



# Government fertilizer subsidy and commercial sector fertilizer demand: Evidence from the Federal Market Stabilization Program (FMSP) in Nigeria



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## ABSTRACT

We examine how the previous fertilizer subsidy program in Nigeria (FMSP) affected the demand for commercial fertilizer. We apply an endogenous double hurdle model to a pseudo-panel and cross-section data of farm households. The methodology accounts for potential endogeneity of commercial fertilizer price with subsidy. Our specification is also appropriate where few farmers report the use of both subsidized and commercial fertilizer. We find that 100 kg of subsidized fertilizer supplied to a farm household reduced the probability of its participation into commercial fertilizer market by 10–21% points, while not affecting fertilizer use upon participation.

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## Introduction

Increased fertilizer use is often regarded as an important factor for agricultural productivity growth in sub-Saharan African (SSA) countries, where fertilizer use has been low and yields growths of major crops have been slow. Several policies have been adopted in SSA with the aim of developing a commercial inputs sector, including subsidies, development of input-supply networks through credit guarantees, or liberalization and de-regulation (Kelly et al., 2003; Ariga and Jayne, 2011; World Bank, 2007; Morris et al., 2007). Among those, input subsidies have often been popular policy tools used by SSA countries. Public input subsidies can be Pareto inefficient, inducing overuse of inputs. Many countries, however, use subsidies on the premise that they can be second best policies (Stiglitz, 1987) that help the agricultural input sectors to grow sustainably.

Fertilizer subsidies can crowd in the commercial fertilizer sector by sensitizing farmers to the benefits of fertilizer, boosting its demand, and helping commercial fertilizer sectors to raise their profitability through economies of scale from handling a larger volume of fertilizer. Increased demand may also facilitate the importation and domestic transportation of fertilizer in bulk quantity,

further reducing unit costs (World Bank, 2007, 150–151). If farmers make sufficient savings from either reduced production costs due to fertilizer subsidies, or increased sales from increased use of fertilizer, subsidies could also help farmers graduate into and sustain input intensive production systems with high fertilizer demand even after the withdrawal of subsidy program, which also creates a sustainable enabling environment for the commercial fertilizer sector to operate. Fertilizer subsidies can, however, crowd out the commercial sector if these conditions do not hold. Recent literature in SSA generally suggests that fertilizer subsidies crowded out the commercial fertilizer sector (Xu et al., 2009; Ricker-Gilbert et al., 2011), although it is found still possible for the subsidy to stimulate fertilizer demand through improved beneficiary targeting (Liverpool-Tasie forthcoming).<sup>1</sup>

The Government of Nigeria recently launched a new fertilizer support program in which a fertilizer subsidy is provided through targeted vouchers nationwide. One of the goals of the new program is to grow the commercial fertilizer sector. This new subsidy program is a shift from the previous Federal Market Stabilization Program (FMSP)<sup>2</sup> in Nigeria. FMSP was similar to the parallel

<sup>1</sup> Findings from Liverpool-Tasie (forthcoming) are, however, based on cross-sectional data which cannot control for unobserved heterogeneity.

<sup>2</sup> In this paper, we refer to FMSP more broadly as representing the old subsidy scheme, whereby the roles of state governments, as described later, are also implicitly captured.

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distribution schemes in Zambia (Xu et al., 2009) in which subsidized fertilizer was directly provided by the government, in parallel with the commercial market providing unsubsidized fertilizer at competitive prices.

However, the impact of such a policy shift cannot be evaluated without information about the impact of the FMSP. Historically, the Nigerian government repeatedly implemented various fertilizer subsidy schemes that had been once considered failures (Liverpool-Tasie and Takeshima, 2013), partly because little empirical evidence had been provided to guide such decisions. We provide evidence on how the FMSP crowded in/out the commercial fertilizer sector. The objectives of our study are twofold. We first discuss key fertilizer market characteristics under the FMSP and patterns of fertilizer sourcing by farmers. We then assess how fertilizer subsidies crowded in/out household demand for fertilizer from commercial sources. We use two datasets; a pseudo-panel dataset of export-crop growers in Nigeria collected in 2003 and 2007; and the nationally representative agricultural household data collected in 2010. In doing so, we consider potential endogeneity of the commercial fertilizer price with demand for subsidized fertilizer. Importantly, in Nigeria, governments in each state and local government area (LGA)<sup>3</sup> are heavily involved with the provision of fertilizer subsidies. We show that with such influence of state and local governments, an endogeneity issue may arise in the commercial price of fertilizer.

Our analysis contributes to the literature in the following way. First, we build on the past studies analyzing the effect of fertilizer subsidies on the commercial fertilizer sector in SSA by providing evidence from another SSA country, Nigeria. Second, we present the methods which incorporate the potential endogeneity of fertilizer prices in subsidized fertilizer use. Third, our methods also overcome limitations in the data where there are relatively few observations reporting quantities of both subsidized fertilizer and commercial fertilizer.

Our paper has the following structure. 'Fertilizer subsidy under the Federal Market Stabilization Program (FMSP) in Nigeria' describes the FMSP in Nigeria. 'Conceptual framework of crowding in/out at the household level' presents the key conceptual framework. 'Data' describes the data used. 'Empirical specification' presents the empirical model, 'Results' discusses the results, and 'Conclusions' concludes.

### Fertilizer subsidy under the Federal Market Stabilization Program (FMSP) in Nigeria

Historically, fertilizer subsidies accounted for about 30% of the total federal budget for agriculture in Nigeria, although the federal government generally allocated less than 3% of its budget to agriculture (Mogues et al., 2012). The FMSP officially started in 1999 under the democratically elected government, and lasted until 2011 (Liverpool-Tasie and Takeshima, 2013). Under the FMSP, subsidized fertilizer was distributed through complex channels (Fig. 1). Detailed descriptions of the fertilizer market structure as well as its development are provided in Gregory (2008), Banful et al. (2010), Banful and Olayide (2010) and Liverpool-Tasie et al. (2010).

Under channel A in Fig. 1, each state government submits a request to the federal government to procure a certain quantity of fertilizer based on the demand projections for fertilizer in their states (subsidized and unsubsidized combined), determined by the estimated farm area and recommended fertilizer application rates.<sup>4</sup> The federal government then determines the procurement

quantity based on actual budget allocations and issues tenders to private fertilizer manufacturers. Private fertilizer manufacturers obtain fertilizer, particularly Nitrogen-Phosphorous-Potash (NPK) compound,<sup>5</sup> from the international market, and supply it to the federal government. The federal government then distributes fertilizer to three Ministry of Agriculture warehouses in each state (Gregory, 2008). The federal government calculates pan-territorial delivered prices for NPK, Urea, and Single Super Phosphate (SSP) based on the Cost, Insurance and Freight (CIF) price and the estimated national average domestic transportation costs, and deducts 25% from the price when delivering to each state. Each state then distributes fertilizer to farmers through outlets, mainly the Agricultural Development Project (ADP), often adding a subsidy ranging from zero to 50%. Under the second channel (Channel B in Fig. 1), unsubsidized ("commercial") fertilizer is obtained from the open market, where fertilizer is bought directly from the international market or private manufacturers.

Under the FMSP, the commercial sector was involved in fertilizer manufacturing, blending, distribution and retailing. In 2006 there were about 25 private fertilizer manufacturers or blenders (Banful and Olayide, 2010). Distributions and retailing of fertilizer in the commercial sector were done by agro-dealers in Nigeria, which numbered around 10,000 in 2008, mostly small-scale (Gregory, 2008). These private input dealers buy fertilizer either from the private manufacturers or the state Ministry of Agriculture and sell to farmers (Banful and Olayide, 2010).

In the FMSP, the quantity of subsidized fertilizer was rationed at the aggregate level. The subsidized fertilizer market was not competitive because the government, rather than the market, determined the quantity of subsidized fertilizer to be distributed. Past studies indicate that in Nigeria, subsidized fertilizer was often diverted and sold in the open market by farmers or dealers who were well-connected with government officials or public institutions (Banful et al., 2010), which might have crowded out the commercial traders who can only sell fertilizer through the commercial channel. Poor targeting of fertilizer subsidies might have also induced leakages and led to the situation where the subsidy was ineffective in meeting the potential demand by the intended beneficiaries (Banful et al., 2010).

Table 1 presents the quantity of subsidized fertilizer, total fertilizer consumption, and estimated supply of commercial fertilizer in Nigeria between 2000 and 2008. While the actual quantities of subsidized and commercial fertilizer received by farmers may differ from these figures because of potential leakages, these figures still provide useful insights. Roughly speaking, except in 2006, the quantity of commercial fertilizer was negatively associated with the quantity of subsidized fertilizer. In 2008, the subsidy quantity increased substantially but the quantity of commercial fertilizer remained low. Such negative associations are consistent with the hypothesis that subsidies crowded out the commercial fertilizer sector. In addition, the quantity of subsidized fertilizer accounted for a large share of total fertilizer consumption, with a potential to affect the commercial fertilizer sector. These conditions altogether motivate our further empirical investigation of the crowding in/out issue.

### Conceptual framework of crowding in/out at the household level

While many earlier studies examined the issue of crowding in/out, few provided a theoretical framework of how they may occur. Here we briefly illustrate such a framework. A useful setup is a simplified version of mixed-regime utility maximization problems

<sup>3</sup> Nigeria has 37 states, and 774 LGAs placed under the state.

<sup>4</sup> Based on personal communication with a local expert.

<sup>5</sup> In this paper, "NPK" refers to NPK 15-15-15 or 20-10-10 fertilizer, which are commonly used types in Nigeria.

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