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Explaining smallholder maize marketing in southern and eastern Africa: The roles of market access, technology and household resource endowments

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ABSTRACT

Research on household food grain sales behavior in developing countries has tended to focus on the roles of market access and prices to explain why many rural households do not sell staple crops, though recent literature suggests that low household asset endowments may also be key constraints. We use econometric analysis of panel data from smallholders in Kenya, Mozambique, and Zambia to inform the design of public investments that will enable smallholders to increase their maize sales. Results show that investments that raise farm-level productivity and land access are an essential complement to investments that improve market access.

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Introduction

Given the new international food price environment and continuing rapid urbanization, African governments are anxious to increase the availability of domestically-produced marketed food staple surpluses. In most African countries, smallholders account for the majority of marketed food staples, even though only a small proportion of the rural population are net sellers. Broadening the base of smallholder maize market participation and increasing their ability to respond to price incentives therefore represents both a means to improve food security and a potential opportunity to raise smallholder incomes. But what kinds of investments are most likely to achieve this objective?

During the 1990s it was a widely held view that market-friendly policies, combined with investments in public or collective goods to increase farm productivity and reduce marketing costs, would be sufficient to overcome barriers to specialization and trade by rural smallholders. In practice, however, levels of investment in important public goods such as national agricultural research and extension systems were woefully inadequate in the 1990s and are only beginning to increase after two decades of neglect. Furthermore, some recent literature has questioned whether heterogeneity in household resource endowments might also constrain an important number of poor households from taking advantage of lower market access costs (Boughton et al., 2007; Barrett, 2008). In other words, increases in public good-type investments to improve market access may be a necessary but not sufficient condition to enable a significant number of households to escape poverty and become food secure.

In this paper, we use econometric analysis of nationally-representative smallholder panel data sets from Kenya, Mozambique, and Zambia to inform the design of public investments that will enable smallholders to increase their marketed food staple surpluses in a financially sustainable manner. The heterogeneity across and within the smallholder sectors of these countries allows us to analyze the extent to which smallholder maize marketing patterns vary by levels of market access, household assets, use of improved inputs, and agro-ecological potential. The principal conclusion from our analysis is that investments that raise farm-level productivity and land access are an essential complement to investments that improve market access (reduce marketing costs).

The paper is organized as follows. Data sources describe the data sources, and Conceptual framework discusses the conceptual framework for modeling smallholder maize marketing. Methods discuss the econometric model and estimation issues, and Results the key empirical results. The concluding section briefly discusses implications for investment programs aimed at increasing smallholder marketed maize surpluses in eastern and southern Africa.

Data sources

Kenya: The Tegemeo Institute of Egerton University and Michigan State University designed and implemented smallholder farm surveys in eight agro-ecological zones where crop cultivation predominates. The sampling frame for the survey was prepared in

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consultation with the Central Bureau of Statistics. Households and divisions were selected randomly within purposively chosen districts in the eight agro-ecological zones. The nationwide survey includes 106 villages in 24 districts. Sampling details are provided in Argwings-Kodhek et al. (1998). A total of 1578 small-scale farming households were surveyed in 1997. Of these, we drop 48 households because either they were found to be mainly pastoral farmers or their landholding size exceeded 20 ha. The 1997 survey therefore constituted 1530 sedentary households farming under 20 ha. Subsequent panel waves were conducted in 2000, 2004, and 2007. The 2007 sample contains 1342 households of the original 1578 sampled, a re-interview rate of 85%. Due to problems with the 2000 survey implementation, for this paper, we use a balanced panel of households interviewed in each of the 1997, 2004 and 2007 surveys.

Mozambique: In 2002, the Mozambican Ministry of Agriculture and Rural Development (MADER) in collaboration with the National Institute of Statistics (INE) conducted a national rural household income survey – the Trabalho do Inquerito Agrìcola (TIA). The sampling frame was derived from the Census of Agriculture and Livestock 2000, and used a stratified, clustered sample design that is representative of small- and medium-scale farm households at the provincial and national levels. The sample was stratified by province (10 provinces) and agro-ecological zones, and included eighty of the country's 128 districts. A total of 4908 small and medium-sized farms were interviewed in 559 communities (clusters). A subsequent panel wave was conducted in 2005, with a re-interview rate of 82.7%, and replacement of attrited households to retain a representative sample of the population.

Zambia: Data is drawn from the Central Statistical Office's Post Harvest Survey (PHS) of 1999/2000, and the linked 2001, 2004, and 2008 Supplementary Surveys (SS) designed and conducted jointly by the government's Central Statistical Office and Michigan State University. A 3-wave household panel data set is available for the three agricultural production seasons covered by the three Supplemental Surveys, 1999/2000 (SS 2001), 2002/2003 (SS 2004), and 2007/08 (SS 2008). The PHS is a nationally representative survey using a stratified three-stage sampling design. Census Supervisory Areas (CSA) were first selected within each district, next Standard Enumeration Areas (SEA) were sampled from each selected CSA, and in the last stage a sample of households was randomly selected from a listing of households within each sample SEA. The SEA is the most disaggregated geographic unit in the data, which typically includes 2–4 villages of several hundred households. The 2001, 2004, and 2008 surveys are based on a sample frame of about 7400 small-scale (0.1–5 ha) and medium-scale farm households, defined as those cultivating areas between 5 to 20 hectares. For our panel econometric analysis of the Zambia data, we use the 68.2% of households that were successfully interviewed in both the 2001 and 2008 survey waves. We do not use cases from the 2004 survey wave as it failed to collect information on a key variable for our analysis (total landholding). Because the 2001 Supplemental Survey covered the 1999/2000 agricultural year, we refer to this survey wave as 2000 from here on.

Because this descriptive and panel work is focused on small and medium-scale farmers, we drop sample households with greater than 20 ha cultivated in Mozambique and Zambia ($n = 7$ and $n = 74$ households, respectively), and households with greater than 20 ha owned in Kenya ($n = 16$ households). For this paper we only use households that were interviewed in each of the panel years (attrition bias tests are discussed in Panel attrition). This enables us to take advantage of panel econometric techniques that help us to control more effectively for potential endogeneity bias that could arise if unobserved time-constant household-level factors are correlated with explanatory variables (as explained in Household-level unobserved heterogeneity)

Conceptual framework

The conceptual framework for many of the existing empirical papers on marketed food staples is based on seminal theoretical work by de Janvry et al. (1991), who used a household model to demonstrate that costs associated with market transactions can explain why some households avoid engaging in food and cash crop markets. Their results derive from the premise that the typical rural household in a developing country faces a wedge between the sales price of a given commodity and its purchase price. This wedge may be due to a combination of factors related to marketing, production, or consumption. Market-related factors include transport costs between the farm household's village and the relevant market, non-competitive behavior among local traders, poor access to price information, and shallow local markets. Production-related factors include lack of access to finance for key inputs and low food crop productivity, while consumption-related factors include lack of insurance mechanisms (e.g., credit) against risks of excessive variation in food market prices and/or availability. The larger the wedge between sales and purchase prices, the greater the width of the price band or wedge in which the costs of selling exceed a household's willingness to sell, and the costs of purchasing the commodity are greater than a household's willingness to pay. A household whose internal or shadow price for the commodity falls within this price band or wedge will thus chose to not participate in the market, as either a seller or buyer. This condition is sometimes referred to as a missing market or as a market failure. In this context, market failure is household- and not commodity-specific.

The principal strand of empirical literature on smallholder participation in staple food markets has built upon these theoretical results, yet has focused primarily on the role of transaction costs in discouraging market participation (Goetz, 1992; Key et al., 2000; Renkow et al., 2004). In general, these studies find that transportation and search costs (usually proxied for by distance from the village to the nearest road or town) are negatively associated with market participation, while household ownership of transportation assets such as bicycles, pack animals, carts, and motorized vehicles (which would tend to reduce search costs) have a positive association with market participation. Based on these results, they argue that the effects of price policy are muted for a majority of rural households due to insufficient investment in institutional and physical marketing-related infrastructure.

However, de Janvry's theoretical model does not explain the missing market outcome on the basis of transaction costs alone. For example, while transaction costs define the width of the price band, the location of the household's individual shadow price for the commodity is also influenced by its supply curve, which is determined by household asset levels (landholding, farm equipment), input choices (including technology choice), local agro-ecological potential, etc. Alene et al. (2007) recent empirical study on the role of transaction costs in impeding market participation is one of the few papers in this area which also highlight the role of non-price factors such as household landholding and technology choice in household maize marketing decisions. The location of household-specific price band is also determined by the household-specific demand curve, which is a function of not only household income but also socio-demographic factors.

More recent literature has questioned whether the lack of smallholder response to the market reforms of the 1980s–90s in eastern and southern Africa (ESA) is due to heterogeneity in household resource endowments, which prevents a large number of poorer households from taking advantage of lower market access costs (Boughton et al., 2007; Barrett, 2008). The conceptual framework underlying these papers comes from the theory of asset

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