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The Effect of Bt Corn Adoption and Risk Aversion on Farmer Investment Decisions

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Introduction

Bt corn has been shown in studies to reduce corn yield risk (Shi, Chavas and Lauer 2013). Changes in the yield risk change the distribution of incomes generated from the farm. This in turn may affect farmer perception of income generated from the farm. Outcomes likely to be affected include the on-farm off-farm labor substitution ratio and the farmer on-farm investment decisions.

Objective

To examine the changes in on-farm investment decisions of farms adopting Bt corn in response to Bt corn adoption. Of particular interest is postulating a model, based on loss aversion, that can help to explain such responses.

Data

The data used is a two year panel of farmer in the South Cotabato and Isabela provinces in the Philippines. In total 278 farmers were sampled with in 2007 and 2010. In 2007 120 hybrid farmers and 150 Bt farmers were sampled. In 2010, 30 of the farmers were planting hybrid, 23 were planting Bt and 218 planted a new variety that contained both the Bt and herbicide tolerance traits, which we refer to as the stacked trait.

The data also contained information on farmers finances such as assets, income from other sources. In addition the data contained information on purchases of farm machinery and irrigation equipment which we consider to be investment expenditures for this study.



Model

The model assumes farmers are concerned with their position relative to a reference wealth level. α , the proportion of wealth diverted to farm investments diverted to investment, is a function of the probability of sinking below the desired threshold. To obtain the optimal proportion of α

$$\max EU(W_{t+1} - \widetilde{W}) + U\left(\int_{-\infty}^{W-W_t} f(R_r) dR_r\right)$$

s.t.

$$E(W_{t+1}) = \alpha E(R_r) + (1 - \alpha)R_f + W_t$$

Solving this system of equations yields solutions for α :

 $\alpha = f(R_r, R_f, P_l)$

This yields a curve that is U shaped when alpha is plotted vs wealth, suggesting that farmers are risk seeking below their reference wealth, cautious when near their reference wealth and display decreasing risk aversion when they are well above their reference wealth.



Estimation Procedure

The estimation proceeded along three lines:

- Yield estimation to determine the yield effects of Bt and Stacked compared to hybrid corn in the data.
- Just and Pope partial moment risk analysis to determine the effect of Bt and Stacked trait adoption on the distribution of corn yield
- A fifth order polynomial regression of an interacted seed type and income level on investment to determine the any non-linear

response as a function of income of investment to GMO adoption. Estimates were plotted to visually verify the curvature implied by the estimates obtained.

Results

	Polynomial Coefficients
GMO/Income Interaction	-0.358*
	(-2.26)
GMO/Income ² Interaction	0.00000248**
	(3.07)
GMO/Income3 Interaction	-5.06e-12**
	(-3.23)
GMO/Income ⁴ Interaction	3.78e-18**
	(3.26)
GMO/Income ⁵ Interaction	-8.77e-25**
	(-3.26)
Observations	429

t statistics in parenthese:

p < 0.10, *p < 0.05, **p < 0.01, ***p < 0.001

I investment regressions included a variable controlling for the stock of wealth such as the due of house and land. Controls for farmer age and years of farming experience. The rmers ownership status as some farmers ranted land rather than owned it and their pectation of both yield and pest infestation. As well as time and individual fixed effects tich were left out for presentation purposes.



Discussion and Conclusion

- Farmers appear to be responding to risk and income incentives produced by Bt adoption by increasing investment levels
- The response is non-linear and this nature deserves special consideration for policy analysis
- This has implications for poor countries hoping to encourage greater level of entrepreneurship and farm growth

