ADOPTION OF TECHNOLOGY IN DEVELOPING COUNTRIES (SELECTED PAPER SESSION 6R): DISCUSSION

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The papers presented in this session move beyond the questions of who adopts technologies to ask how preferences for characteristics (of maize in Mexico or cattle in Burkina Faso) affect adoption, how technical change differentially affects semi-subsistence farmers, and how it affects productivity and yield variability when the characteristics of adopting and non-adopting farm households are explicitly modeled.

Paper 1: *Modeling the Impacts of Soil Conservation on Productivity and Yield Variability: Evidence From a Heteroskedastic Switching Regression* – Gerald Shively (Purdue U.)

This paper offers a methodology for incorporating unobserved farmer characteristics into empirical analysis of the yield effects of soil conservation technologies. The author employs a straightforward empirical approach – a Heckman-style two-stage estimation procedure – to correct the potential self-selection bias associated with these latent variables. The central finding of the paper is an important one: that explicitly accounting for farmer or farm characteristics may eliminate the positive yield effect that less careful authors have typically attributed to soil conservation technologies. Surprisingly, it isn't until fairly far into the paper that the reader becomes aware that this is the key result that emerges from the econometric analysis. I would urge the author to highlight the fact that this paper is about "debunking" (or at least qualifying) what passes for conventional wisdom in the sustainable agriculture set about the positive yield effects of soil conservation technologies.

The paper did raise a few questions in my mind that may be more matters of clarification than anything else. First, I'm not sure what motivated the author to organize his analysis around

"effective" yields on the acreage actually farmed, rather than including the lower total yield that includes non-producing lands occupied by hedgerows. I assume that the author is being conservative here – i.e., if he can't find a positive "effective" yield effect then he certainly won't find a positive "overall" yield effect. But this is not stated. Second, insofar as the hedgerows consist of nitrogen-fixing legumes, there may be a positive effect on profits attributable to fertilizer savings (in addition to positive yield effects) and quite distinct from erosion control. Finally, I was puzzled that author didn't include any variables in his first-stage regression to account for differences in education or experience among farmers. It's always seemed to me that a key issue in adoption of so-called "sustainable" technologies is the potential adopter's personal discount rate, since the payoffs (such as they are) invariably occur over a long period of time while the costs are incurred mainly at the front end. Indeed, I could easily imagine that factors like age and experience are the primary latent characteristic, and I would urge the author to consider including these in his econometric analysis.

Paper 2: *Selecting Genetic Traits for Cattle Improvement: Preservation of Disease Resistant Cattle in Africa* – Kouadio Tano (U. of Abidjan), and Merle Faminow (U. of Manitoba).

This paper uses conjoint analysis to investigate the kind of cattle traits most highly valued by farmers in Burkina Fasso. Given the thinness of cattle markets in that part of the world, using a contingent valuation technique such as conjoint analysis is probably the only way of getting at the basic research question posed by the authors. One of the keys to successfully using these sorts of techniques lies in construction of the survey, particularly in designing hypothetical scenario and framing the questions to minimize any possible divergence between what the research thinks he or she is asking and what the respondent thinks he or she is being asked.

Unfortunately, the description of the data collection exercise described in the paper did not leave me feeling confident that the authors had succeeded on this score. Particularly worrisome is the fact that the diversity of languages spoken and limited literacy among respondents within the study area required reliance on pictorial representations of the kinds of cattle traits of interest to researchers. This seems problematic. How, for example, does one depict a disease resistant cow versus a non-resistant cow without eliciting a response to the question "Do you prefer sick cows or healthy ones?"

On the econometric front, I was troubled by the fact that the authors chose to only include half of the explanatory variables of interest in each "survey." The motivation for this was to not overload farmers with choices; however, by proceeding in this way they appear to have more or less formally introduced omitted variables into their empirical analysis. This is particularly troublesome since remedying this problem would require re-sampling.

Paper 3: *Variety Characteristics and the Land Allocation Decisions of Farmers in a Center of Maize Diversity* – Melinda Smale, Maricio Bellon, and Alfonso Aguirre (CIMMYT)

The issue of genetic diversity has gained widespread currency within the CGIAR in recent years. This paper is among the first rigorous attempts to analyze the microeconomics of farmer involvement in preserving genetic diversity via *in situ* conservation. I applaud the authors for their bravery in tackling this complex issue, and on having taken some important first steps toward making an significant contribution to the empirical literature on this subject. However, I don't believe that they are "there" yet, and here I will simply point toward a few potentially fruitful avenues to explore as they proceed in this research.

First, and most importantly, there is the issue of the why genetic diversity at the community level ("big Z") would enter into any household's utility function. The authors make a fairly half-

hearted attempt to explain this on the basis of big Z being interpreted as the supply of distinct characteristics in the community (whatever that is), but this is hardly convincing in a world of free riders and seed markets. In my opinion, the authors would do better to abandon forming any sort of underlying utility theoretic explanation of big Z and instead focus their modeling efforts on little z (household level diversity). In this regard, explicitly treating markets for seeds of different varieties (or lack thereof) would certainly enrich the model. Second, as an empirical matter, I wonder if the number of varieties planted by a particular farmer or within a given location isn't to some (possibly large) extent merely a proxy for variation in soil types or other site-specific agronomic variables. I think the empirical analysis would benefit by better controlling for these sorts of fixed effects. Third, I wonder if the authors have considered simply estimating the household-level diversity equation as a reduced form that includes the RHS variables used in estimating the variety choice equation.

Paper 4: *The Distributional Impacts of Farm Policy in Semi-Subsistence Agriculture* – Garth Holloway and Nermin Akyil (AERI).

This paper provides a theoretical underpinning for the authors' research on the distributional effects of technical change in LDC agriculture. The primary contribution of their model is to provide a closed-form equilibrium solution for prices and quantities that follow on differential adoption of improved technologies technological change. The model's solution is based on a simple linear formulation of aggregate supply and demand. One aspect of the model that I found troubling is that it apparently assumes that all semisubsistence households are net producers. I would have liked to see the what the model predicts for net consuming households (typically, the majority of poorer semisubsistence households).

I gather that the authors are currently collecting data with which to implement their model (or some variant thereof). I would offer the following three suggestions to the authors in their empirical work. First, they probably ought to allow for the possibility of some semisubsistence households being net consumers. In the rarified air of the model contained in the paper, the direction of welfare effects is captured with reference to urban consumers. But in real life situations, the actual welfare consequences for specific geographic locations or demographic groups are likely to be quite sensitive to households' status as net consumers or net producers. Second, the authors ought to pay attention to non-farm sources of income among semisubsistence producers. In many areas of the world, it is not uncommon for non-farm income to dominate farm income – particularly among poor households and in marginal production environments. In these settings, there is a tendency for agricultural researchers to overestimate the impact of new agricultural technologies on household income. Finally, the authors' model assumes a closed economy. If they are dealing with a commodity which is traded extensively in world markets – Turkish wheat, for example – then the authors will need to justify the kind of price formation and attendant welfare impacts that hinge on this assumption.