Fertilizer Subsidies and Smallholder Commercial Fertilizer Purchases: Crowding out, Leakage, and Policy Implications for Zambia

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Key Points:

1. Two key determinants of the effect of a fertilizer subsidy program on total fertilizer use are (a) the extent to which subsidized fertilizer "crowds out" or "displaces" farmers' purchases of fertilizer from commercial retailers, and (b) the extent to which fertilizer intended for government subsidies leaks out of the government channel and is resold as commercial fertilizer.

2. Results suggest that smallholder farm households in Zambia reduce their purchases of fertilizer from commercial retailers by 0.13 kg, on average, for each additional kg of government-subsidized fertilizer they receive.

3. The displacement rate is: (a) higher in areas where the private sector was initially highly active in fertilizer retailing than in areas where it was less active; (b) higher among households cultivating more than two hectares than among households cultivating smaller areas; and (c) higher among male-headed households than among female-headed households.

4. During the years covered in the study (1999/2000, 2002/2003, and 2006/2007), only 67% of the fertilizer intended for distribution through government subsidy programs reached smallholders as subsidized fertilizer. The remaining 33% leaked out of the government channel and was likely resold through commercial channels.

5. This leakage figure coupled with the national average crowding out estimate of 0.13 kg suggests that each additional kg of fertilizer intended for government subsidies that is injected into the system increases total fertilizer acquisition in Zambia by only 0.53 kg.

6. The Zambian government may be able to add more to total fertilizer use through its subsidy programs by reducing leakage through better monitoring of subsidized fertilizer distribution and by targeting subsidized fertilizer to areas where the private sector is less active, to households with smaller landholdings, and to female-headed households.

INTRODUCTION: Targeted fertilizer subsidies are growing in popularity in sub-Saharan Africa and are a pillar of the Government of the Republic of Zambia's (GRZ's) agricultural sector strategy. For example, over the 2004 to 2011 fiscal years, the budget allocation to the Fertilizer Support Programme (FSP) and its successor, the Farmer Input Support Programme (FISP), averaged 40% of the total allocation to the ministries responsible for agriculture, livestock, and fisheries, and 64% of the total budget for agricultural sector poverty reduction programs. However, if subsidized fertilizer distributed through FSP/FISP is allocated to households that would have otherwise purchased it at commercial prices, then the increase in total fertilizer use as a result of the subsidy program

will be negligible. In other words, the change in total fertilizer use depends in part on the extent to which subsidized fertilizer "crowds out" or "displaces" farmers' commercial fertilizer purchases. It also depends on the extent to which fertilizer intended for government programs leaks out of the government channel and is resold as commercial fertilizer.

In this study, we measure the change in Zambian smallholder farm households' purchases of fertilizer from commercial retailers for each additional kilogramme (kg) of government-subsidized fertilizer the household receives. That is, we empirically estimate the extent to which subsidized fertilizer crowds out smallholders' fertilizer purchases from commercial retailers. We also estimate the amount of fertilizer intended for GRZ subsidies that leaks out of the government channel and is likely resold as commercial fertilizer. We then combine the crowding out and leakage estimates to measure the increase in national fertilizer acquisition given an additional kg of subsidized fertilizer injected into the system by GRZ.

The study updates and extends Xu et al.'s (2009) estimates of crowding out for Zambia. That study was based on panel survey data covering the 1999/2000 and 2002/2003 agricultural years. Since its publication, a third wave of panel data covering the 2006/2007 agricultural year has become available. The scale of FSP increased by 75% between 2002/2003 and 2006/2007, and the subsidy level increased from 50% to 60%. Using all three waves of data allows us to study how the rate of crowding out differed between 2002/2003 and 2006/2007. Our study extends Xu et al. (2009) by addressing the issue of leakage of subsidized fertilizer into commercial channels.[1]

DATA AND METHODS: Our crowding out estimates are based on econometric analysis of nationally-representative household-level panel survey data covering the 1999/2000, 2002/2003, and 2006/2007 agricultural seasons collected by the Central Statistical Office (CSO) and the Ministry of Agriculture and Cooperatives (MACO) in conjunction with the Food Security Research Project (FSRP). A total of 5,358 households were interviewed in both the first and second waves of the survey, and 4,286 households were interviewed in all three waves. These 15,002 observations are used in the analysis.

The crowding out estimates are obtained by regressing the household-level kg of fertilizer purchased from commercial retailers on the kg of GRZ-subsidized fertilizer acquired by the household as well as other control variables. Xu et al. (2009) find that the rate of crowding out is much greater in areas where the private sector was initially relatively active in fertilizer retailing compared to areas where it was less active. We therefore estimate separate regressions for high versus low fertilizer private sector activity (PSA) districts. High PSA districts are defined as districts where households purchased an average of 20 kg of fertilizer or more during the 1997/98 agricultural season based on that year's CSO/MACO Post-Harvest Survey data. Low PSA districts are those where households purchased less than 20 kg of fertilizer on average in 1997/98.

Our estimates of the amount of fertilizer intended for government subsidy programs that leaked out of the government channel and was likely resold as commercial fertilizer are based on the difference between: (i) CSO/MACO nationally-representative household survey data-based estimates of the total quantity of GRZ-subsidized fertilizer received by smallholders as such; and (ii) MACO records of the quantities of GRZ fertilizer delivered to the district level for distribution as subsidized fertilizer. For more details on the methods used in this study, please refer to the IAPRI Working Paper No.70 of the same title, available at http://aec.msu.edu/fs2/zambia/research.htm

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[1] A third difference is that we explicitly deal with a statistical problem (endogeneity) following the methods used by Ricker-Gilbert, Jayne, and Chirwa (2011). Endogeneity in this application means that unobserved factors that affect how much commercial fertilizer households purchase also affect how much subsidized fertilizer they acquire. If not corrected for, endogeneity leads to biased estimates.

FINDINGS: The study highlights seven key findings. First, in high PSA areas, each additional kg of GRZ-subsidized fertilizer received by a smallholder household reduces its fertilizer purchases from commercial retailers by 0.23 kg. As expected, at 0.07 kg, the rate of crowding out is considerably lower in low PSA areas. Second, together the high and low PSA displacement estimates suggest that at the national level, 1 kg of subsidized fertilizer crowds out 0.13 kg of fertilizer purchased from commercial retailers.

Third, the displacement rate is higher among households that cultivate two or more hectares of land (0.21 kg) than among households cultivating smaller areas (0.11 kg). Landholding size and area planted are highly positively correlated with household income and assets. Households planting larger areas are more likely to have the means to purchase fertilizer at commercial prices, hence the higher degree of crowding out among such households. Fourth, displacement rates are higher among male-headed households (0.15 kg) than among

female-headed ones (0.09 kg). This is an expected result because male-headed households are more likely than female-headed households to have the resources to purchase fertilizer at commercial prices. Fifth, the displacement rate was somewhat higher in 2006/07 (0.15 kg) than in 2002/03 (0.13 kg), perhaps due to greater targeting challenges in 2006/07 resulting from a 75% increase in the scale of FSP and a reduction in government-subsidized fertilizer distributed through the typically better-targeted Food Security Pack Programme.

Sixth, initial evidence suggests that a fairly large proportion of GRZ-subsidized fertilizer cannot easily be accounted for. The estimated quantity of FSP/FISP fertilizer received by smallholder farmers based on nationally-representative survey data collected by CSO and MACO is only 34% to 87% of the quantity of fertilizer distributed under FSP/FISP according to MACO records (Table 1, column D).

Table 1. GRZ Subsidized Fertilizer and Leakage, 1999/2000-2010/2011

Agricultural year	GRZ fertilizer subsidy programme	MT of fertilizer for GRZ subsidies delivered to districts (based on MACO records)	MT of GRZ subsidized fertilizer received by smallholder households (based on survey data)	Share of fertilizer intended for GRZ subsidies received by smallholders as subsidized fertilizer (share leaked in parentheses)
	(A)	(B)	(C)	(D)=(C)/(B)
1999/2000	FRA-FCP	34,999	21,038	60% (40%)
2000/2001	FRA-FCP	23,227	11,266	49% (51%)
2001/2002	FRA-FCP	28,985	8,365	29% (71%)
2002/2003	FSP	48,000	31,722	66% (34%)
2003/2004	FSP	60,000	33,372	56% (44%)
2004/2005	FSP	50,000	16,792	34% (66%)
2005/2006	FSP	50,000	23,595	47% (53%)
2006/2007	FSP	84,000	58,404	70% (30%)
2007/2008	FSP	50,000	43,596	87% (13%)
2008/2009	FSP	80,000	55,114	69% (31%)
2009/2010	FISP	106,000	69,103	65% (35%)
2010/2011	FISP	178,000	116,116	65% (35%)

Notes: MT=metric tonne. FRA-FCP = Food Reserve Agency Fertilizer Credit Programme.
Sources: FRA Agro Support Department; MACO (various years); MACO (2008); CSO/MACO Post-Harvest Surveys; CSO/MACO/FSRP Supplemental Surveys; and CSO/MACO Crop Forecast Surveys.

In the years covered by the panel survey data used in this study, only 67% of the fertilizer intended for distribution through the Fertilizer Credit Programme (in place in 1999/2000) and FSP (in place in 2002/03 and 2006/07) reached smallholders as government-subsidized fertilizer. The remaining 33% leaked out of the government channel and was likely resold through commercial channels. This is consistent with allegations that some FSP/FISP fertilizer is diverted and resold.[2]

Seventh, this leakage figure coupled with the estimate that each kg of subsidized fertilizer acquired by a household reduces its commercial fertilizer purchases by 0.13 kg implies that each kg of subsidized fertilizer injected into the system by GRZ raises total fertilizer use by 0.53 kg. If the leakage of subsidized fertilizer into commercial channels had not been taken into account, we would have concluded that total fertilizer use increases by 0.87 kg, an overestimate of 63%.

POLICY IMPLICATIONS: Based on these findings, the Zambian government may be able to add more to total fertilizer use through its fertilizer subsidy programs by reducing leakage and by targeting households in low PSA areas, those with relatively small landholdings or cultivated area, and female-headed households. Under FISP, GRZ has taken steps to improve targeting by involving traditional leaders in the selection of beneficiaries. The government could also consider channeling more subsidized fertilizer through the Food Security Pack Programme, which has a better targeting track record. The use of an electronic voucher (e-voucher) system for FISP, where the vouchers are redeemable at commercial retailers, may be a way of crowding in private investment in fertilizer marketing. Under the current FISP modalities, there is limited engagement of the private sector. An e-voucher system also has the potential to improve monitoring of subsidized

fertilizer and to reduce leakage (Sitko et al. 2012).

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[2] See, for example, Mulenga (2009), Nkanga and Sinyangwe (2009), and Chulu (2010), as well as http://www.aec.msu.edu/fs2/zambia/tour/FSP_Difficulties_Press_Clipping_Nov_Dec_2008.pdf for a compilation of Zambian newspaper articles from Nov./Dec. 2008 related to this issue.

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