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Analysis

Social influence and collective action effects on farm level soil conservation effort in rural Kenya

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ABSTRACT

This paper analyzes the effects of social influence and participation in collective action initiatives on soil conservation effort among smallholder farmers in Lake Naivasha basin, Kenya. We apply binary and ordered probit models in a two stage regression procedure to cross-sectional data collected through a household survey among randomly selected smallholder farmers. Smallholder farming systems in the research area are associated with practices that render farmlands susceptible to soil erosion causing negative impacts on land and the environment. Therefore, strategies that encourage soil conservation are likely to also offer solutions for dealing with agri-environmental challenges and poverty alleviation. Results indicate that social capital facilitates participation in collective action initiatives which then influence individual soil conservation efforts. Neighborhood social influences, subjective norms, gender, education level, farm size, access to credit and livestock ownership also emerge as key determinants of soil conservation effort. Policy implications drawn by this study encourage strategies to increase participation and effectiveness in collective action initiatives as a boost to soil conservation. Implementation of soil conservation practices could also be encouraged through awareness increasing instruments, facilitating access to agricultural micro-credit and paying attention to gender related challenges on knowledge access and rights over land and other natural resources.

1. Introduction

The agricultural sector plays a key role in livelihood support and economic development in Sub-Saharan African (SSA). However, statistics indicate that historically agricultural productivity growth in SSA has been lower than in the rest of the world (OECD and FAO, 2012). The stagnation in productivity growth can be attributed to suboptimal external input use, pests and diseases, soil degradation, frequent and prolonged droughts, and poor market integration among other challenges (World Bank, 2008). Soil degradation which occurs mainly through soil erosion and loss of soil fertility is a major challenge to SSA agriculture because it not only causes a decline in crop yields and desertification but also increases crop production costs in the long run. Smallholder farming systems in SSA are characterized by high rates of land fragmentation, intensive tillage of land, nutrient mining and extraction of crop residues to feed livestock. These practices accelerate soil degradation and soil erosion, making agriculture one of the most serious sources of non-point water pollution. In cases where rural agriculture has intensified, increased use of inorganic fertilizers leads to infiltration of nitrogen and phosphorous from agricultural fields to surface water bodies (Berka et al., 2001). Effective soil erosion control could therefore enhance long term productivity of farmers' most valuable physical asset—land, mitigate the negative impacts of soil degradation on crop yields and the environment and also boost efforts towards rural poverty alleviation.

Achieving substantial adoption and diffusion of soil and water conservation practices and other agricultural innovations in SSA has been a challenge in recent decades, a trend that authors attribute to low awareness, negative attitudes and insufficient financial capacity among other factors (Khisa et al., 2007; Pretty et al., 1995; van Rijn et al., 2012). However, it is noted that sometimes even when the right conditions prevail, adoption rates may still remain low. As Lynne et al. (1988) note, awareness, right perceptions and substantial capacity are necessary but not sufficient conditions for the adoption of soil conservation practices. This observation raises the question: Why would farmers not adopt a practice even when economic incentives seem sufficient?

To answer this question, we have to seek other factors beyond individual capacity and perceptions that could explain farmers' choices such as social factors. Given that soil and water conservation practices are associated with benefits that are partly public goods, one of the important aspects to consider is the effect of communal coordination mechanisms on individual adoption behavior. Collective action is cited as one of the most successful coordination mechanisms for natural resources management and also for increasing agricultural production (Meinzen-Dick et al., 2002; Ravnborg et al., 2000). Collective action can be defined as what happens when individuals voluntarily contribute to an effort towards achieving an outcome (Poteete and Ostrom, 2004) or when voluntary action is taken by individuals within a group to achieve a common goal (Meinzen-Dick and Di Gregorio, 2004). At community level, the effects

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of collective action are clear since individuals are able to mobilize local resources as an avenue for seeking solutions to societal problems, especially where isolated individual efforts to solve these problems are not tenable (Swallow et al., 2002). What is not clear is the indirect role of participation in collective action as a driver for individual efforts on soil and water conservation. Do individuals who participate in collective action acquire certain network externalities which enable them to implement better practices? To explain this we need to look at how collective action emerges and operates. Social networks and social participation which are important components of social capital enable individuals to engage in frequent interactions with others and facilitate the access to information and sharing of knowledge and better access to markets through collective bargaining. Reciprocity based on trust and trustworthiness is also an important feature that facilitates collective action since individuals within a social group may engage in informal exchanges with each other in the hope that the counterparts will reciprocate (Pretty and Ward, 2001). Through reciprocate exchanges; individuals are able to minimize costs associated with acquisition of inputs hence making technology adoption easier. Social networks and repeated interactions create mutual social influence between individuals within a group, a phenomenon that is manifested through subjective norms and neighborhood social influences. A subjective norm is defined as "a person's perception that most people who are important to him or her think (s)he should or should not perform the behavior in question" (Ajzen and Fishbein, 1975). Neighborhood social influences relate to the degree of prompting that an individual receives from peers. There is however limited evidence in the literature on the direct role of neighborhood social influences and subjective norms in determining soil conservation effort.

Against this backdrop, the current study seeks to analyze the effect of neighborhood social influence and participation in collective action initiatives on soil conservation effort among smallholder farmers in Lake Naivasha basin, Kenya. Soil conservation effort is measured by the number of soil conservation practices that a farmer has implemented among a variety of practices: terracing, Napier grass, contour farming and filter grass strips. The study seeks to ascertain whether social capital facilitates collective action which then enhances individual action and whether social control that may emerge from social networks within a community may substitute for pure economic incentives to undertake individual action on soil conservation. To achieve the stated objectives, we apply a two stage econometric estimation procedure to primary data collected during a household survey among 307 randomly selected small-scale farmers.

The rest of the paper is structured as follows: Section 2 presents our theoretical and conceptual frameworks and empirical models and Section 3 describes the study area and data collection methods. Section 4 presents and discusses descriptive and regression results, while Section 5 concludes and draws policy implications.

2. Theoretical and Conceptual Frameworks

2.1. Theoretical Framework

Following Fernandez-Cornejo (2007), our theoretical model modifies the agricultural household model (Singh et al., 1986) to accommodate participation in collective action initiatives and technology adoption decisions. The agricultural household model explains farm household optimization behavior by maximizing utility (U) as per the objective function:

$$\text{Max } U = (G, L, H, \varphi) \tag{1}$$

where G = purchased consumption goods, L = leisure, H = factors exogenous to the current decisions such as human capital, and φ = other household characteristics. Household utility is maximized subject to:

$$\text{Income constraint}: P_g G = P_q Q - W_x X' + WM' + I \tag{2}$$

$$\text{Technology constraint}: Q = Q[X(\tau), F(\tau), H, \tau, R], \tau \geq 0 \tag{3}$$

$$\text{Time constraint}: T = F(\tau) + M + L, M \geq 0 \tag{4}$$

where P_g and P_q denote the prices of purchased goods and farm output respectively, G and Q are quantities of purchased goods and farm output respectively; W_x and X are row vectors of price and quantity of farm inputs which is a function of the intensity of technology adoption (τ); I is exogenous income, **R** is a vector of exogenous factors that shift the production function; and T denotes the total household time endowments, which is split between off farm activities, M; Leisure, L and farm work, F which is a function of the intensity of technology adoption (τ) since some technologies are labor saving hence freeing some labor time for allocation to other activities. The technology constrained measure of household income is obtained by substituting Eq. (3) into Eq. (2) (Huffman, 1991):

$$P_g G = P_q Q[X(\tau), F(\tau), H, \tau, R] - W_x X(\tau)' + WM' + I. \tag{5}$$

The first order optimality conditions (Kuhn–Tucker conditions) are obtained by setting up the Langragian function (6) and maximizing $\mathcal{L}$ over (G, L) and minimizing the function over the Langrage multipliers (λ, μ):

$$\begin{aligned}\mathcal{L} = {} & U(G, L, H, \varphi) \\ & + \lambda\left\{P_q Q[X(\tau), F(\tau), H, (\tau), R] - W_x X(\tau)' + WM' + I - P_g G\right\} \\ & + \mu[T - F(\tau) - M - L].\end{aligned} \tag{6}$$

Reduced form equations of the household model obtained from the Kuhn–Tucker conditions of Eq. (6) can be used to obtain optimizations for off farm participation decisions and decisions on adoption of technology. The household decision to participate in off-farm activities depends on the relation between the wage rate and the marginal product of farm labor. This relation can be used to obtain the demand functions for on-farm labor and leisure and eventually the supply function for off farm time. Non-zero optimum off farm time allocation occurs when marginal product of farm labor is equal to the wage rate, or when the wage rate exceeds the reservation wage (Fernandez-Cornejo, 2007). On the other hand, the optimal extent of adoption will occur when the value of marginal benefit of adoption is equal to the marginal cost of adoption, which includes the marginal cost of production inputs and the marginal cost of farm work brought up by adoption of the technology, valued at the marginal rate of substitution between leisure and consumption of goods. Fernandez-Cornejo (2007) suggests the use of implicit function theorem to derive expressions for off-farm labor supply and technology adoption as a function of wages, prices, human capital, non-labor income and other exogenous factors. These factors may be replaced in the reduced form representations of farm labor supply and technology adoption by observable farm and farmer characteristics. The following section reviews the literature on soil conservation to identify important variables that will be used in the empirical models to analyze household decision making in participation in collective action and implementation of soil conservation practices.

2.2. Conceptual Framework and Hypotheses

Adoption and diffusion of agricultural technologies have been studied extensively since the inaugural work by Ryan and Gross (1943) and Rogers (1962). Previous studies have identified key determinants of soil conservation technology adoption which can be categorized into personal characteristics such as age, gender and education level (Doss and Morris, 2001; Napier et al., 1984); economic factors like income, farm size and household asset ownership (Ervin and Ervin, 1982; Kabubo-Mariara et al., 2006; Marenya and Barrett, 2007; Nkonya et al., 2008); physical factors like slope, altitude, climate and soil quality