

Smallholder Heterogeneity and Maize Market Participation in Southern and Eastern Africa: Implications for Investment Strategies to Increase Marketed Food Staple Supply¹

by

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Policymakers in many African countries, and other parts of the world where a significant part of the rural population is poor and food insecure, face a two-edged dilemma. On the one hand there is a need to increase the quantity of marketed food staple surpluses to feed a growing population, especially rapidly growing urban centers where unrest can be politically destabilizing. Many of these new urban consumers are very poor, arriving from the countryside with few skills and barely subsisting on informal sector daily earnings. At the same time they seek to reduce rural poverty rates which, since smallholders represent the bulk of the rural poor, means finding ways to increase smallholder incomes. Are these two objectives, increases in marketed supply of low-cost staples and increases in smallholder incomes, in conflict with one another or are they complementary? The answer is very important for CAADP investment plans in Africa, and similar programs in other food insecure countries, that aim for *sustained* increases in marketed food production and rural economic growth.

A number of African countries have recently sought to resolve the dilemma through large-scale fertilizer subsidy programs to increase production, often coupled with purchases of a large part of the marketed surplus by state-run marketing boards to avoid price collapses. There is growing evidence that such programs are not sustainable from a fiscal perspective, and have little enduring benefit for either urban consumers or rural smallholders. The evidence presented in this paper suggests that there are alternative ways to invest these resources that will lead to sustainable outcomes, recognizing that safety nets for poor urban consumers and food insecure rural households will continue to be needed in the near term to alleviate suffering and safeguard political stability until they bear fruit (an area addressed by CAADP's Pillar 3).

We examine the question how to achieve increases in marketed surplus and improve smallholder incomes for the case of maize, Africa's most widely marketed cereal food staple, using nationally representative smallholder panel data sets for Kenya, Mozambique and Zambia. Across these three countries there is a wide range of market access as conventionally measured by distance to a tarmac road or an input dealer. In Kenya, for example, a smallholder farmer need travel just 3 km on average to purchase from a fertilizer retailer, compared to 37km in Zambia and almost 70km in Mozambique. Within countries there is again wide variation in household assets and agro-ecology. This diversity allows us to analyze smallholder production and marketing patterns in depth, and use panel regression

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techniques to determine how changes at the margin in smallholders' access to assets, technologies or markets are likely to affect their decisions about whether and how much maize to sell.

Kenya has both the highest level of smallholder commercialization and the lowest rural poverty rate of our three study countries. The median Kenyan smallholder sells almost half the value of their agricultural production, four times the share sold by Zambian smallholders and six times the share sold by Mozambican smallholders. Even though the share of total household income from crops and livestock in Kenya is only slightly lower (at 62%) than either Zambia or Mozambique (64% and 69% respectively), median household income per adult equivalent in Kenya is almost six times that of Mozambique and almost four times that of Zambia. Kenya demonstrates that smallholder agriculture can provide a pathway out of poverty when households have the necessary assets to take advantage of investments in market development.

In all three countries maize sales are concentrated in a minority of the population. In Kenya, approximately a quarter of the smallholders sell more than a 100kg bag per adult equivalent, in Zambia between 10 and 20% depending on the year, and in Mozambique only 3%. In all three countries, smallholders selling more than a 100kg bag have production levels per adult equivalent five times that of their counterparts who have negligible or no sales. What kinds of CAADP investment will shift more of the smallholder distribution into the category with significant maize surpluses to sell on a sustainable basis?

The correlation between landholdings and smallholder incomes has been well documented empirically, so it is not surprising that access to land also affects smallholder maize marketing (sustainable land use is the focus of CAADP's Pillar 1). Marginal increases in landholding have the largest incremental effect on maize sales in Mozambique, where extremely limited access to improved inputs like seed and fertilizer makes increases in cultivated land area the only way to increase labor productivity for most smallholders, and opportunities to diversify into more lucrative crops are few. But even in Mozambique, diminishing marginal returns to increased land area could be expected to set in quickly due to the absence of animal traction (except in the southern part of the country which is not well-suited to maize production). In Zambia and Kenya, small increases in landholding would have a significant impact on marketed maize surpluses by smallholders in the middle and upper parts of the land distribution. In none of our three countries can we predict that smallholders in the bottom 25% of the land distribution would increase participation in maize markets in response a small increment in landholding, since a small increment in land access by itself would still not be sufficient to meet their own consumption needs.

Not surprisingly, in view of the susceptibility of maize yields to rainfall amount and distribution, and the response of hybrid yields to elevation, smallholder maize market participation in terms of both probability of sale and quantity sold is affected by agro-ecology. This has obvious implications for the geographic focus of CAADP programs aiming to increase marketed maize surpluses to feed growing urban populations, but also to the role of improved technology to which we turn next.

In contrast to the relatively limited effects on smallholder maize market participation of marginal increases in land, the use of improved technology (the focus of CAADP's Pillar 4) has significant effects across the whole spectrum of smallholder landholdings under suitable agroecological conditions. In Zambia, for example, adoption of hybrid seed by smallholders not currently using this technology would be expected to result in a significant increase in the probability of sale and a significant increase in quantity sold for all landholding quartiles, with the strongest effects in the better agro-ecologies. In Kenya, the expected effects of adoption on maize quantity marketed are smaller (although still significant), reflecting the fact that hybrid seed use has already been widely adopted. Marginal increases in fertilizer use are predicted to have similar pattern of effects to hybrid maize adoption in both countries. This is not surprising given that hybrid seed and maize are often adopted together. The effects of fertilizer are more spatially concentrated on the higher potential agro-ecological zones in the case of Zambia compared to Kenya, where distance to fertilizer sellers is much shorter. This is understandable given that fertilizer is a much more bulky input than hybrid seed.

In Mozambique hybrid maize seed use is negligible, in part because of lack of availability except in border areas close to Zimbabwe, Zambia or Malawi, and in part because these are the only mid-elevation areas in the country where hybrids currently demonstrate a noticeable yield advantage over non-hybrid varieties. Fertilizer availability is also negligible outside smallholder tobacco contract schemes. Clearly expanded access to improved seed and fertilizer, combined with the widespread introduction of animal traction, are pre-requisites for Mozambican smallholders to move beyond a largely semi-subsistence mode of farming.

Investments to increase smallholder market access (the focus of CAADP's Pillar 2) commonly refer to improvements in road infrastructure to reduce transport cost, increasing the availability of market information to reduce search costs for farmers and traders, and club goods such as farmer associations to undertake group marketing. Essentially, market access investments seek to reduce the costs and/or improve the price smallholders receive when they exchange physical produce for cash (or equivalent value in goods or services). Our study looks at the effects of distance, access to transport, expected prices at time of planting, and access to market information on smallholder market participation.

Distance to the nearest tarmac road does not have a significant effect on smallholder market participation in our study, but owning transport does. The reason that distance does not have a direct impact is that most villages, even in Mozambique, receive an influx of itinerant and/or seasonal buyers during the post-harvest period. The additional transport costs are reflected in the prices received by farmers, and these price levels are controlled for separately in the regression analysis. Furthermore, distance is only part of the costs that traders have to build in to their margins, and these costs have been reduced considerably as cell phone access allows them to coordinate transport and use their time more efficiently, making distance less of an obstacle than it used to be. Finally, farmers close to tarmac roads are likely to have more options for diversification into higher value, but perishable commodities, whereas farmers further away are more likely to focus on non-perishable crops like maize despite the higher transport costs. Thus the cost advantage of smallholders closer to tarmac roads may be offset by their comparative advantage in non-maize crops. Nevertheless, smallholder farmers that own transport, especially bicycles in Mozambique, are significantly more likely to participate in markets. Ownership of

a bicycle allows them to capture the village traders' margin and/or sell at the period they choose rather than when seasonal traders are in the village. This is not to say that improved road infrastructure is unimportant for smallholder food security and incomes. On the contrary, it is likely to be very important for providing farmers with greater access to improved inputs to increase productivity and for diversifying their production into higher value commodities, as illustrated by smallholder farming systems in Kenya.

Expected farm prices had little impact on smallholder market participation except in Kenya and the largest smallholders (in landholding terms) in Zambia. This is because the impact of prices on farmers' incomes is inversely proportional to the share of the crop they sell. For farmers who sell all or most of their crop expected prices matter a great deal to their decisions on how much to produce. But for farmers who do not sell anything expected prices have no impact on their cash incomes (although higher prices will make net buyer households worse off). In Mozambique, 90% of smallholder households had negligible or no sales, while in Zambia between 70% and 80% of smallholders were in this category. Hence it is not surprising that we see few statistically significant responses to expected prices. In Kenya, on the other hand, where a quarter of smallholders sell more than a 100kg of maize per adult equivalent, we begin to see an effect of prices on market participation, primarily drawing farmers into the market who were not selling before. Once again, the key point is not that prices don't matter for smallholders. Rather, investments to improve market access for smallholder farmers without also expanding their options to raise productivity through access to improved technology and cultivable land are putting the cart in front of the horse.

In contrast to expected prices at planting, access to price information after harvest had significant effects on market participation in all countries, especially for smallholders with larger landholdings in Mozambique and Zambia. Access to price information empowers farmers with a surplus to negotiate more attractive prices.

What are the implications of these findings for CAADP investment programs? First, CAADP investment plans can achieve both increased marketed surpluses of food staples and reduce poverty but they will need to target different investment bundles to different groups of smallholders, adapted to the agro-ecology where they farm. In general, smallholders who are able to increase marketed maize production quickly to supply growing urban populations will often be among the less poor smallholders in terms of their access to land, in favorable agroecological zones, but with limited potential to diversify into higher value farm enterprises. Poorer, often more land-constrained smallholders, will find it easier to increase their income by a combination of increasing food staple production for own consumption and diversifying into higher value crops (or livestock) to market. Second, expanding access to improved seed and fertilizer is a powerful way to overcome smallholder land constraints in the short run; while expanded access to animal traction and/or re-settlement in more land abundant areas can further increase labor productivity and incomes in the medium to longer term. Technology packages need to be well adapted to agro-ecological conditions, and integrate conservation agriculture methods to counter weather shocks. In the case of maize, for example, high-yielding longer duration hybrids will be more appropriate for commercial smallholders in mid-elevation areas whereas a combination of medium and short-duration drought tolerant varieties would be more appropriate for vulnerable smallholders and/or

low elevation zones. Third, improvements in access to input markets and extension to enable smallholders to deploy profitable technology packages is at least as important as access to output markets, especially in countries like Mozambique and Zambia where the majority of farmers have negligible amounts of surplus staples to sell. Fourth, access to market information is positively correlated with smallholder market participation in maize markets, indicating that it adds value to farmers' earnings irrespective of distance to market.

An important point to note is that no one CAADP pillar can by itself address the needs identified above. All four CAADP pillars need to be integrated at the smallholder farmer level, with different emphasis and content according to agro-ecology, household assets, and degree of market development.