An Estimable Model of Farmer Choice With Observed Price, Weather and Pest Expectations

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Goals of Paper

This paper addresses the following questions:

1. How do the subjective distributions that farmers hold over uncertain future outcomes – crop yields, pest pressure, rainfall and output prices – influence production decisions at intermediate stages?

2. What is the value to the farmer of reductions in uncertainty at intermediate stages of production?

Contributions:

- First paper, to my knowledge, that uses high frequency input data and high frequency expectations data to study agricultural production
- First agricultural panel study in Africa that uses data gathered by phone
- More generally, first dynamic resource allocation problem studied with observation of decision makers' expectations over uncertain random variables

Data and Setting

Data Collection:

- 300 cotton farmers from 15 villages in NW Tanzania
- Baseline survey in summer 2009
- 198 farmers given a phone at baseline, to be used for high frequency interviews
- Calling schedule and provisions for phone charging made within each village
- Every 3 weeks we called each farmer to gather data on input use, labor, credit, crop and livestock transactions, subjective expectations, and other relevant matters
- Follow-up survey in summer 2010 with all 300 farmers

For details on phone survey methodology see my paper "Using Mobile Phones to Collect Panel Data in Developing Countries" forthcoming in *Journal of International Development*

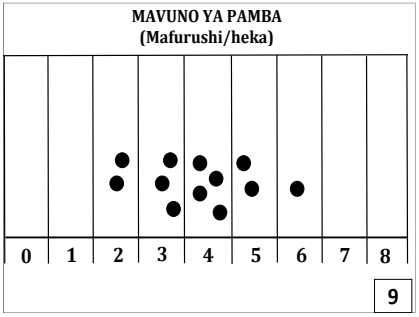
Cotton in Tanzania:

- Primary cash crop in NW Tanzania
- Produced exclusively for export, by ~450,000 smallholders
- Accounts for about 15% of Tanzania's ForEx earnings
- Arguably the most competitive Ag output sector in TZ

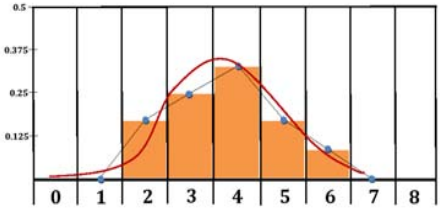
Measuring Subjective Distributions

Using sheets like the one below, respondents indicate their subjective distributions by allocating a fixed number of stones, beans or seeds to the bins of a histogram:

"Cotton Yield
(Mafurushi per acre)"

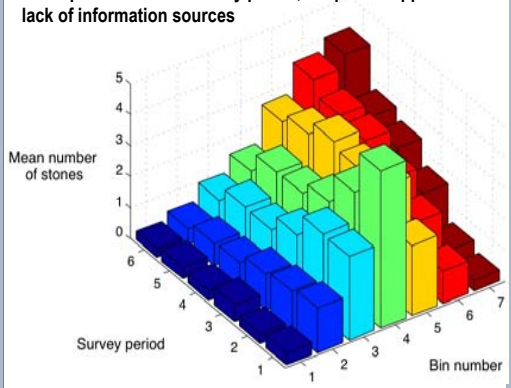


1 Mafurushi ~= 89 Kilograms



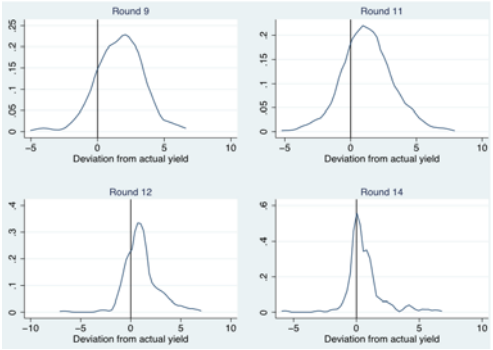
Evolution of Price Distributions

Surprisingly, average price distributions tracked changes in world prices over the survey period, despite an apparent lack of information sources



Evolution of Yield Distributions

As expected, deviation of yield expectation from eventual yield realization decreases as the cultivation period progresses



Model and Estimation Procedure

Following Fafchamps (1993), I estimate a CES model with preferences over leisure and consumption (which is tantamount to harvest revenue), subject to budget and hours constraints.

Objective function:

$$\max_{c,d,l,h,w,q} U_t = \sum_{s=t}^{6} \delta^{s-t}[u(c_s, l_s)] + v(\hat{W})$$

such that (2) holds

$$c_t + p_t^k k_t \leq W_t \ \forall t$$
$$h_t^c + h_t^m + l_t = L \ \forall t$$
$$k_t \geq 0 \ \forall t$$

Results

On the way…