HETEROGENEOUS FARMERS’ TECHNOLOGY ADOPTION DECISIONS: GOOD ON AVERAGE IS NOT GOOD ENOUGH

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Motivation

Despite the importance of the agriculture sector, farmers in Sub-Saharan African countries persistently use traditional farming methods and face low agricultural productivity [7]. A large share of current studies focus on obstacles that have caused the insufficient usages of modern technology, such as information failure [1] [4] [6], supply shortages [5], credit constraints [3], and behavior constraints [8]. These factors contribute to the low and stagnant rate of technology adoption, but they cannot fully account for it.

Objectives

- Understand the rationale behind farmers’ technology adoption decisions.
- Construct a structure model that could be used to examine technology adoption decisions under uncertainty.

Theoretical model

At the beginning of each farming season, farmers consider various existing agricultural technologies \((\theta_{ijt})\) and choose which one to adopt for each plot. Assume that farmers are expected utility maximizers and care about both the expected returns and the variance of profits, which are defined as minus yields costs:

\[
\max_{\theta_{ijt}} -x_{ijt}y_{ijt} + \nu_{ijt}
\]

where \(i\) represents farmer, \(j\) refers to plot, \(t\) stands for agriculture season, and \(\nu\) is the profit.

I build farmer’s production function with four special proprieties: 1) heterogeneous returns, 2) selection bias, 3) heterogeneous variances, and 4) multiple technology choices:

\[
\pi_{ijt} = Z_{ijt}^\prime \beta + \epsilon_{ijt}
\]

To empirically study farmers’ decisions about agricultural technology adoption, I estimate the farmer’s decision-making model through four steps.

1. Evaluate the farmer’s production function as a correlated random coefficient (CRC) model and substitute farmer’s unobserved and endogenous productivity with its linear projection on the farmer’s full history of adoptions and their interactions.
2. Decompose the previously estimated residual term of the farmer’s production function through the feasible generalized least squares (FGLS) method, to separate out the intrinsic characteristic of the technology set that affects the variance of production.
3. Re-estimate the production function with a weight derived from the previous step, thereby all coefficients are updated to be both consistent and asymptotically efficient.
4. Calculate farmers’ responses to the expected value of profit and the variance of profit and analyze factors that influence farmers’ technology adoption decisions using the alternative-specific conditional logit method.

Expected returns justify the adoption of fertilizer and both technologies, but cannot justify the adoption of intercropping.

Policy implications

1. Given the high variation in yields and profits, providing crop insurance to insure production risk could increase fertilizer adoption and therefore overall yields.
2. Given the importance of variance on farmer’s decision making, it is beneficial to have more agronomic research aimed at inventing low-variance technologies.

References