



Research paper

Locus of control and technology adoption in developing country agriculture: Evidence from Ethiopia[☆]Kibrom A. Abay^{a,*}, Garrick Blalock^b, Guush Berhane^c^a Department of Economics, University of Copenhagen, Denmark^b Charles H. Dyson School of Applied Economics and Management, Cornell University, United States^c International Food Policy Research Institute, United States

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ABSTRACT

We investigate the implication of farmers' locus of control on their technology adoption decisions. Our empirical analysis is based on two longitudinal surveys and hypothetical choice exercises conducted on Ethiopian farmers. We find that locus of control significantly predicts farmers' technology adoption decisions, including use of chemical fertilizers, improved seeds, and irrigation. We show that individuals with an internal locus of control have higher propensity of adopting agricultural technologies. We observe these empirical regularities in both datasets, and for both revealed measures of farmers' technology adoption decisions as well as farmers' hypothetical demand for agricultural technology. The results hold even in a more conservative fixed effects estimation approach, assuming locus of control as time-variant and dynamic behavioral trait. These findings provide behavioral and psychological explanations for the low rates of adoption of profitable agricultural technologies in Sub-Saharan Africa. Our results highlight that improving farmers' non-cognitive skills (locus of control) may facilitate technology adoption and agricultural transformation. More generally, the results suggest that anti-poverty policies that only focus on relaxing short-term external constraints, including physical access to markets and technologies, may not sufficiently alleviate agricultural underinvestment.

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1. Introduction

Despite substantial efforts and investments to promote modern agricultural technologies, reconciling the empirical puzzle associated with the low adoption rates of profitable agricultural technologies in many African countries remains a challenge. This is particularly crucial for many Sub-Saharan African countries where the aggregate technology adoption trends remain low (Morris et al., 2007; Rashid et al., 2013; Sheahan and Barrett, 2014).

A large literature points mainly to external constraints of farmers as limiting factors to technology adoption in Africa. These external constraints include credit constraints, transaction costs, and related market imperfections.¹ Most previous

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¹ For example, Moser and Barrett (2006), Giné and Klöpper (2005), Duflo et al. (2011), and Minten et al. (2013) indicate that credit constraints and transaction costs are central factors that may limit the adoption of agricultural technologies in Sub-Saharan Africa. Along this line of reasoning, some

theoretical and empirical studies on technology adoption are founded on the notion that farmers are “poor but rational” (Schultz, 1964). This neoclassical argument implies that farmers are rational profit maximizers and hence will choose the optimal level and mix of alternative agricultural technologies.² Duflo (2003) and Duflo et al. (2011) argue that the existing low level of adoption of agricultural technologies in Africa is not consistent with this argument. This contradiction opens a room for insights from behavioral economics that can help understand household decision making processes and technology adoption decisions.

Recently, evolving behavioral and psychological studies argue that poor households in developing countries not only suffer from external constraints but also internal constraints and behavioral biases that may hinder profitable agricultural investments (Bertrand et al., 2004; Banerjee and Mullainathan, 2010; Duflo et al., 2011; Mullainathan and Shafir, 2013; Haushofer and Fehr, 2014; Bernheim et al., 2015). Some of these internal constraints include self-control problems, high discounting, and poor intertemporal planning behavior. More generally, behavioral economists provide two relevant explanations why farmers' agricultural investment decisions may deviate from the neoclassical economic theory discussed above (see, Mullainathan and Thaler, 2000). First, people might be bounded rational, in the sense that they may have limited cognitive and non-cognitive ability to solve complicated intertemporal choice problems. This problem is expected to be substantial amongst developing country rural farmers with limited consumer education. Second, people (particularly the poor) may have bounded “willpower” due to self-control and temptation problems, which may restrict people from making optimal intertemporal choices. For instance, although farmers may realize that fertilizer adoption is the best choice, they may not actually adopt it due to self-control problems. Duflo et al. (2011) argue that farmers with time-inconsistent preferences, those with self-control problems, are less likely to invest in chemical fertilizers.

This paper examines the implication of a psychological concept intrinsically related to the above two types of internal constraints on technology adoption decisions of farmers in Africa. We investigate the implication of farmers' locus of control on technology adoption decisions in Ethiopia where agricultural intensification remains low. To our knowledge, this paper is the first to consider the role of locus of control in the growing and important literature on agricultural technology adoption. Locus of control is “a generalized attitude, belief, or expectancy regarding the nature of the causal relationship between one's own behavior and its consequences” (Rotter, 1966). Adoption of a new technology involves some intertemporal opportunity costs and uncertainty. Hence, individuals' subjective belief about future outcomes and the extent to which these events can be affected by one's own actions, can affect adoption decisions. It is reasonable to expect that individuals with an internal locus of control, those who believe that life events can be sufficiently influenced, are more likely to invest in agricultural technologies than those with an external locus of control, those who believe that life events are more of out of their control. Previous studies show that individuals with an internal locus of control are associated with higher investment decisions, including human capital investments (Coleman and DeLeire, 2003; Heckman et al., 2006).³ Coleman and DeLeire (2003) present a theoretical human capital investment model and show that locus of control can affect individuals' human capital investment decisions by shaping their perceived (subjective) probability of success of a specific investment.

Following this conceptual framework, we aim to provide first-hand empirical evidence on the implication of locus of control on agricultural technology adoption decisions, and hence agricultural investments. Overall, this study is the first attempt to uncover some behavioral and psychological explanations to the existing low levels of adoption of profitable agricultural technologies in Sub-Saharan Africa. These explanations may also help to attribute some of the existing “unexplained” heterogeneities in technology adoption decisions among rural households in Sub-Saharan Africa (Suri, 2011; Sheahan and Barrett, 2014; Abay et al., 2015).⁴

We use two longitudinal datasets to pursue the above empirical analysis. The first dataset is a large survey which covers the most important agricultural zones in Ethiopia. The second dataset comes from a randomized controlled experiment conducted to evaluate the implication of weather-index crop insurance on technology adoption in Ethiopia. We investigate the implication of locus of control on farmers' actual technology adoptions as well as on their hypothetical demand for a new agricultural technology. This is particularly appealing given that locus of control may correlate with some other unobservable factors that may affect farmers' actual technology adoption decisions. Hence, using farmers' hypothetical demand for new agricultural technology may help us minimize some of the endogeneity and reverse causality problems, while also highlighting the implication of individuals' locus of control on future agricultural investments and aspirations. Following the existing literature in the field, farmers' locus of control is elicited using Rotter's (1966) scale; by employing the commonly used and contextualized list of ten items. Our empirical analysis employs alternative econometric approaches that exploit the cross-sectional as well as longitudinal variations in farmers' locus of control.

We find that farmers' locus of control significantly predicts adoption of considerable list of agricultural technologies, including chemical fertilizers, improved seeds, and irrigation practices. More specifically, we show that those farmers with

studies show that relaxing credit constraints can improve farmers' technology adoption in Africa (e.g., Zerfu and Larsen, 2010; Lambrecht et al., 2014; Beltramo et al., 2015; Bensch et al., 2015; Abate et al., 2016).

² This argument has long been a source of debate on whether the adoption of chemical fertilizers should be subsidized or not.

³ Most previous studies on locus of control focus on the implication of these non-cognitive skills on individuals' labor market outcomes (Coleman and DeLeire, 2003; Heckman et al., 2006; Cobb-Clark and Schurer, 2013; Caliendo et al., 2015). An exhaustive review of these studies is given in Cobb-Clark (2015).

⁴ For instance, Abay et al. (2015) document substantial heterogeneities in technology adoption decisions that cannot be explained by the commonly observable attributes and characteristics of households.

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