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Smallholder maize market participation and choice of marketing channel in the presence of liquidity constraints: Evidence from Zambia

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INTRODUCTION

Smallholder participation in agricultural output markets holds potential to move farmers out of subsistence farming to more commercial and profitable agricultural enterprises (Heltberg and Tarp 2002; Barrett 2008; Von Braun et al. 1994; Timmer 1988). Yet, a relatively low portion of smallholder farmers participate in food markets as net sellers in many sub-Saharan African (SSA) countries (Barrett 2008; Mather, Boughton, and Jayne 2013). Most studies that empirically study the reasons behind this low participation have focused on transaction costs of accessing output markets such as poor roads, infrastructure, and/or insufficient endowments of public and private assets. However, constraints that limit a household's capacity to produce a surplus beyond meeting its consumption needs could also limit a household's capacity to be a part of commercial agriculture. One such constraint is the inability to invest in productivity-enhancing agricultural inputs such as inorganic fertilizer and improved seed due to lack of liquidity (i.e. cash from income or credit) at time of planting. There is clear evidence that liquidity constraints at planting time lead to lower agricultural output (Winter-Nelson and Temu 2005; Foltz 2004; Feder et al. 1990). This paper extends this literature to assess the extent to which liquidity constraints that constrain agricultural output can subsequently also limit the household's capacity to sell agricultural output.

Liquidity constraints are also known to make agricultural households "sell low, buy high", i.e. they sell their grain output immediately after harvest (when prices are lowest) to meet cash needs, and then they end up buying grain later in the lean season when prices rise. This behavior could also potentially have an impact on the marketing channel that is chosen by the participants of agricultural output markets, particularly if a channel is characterized by uncertainty of the time of purchase, purchase price, and delays in payment.

Key Findings

- Smallholders with liquidity constraints in maize production are 11% less likely to be a net seller of maize. One explanation for this is that liquidity constrained households are less able to adequately invest in productivity-enhancing inputs, thus limiting limits their capacity to produce a marketable surplus.
- While households without liquidity constraints (UC) have a statistically significant positive response to higher maize prices, liquidity-constrained (LC) households do not respond to changes in maize prices.
- A 10% increase in maize production is correlated with a 4% increase in probability of being a net seller for UC households and 3% for LC households.
- An additional expected moisture stress period during the growing season reduces the probability that a LC household is a net seller by 16%.
- LC households are 18% less likely to sell to the FRA, and thereby are less likely to be able to enjoy the benefits of relatively high FRA maize purchase prices.

We base this study on the maize markets of Zambia. Maize is the staple food grain of Zambia, is grown by almost all farm households and is an important source of cash for many of them (Chapoto et al 2015). Using data from the Rural Agricultural Livelihood Survey (RALS), a nationally representative two-wave panel dataset of smallholder farm households in Zambia for

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2012 and 2015, we study the following questions for maize smallholders in Zambia:

1) First, we assess whether liquidity constraints during the maize production period affect a farm household's decision to participate as a net seller of maize.
2) We then study whether liquidity constrained households are less responsive to changes in maize prices with respect to this decision.
3) Finally, we explore whether liquidity constraints have an effect on the choice of marketing channels for net sellers of maize.

This third question is of particular interest in the case of Zambia given the significant role played by the Food Reserve Agency (FRA) in both its domestic maize market and in agricultural policy in general. The role of the FRA is particularly relevant because although the FRA typically purchases maize from farmers at a price that is higher than the prevailing producer sale price, the timing of FRA maize purchases each marketing season is uncertain. More significantly, there is typically a relatively long and unpredictable delay in FRA's payment to farmers for the maize they purchase from them. We define a household as liquidity constrained in the maize production period if one or both of the following conditions are met (following the approach similar to Winter-Nelson and Temu (2005)): (1) The household claims to not have acquired fertilizer from market due to lack of cash, and/or (2) the household claims to not have obtained fertilizer from the Farm Input Subsidy Program (FISP) due to: a) not being able to afford the down payment for obtaining fertilizer through FISP and/or b) lack of cash for the mandatory cooperative membership payment required for participation in the program.

DATA

We use data from three main sources in this study. The household data is derived from the Rural Agricultural Livelihoods Survey, a nationally representative two-wave panel dataset of smallholder farm households in Zambia from 2012 and 2015. The 2012 survey covered the 2010/11 agricultural year (October 2010–September 2011) and the associated crop marketing year (May 2011–April 2012). Our analysis thus uses sample of 6,063 households in each year leading to a total of 12,126 observations.

We also use district level average retail maize price data for from the Central Statistical Office (CSO 2018) and geospatial time series data on rainfall indicators from the Tropical Applications of Meteorology using Satellite (TAMSAT) that has been matched with the RALS households by Snyder et al (2019).

METHODS

We employ an ordered probit regression in order to test whether liquidity constraints impact the probability that a household sells maize. The dependent variable is the maize market position of the household that can take on one of the following values: 1- if household is a net-buyer of maize, 2- if the household is a net-seller of maize, and 3- if the household is a net-seller of maize. A household is defined to be a net-buyer of maize if the value of its maize sales is less than the value of its maize and maize meal purchases; autarkic if the household either has no maize sales or purchases or if the value of its maize sales equals the value of its maize and maize meal purchases; and a net-seller of maize if the value of its maize sales is greater than the value of its maize and maize meal purchases.

The main explanatory variable of interest is household liquidity status, which =1 if the household is defined as being liquidity constrained in the production period and =0 otherwise. Other important explanatory variables are: price variables (market price of maize net of transport costs; and FRA maize price net of transport costs); realized maize output; measures of transaction costs (distance from nearest road, boma, market, number of maize traders visiting the village); measures of liquidity in the maize marketing period (non-farm income and tropical livestock unit); measures of agro-ecological potential (rainfall and stress periods); household assets that may influence production and market access (plows, harrows, radio, bicycle, and cellphone); and household-level demographic variables (household size, age, years of education and gender of household head). Finally, we include provincial dummies and a dummy for the second of our two years of panel data.

To analyze the choice of marketing channel for the sub- sample of net-sellers of maize, we use a multinomial logit regression. The dependent variable is the choice of marketing channel for a household's

largest maize sale. This variable can take one of three values: 1-Private traders of maize (including small-scale traders, large-scale traders, wholesalers, and retailers); 2- Direct and indirect (through farmer cooperative) sale to the FRA; 3- Other households (includes sale made to community church, school and hospital). Important explanatory variables included are the liquidity status in production period, the price of maize offered in the market and by FRA net of transport costs, distances from the nearest road and market, and non-farm income. The panel structure of the data enables us to add correlated random effects terms. Because our analysis of household choice of marketing channel uses cases of net sellers only, we test for sample selection bias using Heckman's two-step approach.

RESULTS

We find that more than half of all smallholders in the sample were liquidity constrained in 2012 and 2015. Being liquidity constrained is found to be associated with lower input use, lower maize productivity and output per capita, and less ownership of landholding and livestock among other factors. The three main maize marketing channels in Zambia were identified as the FRA, private traders and other households, which were chosen by 47, 42 and 11 percent of maize net sellers for their largest maize sales, respectively.

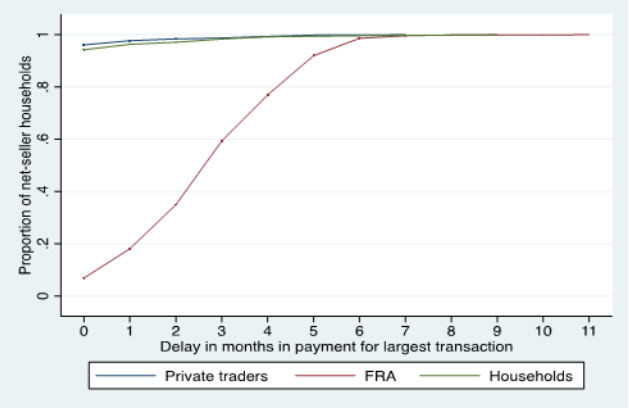
We have five main findings from our regression analysis. First, we find that liquidity constraints during the production period is associated with an 11 percent reduction in the probability that a liquidity-constrained household is a net seller of maize. Although we are not able to establish causality in this relationship, it appears that because liquidity constrained (LC) households are not able to adequately invest in productivity-enhancing inputs, this limits their capacity to produce a marketable surplus, thereby decreasing their probability of being a net seller of maize.

Second, we find that while households without liquidity constraints have a statistically significant positive response to higher maize prices, LC households do not respond to changes in maize prices. This suggests that because LC households are less likely to acquire productivity-enhancing inputs, this mutes their responsiveness to changes in the maize price. Third, we find that measures of market access based on the distance from the household or village to the nearest agricultural market or main district town (boma) do not have a large effect on the probability of being a net seller, for either liquidity-constrained or unconstrained households.

While this result may seem counterintuitive, it is important to note that it does not imply that "market access" or road and market infrastructure do not play an important role in promoting and facilitating market participation by smallholders. What it does imply is that our use of maize prices adjusted for transportation costs to and from each village appear to be capturing an important part of differences in farmgate maize prices between more and less remote villages. In addition, these results suggest that transaction costs of searching for price information and buyers appear to be relatively low – perhaps due to relative proximity to FRA depots, good access to private traders (who visit 75 percent of villages), and the fact that nearly all villages have cell network access. This could also suggest that these transaction costs are being captured by other explanatory variables such as ownership of a cell phone. These results imply that market access and competitiveness in Zambia's maize markets may not be as poor as is often assumed in literature.

Fourth, we find that an additional expected moisture stress period during the growing season reduces the probability that a liquidity-constrained household is a net seller by 16 percent. This highlights the vulnerability of smallholder maize production in Zambia to drought and the potential benefit of the adoption of soil management practices and drought-tolerant maize varieties that can help to mitigate the negative effects of drought on crop productivity (Ajayi et al 2007; Haggblade, Tembo, and Donovan 2004). Finally, we find that liquidity-constrained households are 18 percent less likely to sell to the FRA, and are thereby unable to enjoy the benefits of higher FRA maize purchase prices. Although we are not able to discern the specific reason for this result based on our research to date, we expect that this may be due to uncertainty regarding the timing of FRA maize purchases each year as well as the typically long delay in payment by the FRA to farmers (Figure 1).

Figure 1. Delay in payment made to farmers for their largest maize sale (months)



CONCLUSION

Our results demonstrate that liquidity constraints can limit smallholder participation in food grain markets as net sellers, reduce their responsiveness to changes in maize prices, and limit their access to FRA maize purchase prices, which are relatively high compared with typical producer-level prices. They also provide additional evidence that relatively well-off farmers (those that are not likely to be liquidity constrained) are best able to access the benefits of these relatively high FRA maize purchase prices. Further research is needed to explore policies that can reduce liquidity constraints at time of planting and incorporate mechanisms for productivity enhancement as a measure for encouraging commercial agriculture.

They also suggest a need to investigate ways to reduce smallholder's liquidity constraints in Zambia as related to maize production. This is not a new challenge, and unfortunately there seem to be more examples of ineffective efforts to address this constraint in SSA than successful ones. For example, the history of state-subsidized agricultural credit for staple crop growers in many SSA countries during the 1970s/80s is that farmer default on seasonal agricultural input loans was often widespread (Poulton et al, 1998). While there has been success in the development of micro-finance institutions in rural areas, these are typically incapable of providing seasonal credit for agricultural inputs given the size and lumpiness of such loans as well as the fact that they cannot be repaid for many months (Poulton et al, 2006). A potential remedy to facilitate credit for smallholder grain producers is a Warehouse Receipt System, though the requirements to successfully develop and sustain a WRS are challenging and are not easily met by small farmer associations or cooperatives without considerable outside support (Meyer, 2015).

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