farmers are expected to be risk-seeking in gains and risk-averse in losses (σ tending to zero and λ>1).

Data collection

The data used in the study stems from two sources: (i) household panel survey of 98 households over three periods of time 2003/2004, 2007 and 2011; (ii) economic field experiments among the household heads conducted in 2011.

Methodology

We adapt a maximum likelihood method to jointly estimate the three parameters of the prospect theory-based utility function. We estimate two models. In the first model we assume that respondents are homogenous in their preferences and simultaneously estimate the parameters of the utility model. In the second model we estimate the parameters against socio-economic characteristics. Lag operators (Δ) are included in the model to picture the cumulative dynamic effect of characteristics observed in 2003/2004 and 2007 on farmers' risk attitudes elicited in 2011.

Results

Maximum likelihood estimates under homogenous preferences

Parameter	Estimate	SE	p-value
Probability weight α	0.135	0.033	0.000
Risk aversion σ	0.114	0.012	0.000
Loss aversion λ	1.485	0.371	0.000
H0: α=1			0.000
H0: λ=1			0.191
N=3430 (Number of clusters = 98)			

Maximum likelihood estimates under heterogeneous preferences

Variable	α	σ	λ
Dummy Burkina Faso	2.024*	-0.887***	48.659**
Δ Age of HH Head	0.012	0.001	0.271***
Education of HH Head	0.339*	-0.082***	-85.081
Δ HH size	-0.026	0.015***	-1.834***
Δ Children at school	0.108***	-0.053***	-1.454*
Δ Transports	-0.049	0.017***	-0.579
Δ Cattle	-0.034**	-0.008***	-0.331
Δ Income	-0.0005	0.0004***	-0.015*
ΔTreatment expenditures ($PPP)	0.007**	-0.002***	0.23**
Constant	1.5**	-0.684***	64.33***
N=3430 (Number of clusters = 98) Pseudo-Log Likelihood = -2061.4774			
Note: Single, double, and triple asterisks (*,**,***) denote p < 0.10, 0.05, and 0.01, respectively.			

Discussion

- Farmers overweight small probabilities and underweight large probabilities (H1 confirmed)
- Farmers are risk-seeking in gains but not significantly risk-averse in losses (H2 not fully confirmed)
- Sending more children to school decreases the degree of loss aversion, but increases risk aversion
- Farmers with larger herds are more risk-averse in contrast to a study in Ethiopia (Yesuf & Bluffstone 2009)
- Wealthier farmers are less risk and loss averse in accordance with a study in Vietnam (Tanaka et al. 2010)

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