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Improved Seed, Intra-crop Diversity and Risk Exposure in Ethiopia

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Introduction

Agricultural production is a risky sector. Biological, climatic and institutional factors are some of the factors contributing to farmers' exposure to production uncertainty. Maize is Africa's most important cereal food crop and is grown by more than 300 million vulnerable farmers in rural communities that are mostly dependent on rain-fed systems hence are exposed to high risk and uncertainty.

The onset of the Green Revolution in the 1950s, with which High Yield Varieties (HYVs) of crops such as maize were introduced to farmers in developing countries transformed agricultural productivity trends. Langyintuo *et al.*, 2008 estimate high adoption rates (over 70%) of improved maize varieties in countries like Kenya, Zimbabwe and Zambia. Traditionally, most studies that have focused on productivity analysis have limited their analysis to include only the mean and variance. Including a higher order moment of output distribution, i.e. the skewness allows for investigating the effects of explanatory variables on downside risk which is necessary when analyzing risk.

Farmers' risk management options



Figure 1. Use of Improved varieties



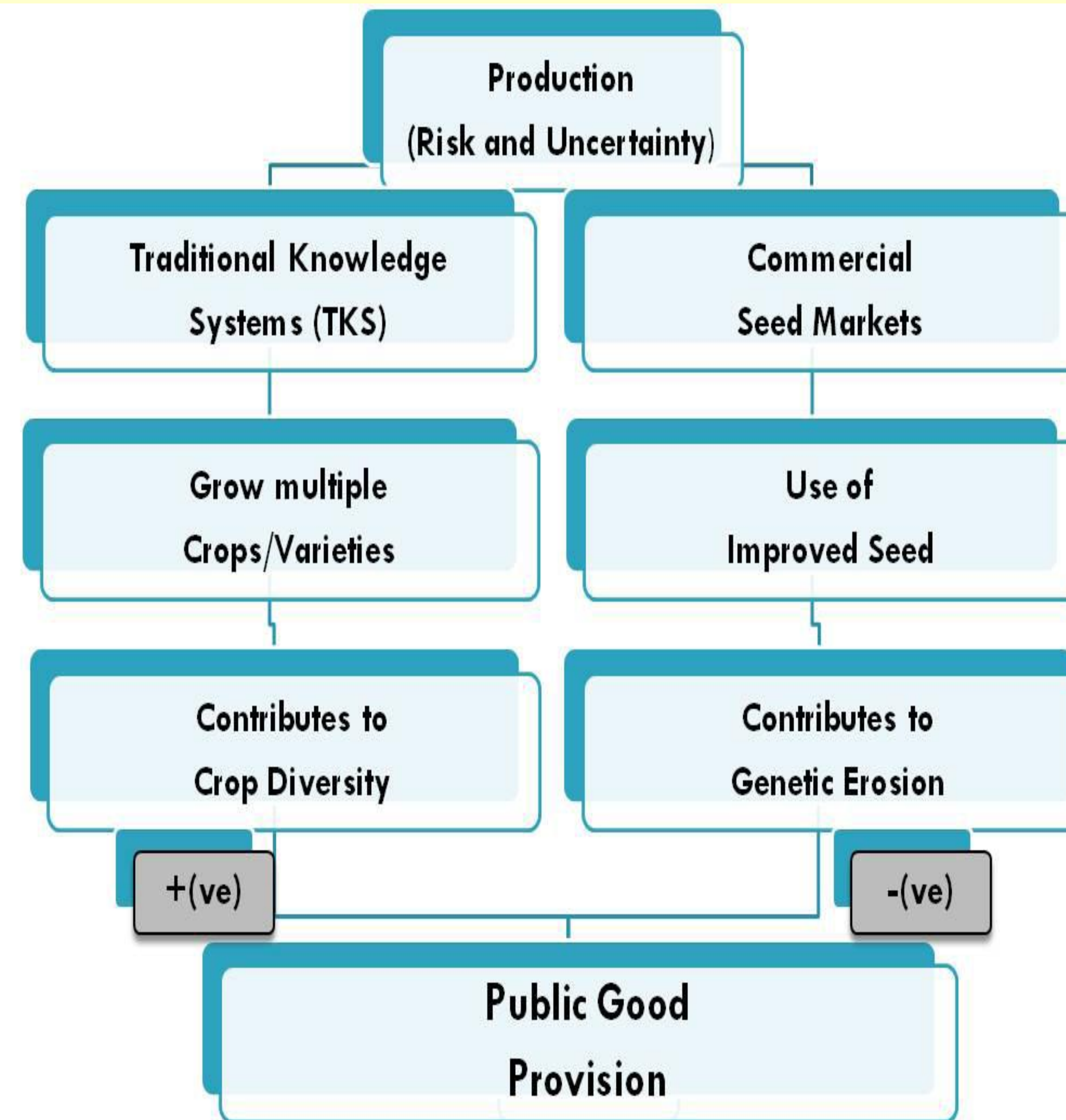
Figure 2. Maintaining Intra-crop diversity

Farmers have a choice of maintaining intra-crop diversity which is a TKS or using improved varieties from commercial seed markets in order to adapt to an ever-changing environment. Intra-crop diversity involves the simultaneous planting of varieties (including traditional and improved) with different variances and co-variances of returns. Since intra-crop diversity contributes to genetic diversity, which is a public good, its private provision by farmers inherently comes short of the socially optimal level of supply.

Objectives of the study

In this study we investigate how maintaining intra-crop diversity and growing improved varieties of maize affects the yield distribution of maize. We go beyond the conventional mean-variance analyses by including a higher order moment i.e. the skewness function, which captures how the explanatory variables affect farmers' exposure to unfavourable downside risk.

Conceptual Framework



Methodology

We use the generalized method of moments on a stochastic production function to obtain the first three moments of yield distribution. We employ a three stage least squares regression to model to investigate the effects of intra-crop diversity and use of improved seed affects farm productivity (the) and downside risk (skewness function). *Data used in this analysis were collected from 369 farmers in two drought prone districts of Ethiopia. The original survey was part of the Drought Tolerant Maize for Africa (DTMA) project implemented by the International Maize and Wheat Improvement Centre (CIMMYT) in collaboration with the International Institute of Tropical Agriculture (IITA) and funded by the Bill and Melinda Gates foundation and the Howard G. Buffett Foundation.

*For full survey details, refer to Legese, G., Jaleta, M., Langyintuo, A., Mwangi, W., La Rovere, R., 2010. "Characterization of maize producing households in Adami Tulu - Gido Kombolcha and Adama districts in Ethiopia". DTMA Country Report - Ethiopia. CIMMYT, Nairobi

Results and Discussions

Three Stage Least Squares Regression Results

VARIABLES	Mean	Variance	Skewness
Fertiliser	0.0400***	-8.05E-05	-0.511***
Labor	0.0172***	0.189***	-0.136***
Area	0.0444***	0.629***	-2.367***
Oxen	0.0551***	-0.159***	0.400***
Fertuse	-0.0542***	-0.500***	2.460***
Manure	-0.00610***	0.716***	-2.307***
DIVERSITY	0.0132***	-0.00232	0.370***
Plots	-0.0419***	0.537***	-2.126***
Age	0.0150***	-1.177***	3.200***
Pestndzz	-0.0211***	0.143**	-0.389***
Weeds	0.0389***	0.155**	-2.193***
IMP_VTIES	0.00717***	0.227***	1.357***
Constant	1.722***	3.416***	-11.17***
Observations	330	330	330

Significance level: *** =1% and ** =5% Source: DTMA Survey data

Estimation results show that maintaining Intra-crop diversity (DIVERSITY) significantly increases the mean output of maize and also reduces the exposure to crop failure. We also find that use of improved maize varieties (IMP_VTIES) also increase the average output of maize, increases the variability of yield and reduces the risk of crop failure.

Conclusions

As farmers are constantly being exposed to production risk and uncertainty, use of improved varieties and maintenance of intra-crop diversity are ex-ante strategies that can potentially help reduce exposure to risk. These two strategies can be used individually or in combination in order to reduce risk of crop failure, thus improving food security and subsequently reducing rural poverty.

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