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Credit constraints and cropland allocation decisions in rural Burkina Faso

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ABSTRACT

This paper examined farm households' cropland allocation decisions under credit constraints in rural Burkina Faso. A fully observed recursive mixed-process model was used to correct for the endogeneity of credit in farm households' land allocation decisions in a multi-cropping context. Estimating the model with survey data collected in 2011 using the conditional mixed-process estimator, the results showed that credit constraints negatively affect farm households' decision to allocate land to maize and cotton production in rural Burkina Faso. In contrast, at the expense of maize and cotton, credit constraints encourage farm households to allocate more land to sorghum and millet. The results also showed that socio-demographic characteristics and the use of animal traction significantly determined farm households' land allocation decisions in rural Burkina Faso.

1. Introduction

Farm household production decisions in developing countries are subject to different constraints related to the availability of technologies, affordability of inputs and endowment in land (Croppenstedt et al., 2003; De Janvry et al., 1991; Simtowe et al., 2009). To mitigate risk related to adverse weather (Adger et al., 2003; Di Falco et al., 2010; Di Falco and Chavas, 2009; Kandulu et al., 2012), price and production (Di Falco et al., 2007; Di Falco and Chavas, 2009; Reardon, 1997), African farm households historically diversify their cropping system by cultivating several crops on different or same piece of land each cropping season, given the technologies available. Beyond the risk mitigation strategy, a farm household's decision to allocate a share of land to a particular crop depends on the expected income and utility from its choice and its ability to afford the necessary inputs such as fertilizers and working capital required for the production process. Access to financial resources is therefore required for farm households to be able to access high level of technology (Simtowe et al., 2009), particularly in rural areas where farm households are too poor to accumulate savings. According to Rashid, Sharma, and Zeller (2004) the lack of access to credit is one of the main reasons farmers in developing countries do not adopt high yielding varieties and continue to allocate a portion of their land to traditional varieties. In Burkina Faso for instance, the availability of credit programme for cotton producers is one of the key determinants of the adoption and the development of cotton production (Dowd-Uribe, 2014). However, the same credit facilities do not exist for other crops in the country, limiting farm households' ability to adopt or allocate more land to a certain number of crops that require some specific inputs such as chemical fertilizers. Although, cereal crops represent up to 77 percent of the total land allocated to agricultural production in the country (MAFAP, 2013) the sector is still facing challenges in relation to access to fertilizers, thereby obligating liquidity constrained farm households to allocate less land to maize which requires more fertilizers than sorghum and millet (Savadogo et al., 1998). According to MAFAP (2013), although rice and maize have the highest value added per hectare among the cereal crops in Burkina Faso, they are still the third and fourth cereal crops grown in the country after sorghum and millet. Sorghum and millet represent respectively 44 percent and 31 percent of the total domestic supply of cereals, and maize and rice represent 21 percent and 4 percent, respectively. Beyond input affordability issues related to rice production, there are not enough irrigation facilities across the country allowing the development of rice production, and challenges related to fertilizer acquisition is one of the reasons maize is not grown as much as sorghum and millet. In fact, millet and sorghum are drought resistant crops and do not require much fertilizers to thrive well to maturity as compared to maize.

According to Dowd-Uribe (2014) many Burkinabe farm households report that they would either leave cotton production or reduce the total amount of land devoted to cotton if different and reliable inputs

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credit mechanism were established for cereals production. Since the cotton sector is the only reliable channel to acquire inputs on credit, to address challenges related to liquidity constraints for purchasing inputs for cereal crops, farm households producing cotton often inflate the total area devoted to cotton in order to obtain more fertilizers and divert a share for cereals production (Dowd-Uribe, 2014), particularly maize. Beyond consumption purpose, maize is a market oriented crop and having access to fertilizers could help to increase yield and therefore increase the households' income. In such an imperfect credit market context, farm households not producing cotton and facing liquidity constraints may be obliged to allocate limited amount of land to fertilizer-intensive crops such as maize and rather focus on less input intensive crops such as sorghum and millet. However, the findings of Dowd-Uribe (2014) were based on descriptive statistics from survey data on Burkinabe farm households' perceptions about challenges related to access to credit and fertilizer for agricultural production in rural Burkina Faso. The study did not model the relationship between those challenges and farm households' cropland allocations decisions.

The aim of this paper is to deeply analyse the link between the credit constraint status of farm households and their cropland allocation decisions in rural Burkina Faso, using an econometric approach. However, empirically identifying who is credit constrained in theory and practice poses challenges. The literature on credit constraints identifies two methodologies for measuring household credit constraints. The first method which is an indirect method links the presence of credit constraints to violations of the life-cycle or permanent income hypothesis (Conning and Udry, 2007; Deaton, 1992; Jappelli and Pagano, 1994; Morduch, 1995). The second which is a direct method collects information directly from household surveys by asking them whether they perceive themselves as credit constrained or not (Jappelli, 1990; Barham et al., 1996; Diagne et al., 2000; Guirkinger and Boucher, 2008; Boucher et al., 2009; Ali et al., 2014), capturing most sources of credit constraints, including quantity rationing, transaction cost rationing, and risk rationing.

Comprehending farmers' cropland allocation decisions is a significant challenge within the field of agricultural economics and has thus been the subject of many studies. However, few studies have attempted to analyse the link between credit constraints and farm households' cropland allocation decisions (Chibwana et al., 2012; Keita, 2012; Kokoye et al., 2013; Komarek, 2010; Rashid et al., 2004; Simtowe et al., 2009; Yi et al., 2015; Zeller et al., 1998). Except the study by Simtowe et al. (2009) in Malawi which used the direct elicitation approach of credit constraints and controlled for the endogeneity of the credit in the empirical strategy, few studies have properly controlled for the endogeneity of credit in the estimation process of households' land allocation decisions models. However, Simtowe et al. (2009) focused on only maize and did not take into account all the crops produced by the households. Farm households in developing countries generally cultivate several crops and limiting their land allocation decision to only a given crop may not be enough to understand farm households' responses to policy interventions. This study aims to fill this gap in the literature by investigating the effect of credit constraints on farm households' land allocation decisions in a multi-cropping context, using a fully observed recursive mixed-process model to correct for endogeneity of credit.

The rest of the paper is organized as follows. Section 2 presents the theoretical framework. Section 3 presents the empirical model. Section 4 describes the data and presents descriptive statistics. Section 5 presents the results and discussions. Section 6 provides the conclusions.

2. Theoretical framework

The theoretical basis of the analysis of farm households' cropland allocation decisions under imperfect markets is built on the farm household model, presenting the farm household as a miniature economy where goods are produced and consumed by its members (Singh et al., 1986; Sadoulet et al., 1998). The farm household model has been used and adapted to study various issues related to farm households' resource allocation decisions, including transactions costs and market participation (Barrett, 2008; Dutilly-Diane et al., 2003; Goetz, 1992; Omamo, 1998), missing markets (Van Dusen and Taylor, 2005), risk aversion (Fafchamps, 1993; Hazell, 1982; Saha, 1994), labour availability (Benjamin, 1992; Lovo, 2012), and credit constraints (Dorward, 2012; Petrick, 2004; Simtowe et al., 2009) in developing countries. The farm household model states that on one hand, as producer, the farm household purchases inputs from the market (e.g. fertilizers) and provides itself inputs such as family labour in order to produce goods that can be partly sold in the market and partly consumed by its members. On the other hand, as a consumer, the farm household maximizes a utility function subject to a cash income constraint in order to find the optimal consumption bundle. In a perfect market scenario, allocation of resources in production can be decided independently of consumption decision (separability property). However, the separability property does not hold under market imperfections scenario, obligating the farm household to take production and consumption decisions jointly. In agricultural production, expenditure and income profiles are markedly seasonal and thus the liquidity constraints in financing production and consumption can be particularly acute (De Janvry et al., 2002). Under credit market failure, the farm household will choose a bundle of crops to produce, depending on its ability to finance the inputs required for the production process. If the farm household is credit constrained, it may decide to allocate more land to crops not requiring much inputs (e.g. sorghum and millet) at the expense of input-intensive crops (e.g. cotton, maize, etc.).

3. Empirical model

Following Simtowe et al. (2009) the effect of credit constraints and the households' cropland allocation decisions can be analysed, using a two-step approach. First, the credit constraint status of the households is determined, using direct elicitation approach. The direct elicitation approach enables distinguishing credit constrained households from credit unconstrained households, through their expression of need for credit for production activities. From their need for credit, it is possible to capture the excess demand for credit of each household, through the following function:

$$K_i^* = \gamma' Z_i + \mu_i \tag{1}$$

where K_i^* is a latent variable denoting an excess demand for credit, Z_i the vector of household and production characteristics, γ the vector of parameters, and μ_i the error term (Ali et al., 2014; Feder et al., 1990; Foltz, 2004; Guirkinger and Boucher, 2008). A household is credit constrained if it has a positive excess demand for credit ($K_i^* > 0$). The observable dichotomous variable K_i indicating whether or not a household is credit constrained is defined as follows:

$$K_i = \begin{cases} 1 & \text{iff} \quad \gamma' Z_i + \mu_i > 0 \\ 0 & \text{iff} \quad \gamma' Z_i + \mu_i \leq 0 \end{cases} \tag{2}$$

In the second step, the household's decision on the land share received by each crop (L) is determined by the household production and consumption characteristics, and socio-economic characteristics including its credit status. Tobit models are used to account for the fact that some households have zero land shares for some crops not because they do not want to grow these crops but because they cannot access inputs required for the production due to liquidity constraints. Assuming that the head of household is one who decides the household's production choices, the probability to allocate a certain amount of land to a particular crop is likely to be correlated with the probability to allocate an amount of land to another crop. Therefore, modelling the land allocation implies a set of equations that may be related not because they interact, but because their error terms are related (Zellner,