INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

sustainable solutions for ending hunger and poverty

Supported by the CGIAR

NSSP Background Paper 1

Agricultural Investment for Growth and Poverty Reduction in Nigeria

Vida Alpuerto, Xinshen Diao, Sheu Salau, and Manson Nwafor

Development Strategy and Governance Division
International Food Policy Research Institute (IFPRI)
and
ReSAKSS-West Africa
International Institute of Tropical Agriculture (IITA)

Nigeria Strategy Support Program (NSSP)

Background Paper No. NSSP 001

August 2009

IFPRI-ABUJA
International Food Policy Research Institute
c/o International Center for Soil Fertility and Agriculture Development
No.6/ Plot 1413 Ogbagi Street
Off Oro-Ago Crescent
Cadastral Zone 11, Garki, Abuja
Nigeria
E-mail: ifpri-nigeria@cgiar.org
www.ifpri.org

IFPRI HEADQUARTERS
International Food Policy Research Institute
2033 K Street NW
Washington, DC 20006-1002 USA
Tel. +1-202-862-5600
Fax +1-202-467-4439
E-mail ifpri@cgiar.org
www.ifpri.org

THE NIGERIA STRATEGY SUPPORT PROGRAM (NSSP) BACKGROUND PAPERS

ABOUT NSSP

The Nigeria Strategy Support Program (NSSP) of the International Food Policy Research Institute (IFPRI) aims to strengthen evidence-based policymaking in Nigeria in the areas of rural and agricultural development. In collaboration with the Federal Ministry of Agriculture and Water Resources, NSSP supports the implementation of Nigeria's national development plans by strengthening agricultural-sector policies and strategies through:

- Enhanced knowledge, information, data, and tools for the analysis, design, and implementation of pro-poor, gender-sensitive, and environmentally sustainable agricultural and rural development polices and strategies in Nigeria;
- Strengthened capacity for government agencies, research institutions, and other stakeholders to carry out and use applied research that directly informs agricultural and rural polices and strategies; and
- Improved communication linkages and consultations between policymakers, policy analysts, and policy beneficiaries on agricultural and rural development policy issues.

ABOUT THESE BACKGROUND PAPERS

The Nigeria Strategy Support Program (NSSP) Background Papers contain preliminary material and research results from IFPRI and/or its partners in Nigeria. The papers are reviewed by at least one reviewer from within the IFPRI network but are not subject to a formal peer review. They are circulated in order to stimulate discussion and critical comment. The opinions are those of the authors and do not necessarily reflect those of their home institutions or supporting organizations.

This paper received support from the Agricultural Policy Support Facility (APSF), funded by the Canadian International Development Agency (CIDA); the U.S. Agency for International Development (USAID)-funded Global Food Security Response (GFSR) initiative, implemented by the USAID MARKETS program; and the West Africa Regional Strategic Analysis and Knowledge Support System (ReSAKSS-WA).

Agricultural Investment for Growth and Poverty Reduction in Nigeria

Vida Alpuerto, Xinshen Diao, Sheu Salau, and Manson Nwafor

Development Strategy and Governance Division
International Food Policy Research Institute (IFPRI)
and
ReSAKSS-West Africa
International Institute of Tropical Agriculture (IITA)

Contents

List of Tables

List of Figures

Acknowledgements

The authors have received a lot of support from various government agencies and research institutions in Nigeria in order to put together all information and data required for this study. The authors thank Valerie Rhoe, James Sackey, Tewodaj Mogues, and Samuel Benin for their useful inputs and suggestions. The authors also thank Bingxin Yu, Alejandro Nin Pratt, Samuel Benin, and Shenggen Fan for their guidance in the econometric estimation. We also appreciate the internal reviewer for his/her comments on the first draft of the paper. The views expressed in this paper are the personal views of the authors and do not represent official positions of the International Food Policy Research Institute (IFPRI) or the International Institute of Tropical Agriculture (IITA).

Abstract

This study assesses public investment required for agricultural growth and poverty reduction in Nigeria. Using time series data for public spending and agricultural total factor productivity (TFP) growth, the econometrically estimated results show that one percent of growth in agricultural spending generates 0.24 percent of growth in agricultural TFP. To support 9.5 percent in agricultural annual growth in 2009-17, a growth rate from the economy-wide analysis on options of growth for poverty reduction (Diao et al. 2009), required agricultural investment would have to grow at 23.8 percent annually in the same period. However, if the spending efficiency were improved based on an estimated elasticity for Sub-Saharan Africa as whole, then required agricultural investment would grow at 13.6 percent per year instead. The study also shows that investment outside agriculture benefits the agricultural sector. By taking into account such indirect effect of public investment, required growth in agricultural spending is much lower.

Keywords: public investment, agricultural growth, Nigeria

Abbreviations and Acronyms

BOF	Budget Office of the Federation
CAADP	Comprehensive Africa Agriculture Development Program
CBN	Central Bank of Nigeria
DCGE	Dynamic Computable General Equilibrium
FMA	Federal Ministry of Agriculture
FMAWR	Federal Ministry of Agriculture and Water Resources
GFS	Government Finance Statistics
IMF	International Monetary Fund
MDG	Millennium Development Goal
NBS	National Bureau of Statistics
NEEDS	National Economic Empowerment and Development Strategy
NEPAD	New Partnership for Africa's Development
NFSP	National Food Security Program
OAGF	Office of the Accountant General of the Federation
TFP	Total Factor Productivity

I. Background

The Comprehensive Africa Agriculture Development Program (CAADP) initiative includes a target of 6 percent annual agricultural growth and a target of 10 percent of government budget spent for agriculture. In the case of Nigeria, the government has set a higher growth target of 10 percent given that the country has achieved 6 percent of annual growth in recent years. In a paper titled "Options of agricultural growth for poverty reduction in Nigeria" under the same project as this report, Diao et al. (2009) assess that to achieve such rapid agricultural growth in the next nine years (2009-17) total factor productivity (TFP) has to become the important engine of growth, instead of a growth led by land expansion as in the past. Their paper indicates that a 5.6 percent of agricultural TFP annual growth is needed for 9.5 percent of agricultural GDP growth. With such growth the national poverty rate will fall to 34.2 percent by 2017, which implies that the country will be able to halve the poverty rate in 1996 of 65.6 percent by 2017, thereby accomplishing the first Millennium Development Goal (MDG1).

Based on the growth result of Diao et al. (2009) this study assesses the required public spending to support such rapid agricultural growth in the next nine years (2009-17). We first describe the patterns and trends of total revenue and spending at the national and sub-national government levels in Section II. In Section III we turn to agricultural spending and emphasize the inconsistency between the magnitude of public resources allocated to the agricultural sector and the sector's role in the overall economy. In Section IV we econometrically estimate the relationship between agricultural TFP and public spending. Using these estimated elasticities we assess the required growth in public spending to support the agricultural growth analyzed in Diao et al. in Section V. Section VI concludes.

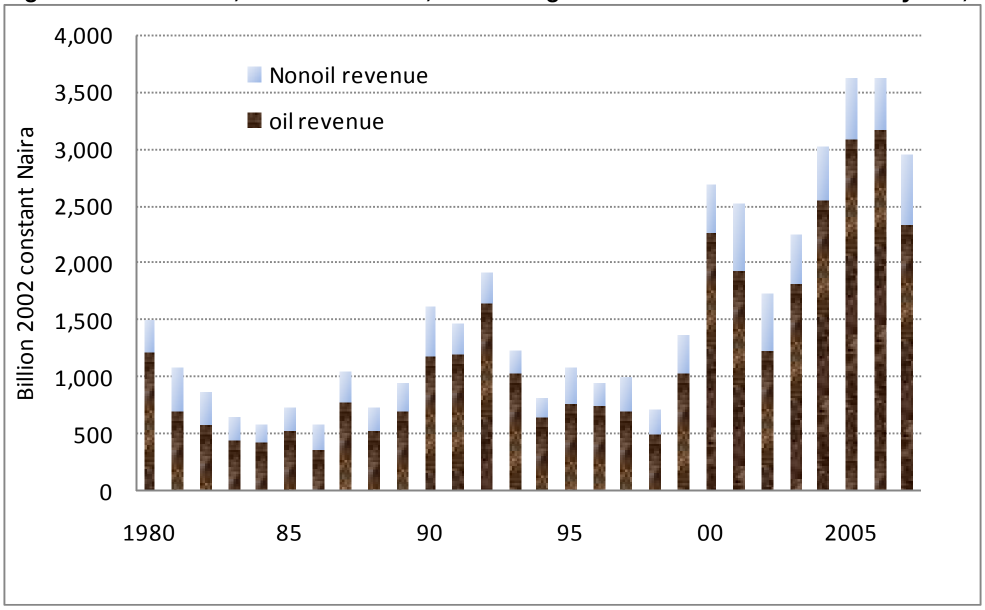
II. Trends and magnitude of aggregate revenue and expenditure

Nigerian government's revenue and expenditure highly depend on oil

Public revenue in Nigeria primarily comes from taxes and royalty on oil and other mineral resources, while taxes on non-oil tradable goods are less important. Prior to independence, agriculture was a major source of revenue but since the discoveries of oil in the 1970s, oil has become the most important revenue-generating export (Budina and Wijnbergen 2008; Obinyeluaku and Viegi 2008). Nigeria has come a long way since then and has become the largest oil producer in Africa and the eleventh largest producer worldwide (Revenue Watch Institute n.d.). Despite fluctuations, oil revenue has always been more than 60 percent of government total revenue after 1980, and it was as high as 80-90 percent in many years. To show the importance of oil revenue to the Nigerian government we display oil and non-oil revenues between 1980 and 2005 in Figure 1. We also normalize the revenues using consumer price index in Figure 1 for better comparison overtime.

The extreme oil dependency led to a historical trend of unstable government revenue and expenditure since oil revenue naturally follows the unpredictable fluctuations in world oil prices and an OPEC assigned oil quota since 1958 when Nigeria became a member (Ukwu, Obi, and Ukeje 2003; Obinyelauku and Viegi 2008) (Figure 2). Such variability disrupts the stable provision of government services, can cause a failure in public spending to reduce poverty, and may not facilitate the diversification and growth of the non-oil sector, particularly agriculture (Baunsgaard 2003). If Nigeria maintains its oil dependency and if the recent oil price decline continues in the coming years, the government would face tremendous challenges in providing the necessary resources to accelerate agricultural growth.

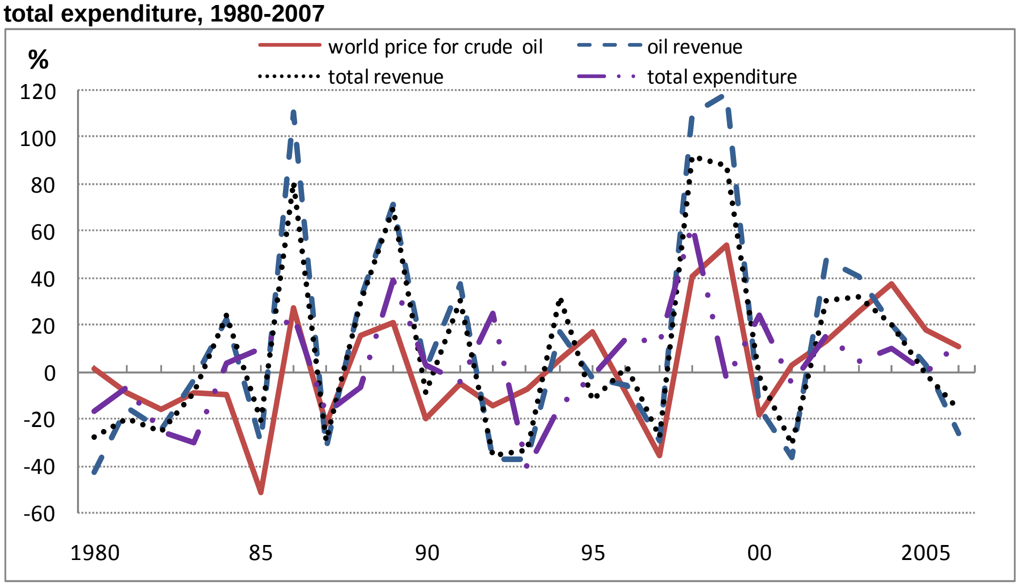
Figure 1 Oil revenue, non-oil revenue, and total government revenue deflated by CPI, 1981-2007



Source: CBN Statistical Bulletin (2009)

Note: The height of the bars represents the total revenue.

Figure 2: Annual change in world price for crude oil, Nigerian government oil revenue, total revenue, and total expenditure, 1980-2007



Source: CBN Statistical Bulletin (2009)

Oil revenue dominates the Federation Account revenue, and the way such revenue is distributed among the three tiers of government is one of the most protracted and controversial debates in the Nigerian economy (Uche and Uche 2004). Historically, numerous attempts have been made at devising an acceptable revenue allocation formula, each of which is more remembered for the controversies it generated than the issues it settled (Report of the Political Bureau 1987 as cited by Uche and Uche 2004). The Nigerian constitution mandates that the oil revenue be shared among all tiers of government and that oil-producing states receive 13 percent upfront (USAID 2008). After the first charges[1] are withheld, the distribution of the remainder among federal, state, and local governments is established by the Acts of the National Assembly (USAID 2008). About half of the net proceeds are distributed to state and local governments according to a formula[2] decided by the parliament every five years making the state and local governments highly dependent on revenue-sharing arrangements with the federal government (Ahmad and Mottu 2003). As of February 2008, the remaining funds are allocated as follows: 52.7 percent to the federal government, 26.7 percent to the states, and 20.6 percent to local governments (USAID 2008). Controversies and political problems arise in the sharing arrangement as the oil-producing states demand an increasing share of oil revenues while the non-oil producers demand greater redistribution of oil resources (Ahmad and Mottu 2008).

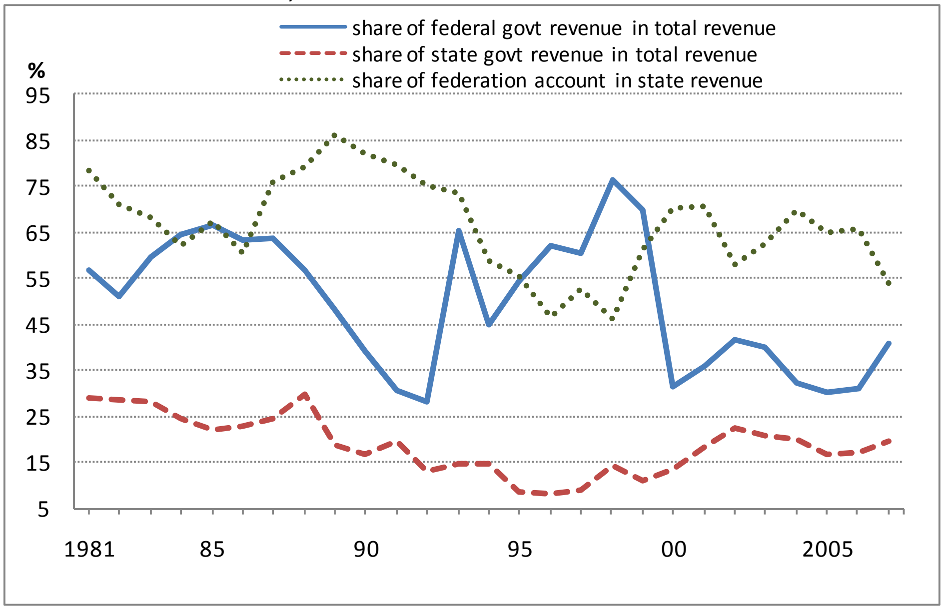
Shares of federal and state government revenue in total government revenue

From 1981 to 2007, the shares of federal and state government revenue in total revenue have both fluctuated (although the latter fluctuated at a lesser degree), strongly reflecting the volatility of oil as the main government revenue source (Figure 3). After a steep decline in the early 1990s, the share of federal revenue in total government revenue increased sharply between 1993 and 1999, creating a huge deviation in oil revenue distribution between these two tiers of government. After 1999, the trends changed as federal share started to decline while state share increased. The increasing share of state in total government revenue can be attributed to the larger share of federation account in state revenue starting in 1999, which is the year when civilian rule returned in Nigeria and the 1999 Constitution mandating the oil revenue allocation was established. In the following years (2000-01) the high oil prices further led to a large increase in the distribution of financial resources from the federal to the state and local governments, particularly to the oil-producing states (Ahmad and Mottu 2003). However, the increased allocation took place without the corresponding assignment of new expenditure responsibilities (Ahmad and Mottu 2003). State and local governments, as mandated by law, should provide public services such as education, health, public works, local utilities, and infrastructure. But aside from having little information on these sub-national governments' budgets, as well as on the level and composition of their expenditure, some sub-national governments' have accumulated considerable bank debts (Ahmad and Mottu 2003). This has further constrained the ability of the federal government to stabilize overall expenditure resulting in fiscal volatility transmitted to the whole economy (Baunsgaard 2003).

[1] Aside from the 13 percent allocated to oil-producing states, first charges are composed mainly of government share of the production cost of oil ("cash calls") and priority projects of the national oil company, and the external debt service (Ahmad and Mottu 2003).

[2] The detailed discussion of this formula can be found in Ahmad and Mottu (2003, p. 17)

Figure 3 Shares of federal and state government in total government expenditure, and share of Federation Account in state revenue, 1981-2007



Source: CBN (2009)

Trends of growth in government expenditure vs. economic growth

Table 1 presents growth patterns of GDP and government expenditure in 1981-2007. The table first displays the average growth rate or shares for the three periods, the period of pre-structural adjustment program (SAP) (1981-85), the period of SAP (1986-94), and the period post-SAP. Given that SAP period is rather long, we further break down this period into two sub-periods: late 1980s (1986-90) and early 1990s (1991-94). We also report annual growth and share in the post-SAP period between 2000 and 2007. The data confirms that when GDP grew slowly due to oil price declines particularly during the periods of 1981-85 and 1991-94 (0.3 and 1.1 percent, respectively), the total expenditure growth rate turned negative. After the structural adjustment period, total expenditure experienced very high growth of 14.6 percent despite having a relatively low GDP average growth (at 2.8 percent) during 1995-99. Isolating the federal and state expenditure during this period reveals that the share of the former is 75.5 percent while for the latter it only stands at 18.8 percent, down from 26.1 percent in 1986-90 and 24.6 percent in 1991-94. On the other hand, there are years when GDP growth rate is high but government expenditure posted negative growth. For example, GDP experienced relatively high growth as a consequence of the most recent oil booms (2000, 2002, and 2006) but expenditure growth rate is negative in the same three years.[3]

[3] The explanations for such opposite patterns of growth in GDP and government expenditure are unclear and hence deserve further investigation.

Table 1 GDP and government expenditure growth (%), 1981-2007

	Pre-SAP	SAP		Post-SAP								
	1981-85	1986-90	1991-94	1995-99	2000	2001	2002	2003	2004	2005	2006	2007
GDP growth rate (%)	0.3	5.9	1.1	2.8	5.1	7.8	3.9	10.2	10.5	6.5	6.0	6.5
Total government expenditure growth rate (%)	-15.1	9.6	-4.3	14.6	-3.4	23.7	-5.1	15.0	4.4	9.5	-0.4	12.5
Share in total expenditure (%)												
Federal	55.5	73.9	71.5	75.5	57.7	57.0	53.2	48.9	47.3	46.9	46.2	45.4
State	44.5	26.1	24.6	18.8	29.6	33.4	37.9	36.7	37.3	38.0	37.9	39.2
Local*	0.0	0.0	3.9	5.7	12.7	9.6	8.9	14.4	15.3	15.1	15.9	15.3
Ratio of total expenditure to GDP (%)	37.7	28.6	29.5	23.2	26.5	37.8	35.2	35.8	26.4	26.7	22.6	23.2

Source: CBN Statistical Bulletin (2009), CBN Annual Report (2007, 2008)

*Notes:

1. Local total government and local agricultural expenditure available from 1993

2. We distinguish between the later part of Pre-SAP (1981-85), early (1986-90) and later (1991-94) years of SAP, and early Post-SAP (1995-99) years. We present the average data for each period and provide yearly data starting in 2000.

III. Trends and magnitude of agricultural spending

We now turn to government agricultural spending which is the focus of this study. Supporting the agricultural sector is a joint responsibility of the three tiers of governments as mandated by the 1999 Constitution. Federal, state, and local government budget and expenditure information has been published by several government agencies in Nigeria including the Central Bank of Nigeria (CBN), Office of the Accountant General of the Federation (OAGF), Federal Ministry of Agriculture (FMA), and Budget Office of the Federation (BOF). The Federal Ministry of Agriculture and Water Resources (FMAWR) also seems to have its own source of data for federal government spending on agriculture.

Inconsistency of agricultural spending across different data sources

The lack of social and economic data with good quality is a well-known problem in Nigeria and it is particularly true for expenditure data. First, it is very hard to find complete time series data for both government total and agricultural expenditure from a consistent source. For instance, total government expenditure data at the federal level is available for 1970-2007 (CBN 2009), but only available at the state and local government levels starting in 1980 and 1993, respectively, from the same source. With regard to agricultural spending, it is even more difficult to have a complete time series at the three government levels from any source. The only available time-series are the budget estimates of the federal government agricultural expenditure between 1980 and 2007 (CBN Statistical Bulletin 2009). The International Monetary Fund (IMF) published the Statistical Index for Nigeria in various years but also only contains budgeted expenditure data at the federal level for 1992-2003. Moreover, in some years the data reported by IMF is different from that reported by CBN (2009), though both data series are sourced from CBN. Several studies including Fan et al. (2008) documented time-series data (1980-2005) of agricultural public spending in Nigeria using combined data reported by the International Monetary Fund (IMF), Government Finance Statistics (GFS), and the authors' own projections.[4] It has to be pointed out that data reporting has significantly improved in recent years as the CBN Annual Report and Statement of Accounts started to regularly report the actual agricultural spending data starting in 2002 (available for 2002-07). However, such a short period of actual spending data constrains us for any econometric estimation.

In the case where data is available, it is often inconsistent across different data sources. For example, the federal government total spending data reported by CBN is 21 to 65 percent higher than that reported by OAGF-BOF between 2002 and 2005, and this trend holds true for both recurrent and capital expenditures (Table 5). The discrepancy is more serious in federal agricultural spending as data from CBN is 38 to 300 percent higher than the data from OAGF-BOF. The second important data inconsistency across different data sources is the growth of spending overtime. In most cases, CBN only reports expenditure data in current prices, and we have to calculate growth rate using the CPI as a deflator. However, calculated growth rate is very different across different data sources. For example, the average annual growth rate of federal government total and agricultural expenditures is 7.0 percent and 8.7 percent, respectively, in 2002-05. In contrast, based on the data reported by OAGF-BOF, the calculated

[4] Such data has also been cited by Mogues et al. (2008) and made available through the Regional Strategic Analysis and Knowledge Support System website (http://www.resakss.org). The nature of our discussion on agricultural spending and respective graphs in this section is similar to that of Mogues et al. (2008). However, our values differ to some extent with Mogues et al. (2008) because the latter solely used agricultural spending data from Fan et al. (2008), while we combined data from CBN (2007, 2008, and 2009), Fan et al. (2008), and IMF (various years).

average growth rate of federal government total and agricultural expenditure is -1.0 percent (declined over time) and 7.6 percent, respectively, during the same period (Table 2).

Mogues et al. (2008) have also pinpointed that the agricultural expenditure provided by the FMA did not correspond with data provided by OAGF-BOF or CBN for the period 2002-2005. As indicated by Mogues et al. (2008), such a discrepancy is puzzling since the OAGF database is supposedly prepared based on the transcripts provided by FMA. Their comparison of the two databases (FMA vs. OAGF-BOF) showed major differences with regard to both budget and actual spending. On average, the difference amounted to more than 54 percent of actual spending in agriculture (Mogues et al. 2008). Aside from this inconsistency, they were also unable to obtain a complete and detailed breakdown of the data for agricultural expenditure from FMA.

Table 2: Comparison of federal expenditure data from different sources

	2001	2002	2003	2004	2005	2006	2007	Growth rate (%)
Federal Total expenditure (billion Naira)								
OAGF-BOF	752	842	743	927	1,263			-1.0
recurrent	447	524	530	586	770			
capital	304	318	214	340	493			
CBN		1,018	1,226	1,426	1,822	1,938	2,451	7.0
recurrent		697	984	1,033	1,224	1,290	1,589	
capital		321	242	351	520	552	759	
Federal Ag expenditure (billion Naira)								
OAGF-BOF	16	11	12	16	21			7.6
recurrent	7	6	7	8	13			
capital	9	5	5	8	8			
CBN		45	16	50	77	107	164	8.7
recurrent		12	8	11	16	18	28	
capital		32	9	39	60	90	136	
Share of Federal Ag expd in Total expd (%)								
OAGF-BOF	2.1	1.3	1.6	1.7	1.7			
CBN		4.4	1.3	3.5	4.2	5.5	6.7	

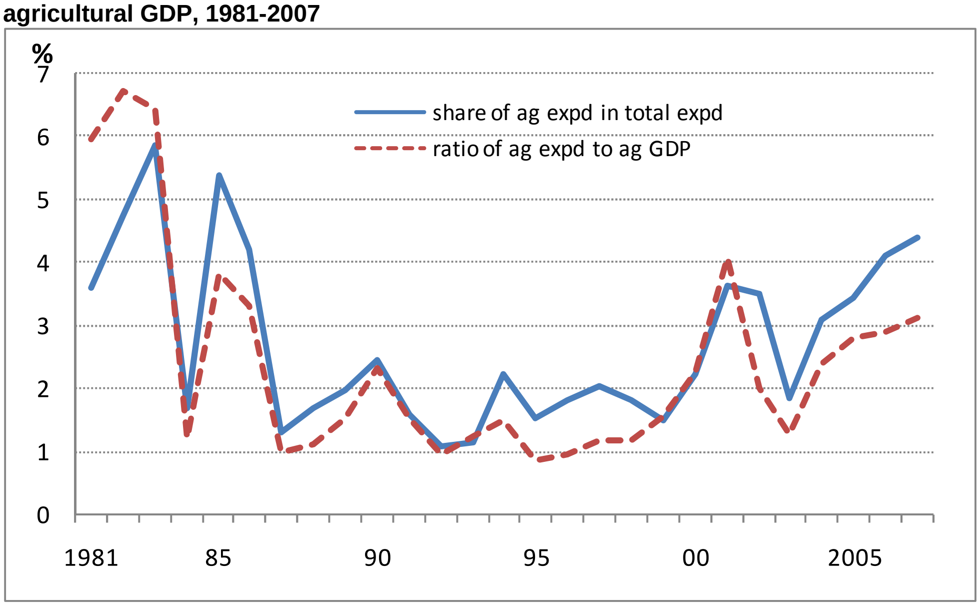
Source: OAGF-BOF drawn from Mogues et al. (2008), CBN (2007, 2008)

*Note: Total spending in CBN (2007, 2008) is not equal to recurrent plus capital because total includes transfers, which are disaggregated into capital or recurrent expenditure. Annual average growth is calculated by the authors and published CPI by the CBN is applied as a deflator.

Share of agricultural expenditure in Nigeria falls behind many other African countries but growth starts to pick up recently

Keeping in mind the data quality problems discussed above, all sources of data show a consistent phenomenon, that is the share of agricultural spending in the government total budget is very low at 1.1 – 5.9 percent. We use data from several sources to present the share of agricultural expenditure in total government spending and as a ratio to agricultural GDP overtime. The sources are Fan et al. (2008) for the period 1992-2001, CBN (2009) for 1971-91 and CBN (2007 and 2008) for the recent years' data. The data clearly shows that the share of agricultural spending in total spending experienced large fluctuations (Figure 4). The share, which provides a good indicator of the attention given by government to the agricultural sector, has been as high as 5.9 percent in the early to mid-1980s but stagnated to below 2 percent in 1990-2000. In recent years (2001-07), the share of agriculture in total spending started to rise and fluctuated between 3.1 and 4.4 percent, except in 2004 when it dipped to 1.9 percent. Under the CAADP framework, agricultural spending is targeted to be 10 percent of total government spending, which is twice the actual share of the country in recent years (2002-2007). While the recent improvement in budget allocation towards the agricultural sector can be seen in Table 5, Nigeria still lags behind countries like Burkina Faso, Ethiopia, Mali, Malawi, and Senegal, which have either achieved or come close to achieving the 10 percent CAADP goal (Fan et al. 2009)

Figure 4: Share of agricultural expenditure in total expenditure and ratio of agricultural expenditure to agricultural GDP, 1981-2007



Source: Fan et al. (2008), IMF Statistical Index (various years), CBN Statistical Bulletin (2009), and CBN Annual Report and Statement of Accounts (2007, 2008).

We are able to get a glimpse of the actual agricultural expenditure at the federal and state levels only in recent years, that is 2002 to 2007, from the CBN Annual Report and Statement of Accounts (2007 and 2008) (Table 3). For comparison purposes, we also report GDP and agricultural GDP during this period in the table. Agricultural expenditures of the federal and state governments have both increased in this period, with annual growth rates of 13.9 and 11.0 percent, respectively. We are unable to find local government agriculture spending from CBN or other sources. A collaborative survey by NBS, CBN, and the National Communication Commission (NCC) in 2006 reported that agricultural and rural development expenditures of the local governments amounted to ₦10 billion in 2006. This number is equivalent to about 15 percent of state level agricultural spending in the same year. The resources devoted by the federal government in agriculture average 4.3 percent of federal total expenditure, while the state governments generally allocates 3.6 percent of its total budget to agricultural expenditure.

Table 3: Level of agricultural expenditure at the Federal and State government, 2002-2007

	2002	2003	2004	2005	2006	2007	Annual average growth rate or average share (02-07)
Billion Naira in current price							
GDP	5,439	6,999	11,411	14,562	18,565	23,281	7.8
Ag GDP	1,883	2,136	3,904	4,763	5,940	7,574	7.0
Total government expenditure	1,913	2,509	3,012	3,889	4,191	5,394	8.1
Agricultural expenditure	67	47	93	133	173	237	13.0
Federal	45	16	50	77	107	164	13.9
State	22	31	43	57	65	73	11.0
Share of ag in federal expd (%)	4.4	1.3	3.5	4.2	5.5	6.7	4.3
Share of ag in state expd (%)	3.1	3.3	3.8	3.8	4.1	3.4	3.6
Share of ag in total expd (%)	3.5	1.9	3.1	3.4	4.1	4.4	3.4
Ratio of ag expd to ag GDP (%)	3.6	2.2	2.4	2.8	2.9	3.1	2.8
Ratio of ag GDP to GDP (%)	34.6	30.5	34.2	32.7	32.0	32.5	32.8

Source: NBS (2007) and CBN (2007, 2008) for expenditure data.

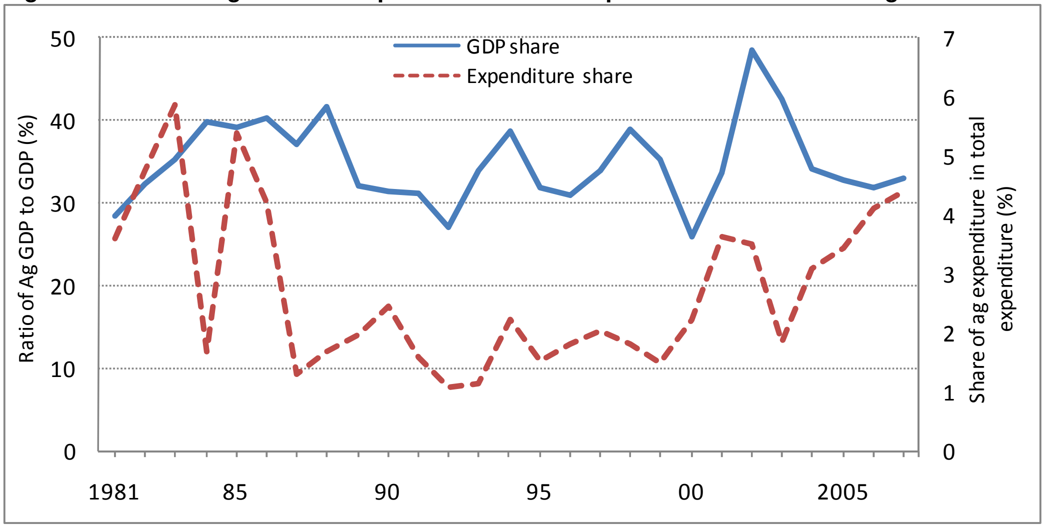
*Note: Growth rate is calculated by the authors and CPI reported by WDI (2008) is used as deflator for growth in spending and constant GDP is obtained from NBS (2007).

Agriculture spending is further measured as a ratio to agricultural GDP to assess their relationship. Although peaking in the early 1980s, the ratio of agriculture expenditure to agricultural GDP is extremely low in most years. Between 1990 and 2000, the indicator stagnated around 1 to 2 percent. As observed in Figure 5, the agricultural sector historically accounts for over 30 percent of GDP. Placing the share of agricultural spending in total spending alongside the share of agriculture in GDP illustrates that although different in magnitude, both have followed quite similar trends for most of the years, that is when the share of agricultural GDP in the economy increased, so did the share of agricultural spending in total expenditure (Figure 5). In the recent period (2003-2007), despite a declining share of agriculture in GDP, the share of agriculture expenditure in total budget rose.[5]

The ratio between these two indicators, i.e. ratio of the agricultural expenditure share to the agricultural GDP share, can be used to better measure the position of the agricultural sector in the country's government budget allocation. A ratio of 1 indicates that the government allocates part of its budget consistently with the contribution of agriculture to the country's economy (Mogues et al. 2008). If the ratio is smaller than one, then it indicates that the agricultural sector did not receive the public fund consistent with its role in the economy. The long-term average for this period is 0.07, signifying that the share of public resources allocated to the agricultural sector is equivalent to less than one-tenth of the contribution of this sector to the country's economy (measured by its share in GDP).

[5] The declining share of agriculture in GDP is primarily due to increased world oil prices, which makes the oil sector's share of GDP higher, with both measured in current prices. On the other hand, growth in agricultural GDP (in constant prices) is much more rapid than growth in oil sector GDP during this period.

Figure 5: Share of agricultural expenditure in total expenditure and share of agriculture in GDP, 1981-2007



Source: Expenditure data from Fan et al. (2008), IMF Statistical Index (various years), CBN Statistical Bulletin (2009), and CBN Annual Report and Statement of Accounts (2007, 2008); GDP from NBS National Account (2007).

Agricultural spending is highly concentrated in a few programs

Mogues et al. (2008) analyzed the structure and allocation of federal capital spending on agriculture in Nigeria from 2001-2005 using data obtained from the Federal Ministry of Agriculture & Water Resources (FMAWR), the only data source in which such information is available. Their findings indicate that at the federal level, nearly 97 percent of capital spending supported the crops subsector, while only about 3 percent was spent on the livestock and fisheries subsectors combined. Moreover, spending is highly concentrated in a few areas as three out of 179 agricultural programs account for more than 81 percent of total capital spending in agriculture. The three dominant activities are: (1) fertilizer market stabilization (average annual allocation of 1.25 billion Naira, or 43 percent of total capital spending in agriculture); (2) food security component of the National Special Program for Food Security (NSPFS) (average annual expenditure of 0.63 billion Naira, or 22 percent of total capital spending in agriculture); and (3) Silos Construction, Maintenance, and Development of Marketing Strategic Grain Reserve (average annual allocation of 0.46 billion Naira, or 16 percent of total capital spending in agriculture) (Mogues et al. 2008). It has to be pointed out that since the agricultural capital spending from FMAWR is equivalent to only about 4.2 to 16.0 percent of capital agricultural spending reported by CBN (2009), the same amount of spending on fertilizer subsidies and for the other two programs would account for a much smaller share of total agricultural spending when data sourced from CBN is applied. Nonetheless, such an agricultural investment portfolio reveals an unbalanced concentration of resources to a small number of interventions, leaving others that are vital for accelerating agricultural productivity and pro-poor growth without enough funding. These vital public investments include agricultural research and extension, capacity building among agricultural officials and farmers, agricultural finance, irrigation, and agribusiness development (Mogues et al. 2008).

IV. Estimated spending required for accelerated agricultural growth and poverty reduction

The quality of econometric analysis depends crucially on the availability and reliability of actual time-series data that also has to be long enough. Without solving the inconsistency problem in the agricultural expenditure data mentioned above, we decided to use the data obtained from CBN for our analysis in this section. While the CBN data cannot be disaggregated into different types of agricultural spending, there are several advantages in using it. First, data obtained from CBN covers a much longer time period (1981-2006) and such data are regularly published by CBN every year as part of information included in the CBN Statistical Bulletin (the most recent version of the data was published in 2009). In contrast, we can only obtain a shorter period of government expenditure data from the other sources. For example, data obtained from OAGF-BOF used by Mogues et al. (2008) is only for 2002-2005. Second, there is much better consistency in the government expenditure data published by CBN with the GDP data published by Nigeria Bureau of Statistics (NBS). As discussed earlier and shown in Table 1, when growth rate in GDP was very low or negative in the periods of pre-SAP or SAP, growth in the government expenditures either stagnated or declined. When GDP registered a high growth rate in the recent period after 1995, growth rate in government expenditure was high as well for most of the years. A third factor could be found in the consistency in pattern between oil revenues and the expenditure data. As discussed earlier, oil revenue is the dominant income source for the Nigeria government. Thus, we also check the consistency between government oil revenue and spending data. As expected, the spending data obtained from CBN confirms that as oil revenue increased (decreased), the federal government total expenditure increased (decreased) (Figure 2). The fourth advantage of utilizing the CBN data is that it includes expenditure at the federal, state, and local levels,[6] while the data obtained from other sources such as OAGF-BOF only provide federal expenditures. This is particularly important for analyzing agricultural spending, as the constitution mandates that state governments play an important role in the agricultural sector. Their roles have become more important recently as the federal government increased the oil revenue allocation to the state governments starting in the late 1990s (see previous discussion and Figure 3 and Table 1).

Conceptual framework for estimation of required agricultural spending

For this analysis, we use agricultural total factor productivity (TFP) to estimate the required agricultural spending based on a conceptual framework in which growth in agricultural TFP is driven by growth-enhancing public investments. Let Q_t represent aggregate agricultural output, then the production function of agricultural output is as follows:

$$Q_t = \eta_t * f(F_t) \quad (1)$$

where η_t represents the level of TFP and $f(.)$ is the production function with a set of inputs, F_t. Obviously, growth in η_t augments the agricultural output beyond what is led by the increased use of inputs (such as labor, land, capital, and other inputs) that are the decisions made by producers in a production process.

While growth in TFP is not a choice variable for producers, it is often linked to public goods or services that generate positive externality in the growth process to benefit private agents such as farmers. The public goods or services that generate such positive externality to agricultural growth include public investment in education and health to improve human capital or infrastructure investment and road network development to reduce transportation and other market-related costs. Such public investments benefit the whole economy including the agricultural sub-sector. However, since such investments do not necessarily target the

[6] Expenditure data at the local level is only available after 1993.

agricultural sector, their impact on agricultural productivity is often embodied in the impacts on the whole economy. Healthy and educated people become more productive but they are not necessarily working in the agricultural sector. Better road connection or increased road density in the rural areas mainly benefits those who directly participate in trading and marketing business. While these factors are outside agriculture, agriculture is indirectly benefited, and thus, we define the impact of such investments as indirect effect on agricultural growth.

On the other hand, there are investments that can directly increase land productivity (yields) through development of new technology and bringing such technology to more farmers through a public agricultural extension system. These investments directly target the agricultural sector and support farmers' use of modern technology in agricultural process such as agricultural research and extension, irrigation development, and land conservation and management. We define such investments as agriculture-related investments and their impact on agricultural productivity growth is the direct effect. Dropping the time factor t to simplify the notation, the following equation mathematically describes the relationship between public investment and agricultural TFP,

$$\eta = g^{\eta}(E_{ag\ exp}, E_{nag\ exp}, X_{\eta}) \qquad (2)$$

where $E_{ag\ exp}$ captures the direct effect of agriculture-related public spending on agricultural TFP, while $E_{nag\ exp}$ captures the indirect impacts of public investment excluding agriculture-related investment (we call it non-agricultural investments for convenience) on agricultural TFP. X_{η} represents the vector of other external factors to the farmers such as climate and organization of the production process that do not directly relate to the factors of production.

In this study, we mainly consider the effects of public spending on the agricultural and non-agricultural sectors on growth in agricultural TFP. Unable to obtain any reliable data or estimates, we have to ignore the multiplier effect or linkage between agriculture and non-agricultural expenditure. Assuming a Cobb-Douglas type of relationship between TFP and public investment, the following equation holds:

$$\ln \eta = \varepsilon_{ag\ exp} * \ln(E_{ag\ exp}) + \varepsilon_{nag\ exp} * \ln(E_{nag\ exp}) \qquad (3)$$

where

$\ln \eta$	=	agricultural TFP in log form
$\ln(E_{ag\ exp})$	=	value of agricultural expenditure in log form
$\ln(E_{nag\ exp})$	=	value of non-agricultural expenditure in log form
$\varepsilon_{ag\ exp}$	=	elasticity of agricultural TFP w.r.t. agricultural expenditure
$\varepsilon_{nag\ exp}$	=	elasticity of agricultural TFP w.r.t. non-agricultural expenditure

Equation (3) can be econometrically estimated using time series data for agricultural TFP and agricultural and nonagricultural spending and obtain the two elasticities as a result. Given the elasticities, the following equation holds after rearranging and taking the total derivative of equation (3)[7].

$$\dot{E}_{ag\ exp} = \frac{\dot{\eta} - \varepsilon_{nag\ exp} * \dot{E}_{nag\ exp}}{\varepsilon_{ag\ exp}} \qquad (4)$$

Where $\dot{E}_{ag\ exp}$, change in the agricultural spending, can be determined by the difference between change in TFP, $\dot{\eta}$, and change in the nonagricultural spending, $\dot{E}_{nag\ exp}$, with the elasticity of TFP growth with respect to such change normalized by the elasticity with respect to the growth in agricultural spending. In Section V, equation (4) is used to assess the required growth in the agricultural spending to support the agricultural TFP growth.

[7] A dotted variable means differentiation of the variable with respect to *t*, i.e., $\dot{E}_{ag} = \partial E_{ag} / \partial t$.

Data and elasticity estimation

Agricultural TFP as a time series of indices is obtained from Nin Pratt and Yu (2008) who conducted a non-parametric estimation using aggregated agricultural output and input data for all African countries. If time-series data on agricultural and non-agricultural spending are available, it is possible to econometrically estimate the elasticities, $\varepsilon_{ag\,exp}$ and $\varepsilon_{nag\,exp}$. As we discussed above, the quality of Nigerian government spending data, particularly agricultural spending data, is relatively poor and inconsistent. We decided to use the results derived from using the time series (1980-2005) expenditure data of Fan et al (2008). The estimated results show that the elasticity of agricultural TFP growth with respect to agricultural spending growth is 0.24[8]. That is, for every one percent growth in government agricultural spending, agricultural TFP grows by 0.24 percent. The value of this elasticity is consistent with the elasticity in the case of India (Fan et al. 2000) when agricultural research expenditure was used to estimate its marginal effect on total agricultural growth. Compared with other studies for African countries in which agricultural growth, instead of agricultural TFP growth, was chosen as the dependent variable, our estimated elasticity is relatively higher. For example, the estimated marginal effect of agricultural spending on agricultural growth is 0.15 in a cross section study for African countries as a whole (Benin et al. 2007), 0.17 in a study for Rwanda (Diao et al. 2007), and 0.19 for Uganda (Fan et al. 2004). However, as mentioned above, the dependent variable in these studies is often overall agricultural growth (for which impact of TFP is only a part). Hence, it is reasonable to believe that the marginal effect of agricultural spending, particularly spending on research and extension and any other type of public good and service provision, on agricultural TFP growth should be higher than on the overall agricultural growth (to which high use of production inputs often contribute a lion's share). By disaggregating agricultural spending, Fan and Rao (2003) obtained a relatively high marginal effect (0.36) when agricultural development expenditure in Africa (instead of total agricultural spending) was considered. To take into account such a broad range of elasticities available in the literature, we feel comfortable using our estimated value of 0.24 with respect to the agricultural spending in the analysis. To further analyze the sensitivity of required spending with respect to the choice of elasticity (which partially reflects the efficiency of spending), we also consider a case in which the elasticity increases to 0.41, which is 70 percent higher than the estimated result of 0.24.

However, the estimated elasticity of agricultural TFP growth with respect to the non-agricultural spending is 0.46,[9] which is much higher than the elasticity of agricultural spending (0.24). Given that a lion's share of public good provision, including investment in infrastructure and spending on education and health, is all counted as part of non-agricultural spending, such an estimation result is not surprising as such spending has definitely benefited the entire economy, including the rural economy and the agricultural sector. However, in terms of the effectiveness of one million dollars of spending, nonagricultural spending is not necessarily more effective than agricultural spending in promoting agricultural productivity growth. As we have discussed above, size of non-agricultural spending is 20 – 25 times of agricultural spending in value in Nigeria, implying one percent of non-agricultural spending is equivalent to 20 – 25 percent of agricultural spending. Thus, the dollar-to-dollar comparison still indicates that agricultural spending is more effective than non-agricultural spending in explaining agricultural productivity growth. Even with

[8] See Appendix and Table A.1. for details.

[9] See Appendix and Table A.1. for details.

this explanation, we are still not comfortable in using this elasticity in the analysis for the following reasons. First, the definition of non-agricultural spending is too broad in this study. Without additional information to further disaggregate total spending, we have to define the non-agricultural spending as the difference between total spending and agricultural spending. Thus, part of the spending that is classified into the non-agricultural category may directly target agricultural and rural development. Second, given that the quality of data for agricultural spending is relatively poorer than the total spending data, and agricultural spending is such a small portion (less than 4 percent in most years) of total spending, it is likely to get a biased estimate by not fully distinguishing between the direct and indirect effects of government spending as suggested in the conceptual framework discussed above. Furthermore, if we apply this elasticity for non-agricultural spending in equation (4), the result is a negative growth rate in required agricultural spending. Past studies such as Fan et al. (2004) and Thurlow et al. (2008) have also faced similar data quality problems in trying to estimate the elasticity in other countries. Hence, following equation (4), a calibration method is applied to help us choose an elasticity for the nonagricultural spending that is consistent with historical growth rates of agricultural TFP and agricultural and non-agricultural spending. Specifically, in equation (4), we assign value to $\dot{E}_{ag\ exp}$ and $\dot{E}_{nag\ exp}$ according to the average growth rate of agricultural and nonagricultural spending between 2000 and 2007; $\dot{\eta}$ according to Nin Pratt and Yu (2008); and the estimated agricultural spending elasticity, $\varepsilon_{ag\ exp}$, which is 0.24 to calculate the nonagricultural spending elasticity, $\varepsilon_{nag\ exp}$. This results in a consistent nonagricultural spending elasticity of 0.14, which is the one we applied in the following analysis.

V. Scenarios and results

We consider a base-run and four scenarios under the CAADP initiative in assessing growth in required agricultural spending to support agricultural TFP growth rate. The base-run scenario uses Diao et al. (2009) DCGE model base-run results where annual growth of agricultural GDP and overall GDP for the next nine years (2009-17) is 5.7 percent and 6.5 percent, respectively. Such rates are consistent with Nigeria's average agricultural GDP and overall GDP growth rates in the past seven years (2000-07). The associated agricultural TFP growth for the base-run scenario is 2.3 percent annually. For the four scenarios, we use the 5.6 percent agricultural TFP growth rate that supports the accelerated agricultural (9.5 percent) and GDP (8.0 percent) growth.

In the first scenario, the econometrically estimated elasticity of agricultural TFP with respect to agriculture spending of 0.24 is applied. Assuming that the growth rate of non-agricultural spending is the same as that of the current trend (which is the same as in the base-run), together with an elasticity of 0.14 for the non-agricultural spending, our analysis shows a required 23.8 percent of annual growth in agricultural spending in the next 9 years (2009-17) in order to support the 9.5 percent agricultural growth target. This result is consistent with the estimation of Fan et al. (2008), in which 25.1 percent of annual growth is required for agricultural spending in order to achieve MDG1 in Nigeria. However, when the agricultural spending is assumed to be more efficient in the second scenario of our analysis, with an increase in the value of elasticity from 0.24 to 0.41, required agricultural spending only needs to grow at 13.6 percent per year (Table 4).

With the additional growth in agricultural spending and given the growth in non-agricultural spending, the share of agricultural spending in the government total expenditure rises gradually. Currently, agriculture accounts for 4.2 percent of total government expenditure and this share will eventually rise to 14.6 percent by 2015 and 18.6 percent by 2017 with the low elasticity in the first scenario. Under the second scenario with a high elasticity (that is with improved spending efficiency), the share of agricultural expenditure in total spending will be 7.3 percent in 2015 and 8.1 percent in 2017 (Table 4 and Figure 6). Obviously, it is necessary in practice to emphasize how to improve the spending efficiency in order to better support agricultural growth with limited resources. This is also important when the CAADP target of allocating 10 percent of the government's budget to the agricultural sector is considered. If the government can significantly improve its efficiency in agricultural investment, much less spending is required to support similar agricultural and economic growth, and hence the share of agriculture in total spending does not necessarily need to be at 10 percent.

In the first two scenarios, we assume the growth in non-agricultural spending is given at its base-run level of 7.1 percent per year (proportional to recent trends in the non-agricultural GDP growth rate of 6.7 percent) and required agricultural spending is the only driver to support accelerated agricultural growth. In other words, we have ignored the indirect effect of additional growth in non-agricultural spending on agricultural growth. In the third and fourth scenarios, we consider this factor and re-estimated the required agricultural spending under low and high elasticity. Increased non-agricultural spending is assumed to be proportional to the non-agricultural sector's TFP growth which increased to 2.98 percent per year from 2.47 percent in the base-run. Such growth in the DCGE model simulation is primarily a result of growth linkages between agriculture and non-agriculture, meaning improvement in agricultural economy benefits the non-agricultural sector. Consistent with increased non-agricultural TFP growth, annual growth in the non-agricultural spending needs to rise from 7.1 percent in the base-run to 8.5 percent in the accelerated agricultural growth scenario. Additional non-agricultural spending is not only necessary for the growth in the non-agricultural economy, but also indirectly affects growth in agriculture. With a similar marginal indirect effect (the elasticity of 0.14 with respect to non-agricultural spending), part of agricultural growth can be indirectly supported by the additional government spending on the economy as whole. This lowers required annual growth in the agricultural spending from 23.8 percent to 17.5 percent (in scenario 3) with a low elasticity of agricultural spending (0.24), and from 13.6 percent to 8.5 percent with a high elasticity (0.41 in scenario 4).

Because of relatively slower growth in the required agricultural spending, the share of agricultural spending in the total government spending will rise at a slower pace than in the previous two scenarios. The agricultural spending will account for 8.6 and 9.9 percent of total spending by 2015 and 2017 with a low elasticity, and will stay at 4.4 percent in the simulated period of 2009-2017 with a high elasticity, a share similar to the current situation. These results further emphasize the importance of taking into account the growth linkage between agriculture and non-agriculture sectors in both the overall economic activity and government spending when setting any target amount for agricultural spending.

Translated into monetary terms, the analysis shows that without taking into account the change in the government non-agricultural spending and under the low elasticity scenario (scenario 1), the government will need to increase its investments in agriculture from ₦185 billion currently

(2008) to ₦1,265 and ₦1,940 billion (in 2008 prices) by 2015 and 2017[10]. On the other hand, in the base-run scenario which follows the current growth trend in government spending, additional agricultural spending will be much lower, only ₦278 and ₦305 billion in 2015 and 2017 (Figure 7). When a more optimistic spending efficiency is assumed in the second scenario (that is with the high elasticity), agricultural spending will be ₦583 billion by 2015 and reach ₦753 billion by 2017, implying that the improvement in investment efficiency allows the government to save more than ₦4,300 billion in total over a period of 9 years (between 2009 and 2017) or more than ₦400 billion per year on average.

Improvement in agricultural spending efficiency also reduces the required total government spending. Under scenario 1 with the low elasticity, the annual growth in total government expenditure will rise to 8.6 percent (Table 7) and reach ₦10,452 billion by 2017 (Figure 8), in contrast with a 7.0 percent of annual growth in the base-run and ₦8,817 billion in the base-run's 2017. With a high elasticity in scenario 2, the annual growth in total government spending will be 7.4 percent. As a result, total government expenditure by 2017 stands at ₦9,265 billion, which is only ₦448 billion more than the base-run's 2017 (Figure 8).

In the third and fourth scenarios when additional growth in non-agricultural spending as well as its indirect effect on agricultural growth is taken into consideration, a relatively slow growth in the required agricultural spending implies a relatively lower level of such spending over time. With a low elasticity in scenario 3, the value of agricultural spending will reach ₦788 and ₦1,087 billion by 2015 and 2017, respectively, while with a high elasticity in scenario 4, it will be ₦356 and ₦455 billion by 2015 and 2017. However, as additional spending on the non-agricultural sector is taken into account, the total government spending will not decline from that in the previous two scenarios. In fact, with either low or high efficiency in agricultural spending, the total government spending rises over time (Figure 8). That is to say, since the non-agricultural spending accounts for a much larger share of total spending than the agricultural spending, even with very rapid growth in the agricultural spending, the driving force of growth in the government total spending will still be spending on the non-agricultural economy.

[10] While there is no data available in the country to further disaggregate the agricultural spending by type, given that we estimated the elasticity of agricultural TFP growth with respect to agricultural spending, additional spending to support higher TFP growth has to focus on those that will benefit the entire agricultural sector, such as research and extension, rural infrastructure, and other public good provisions.

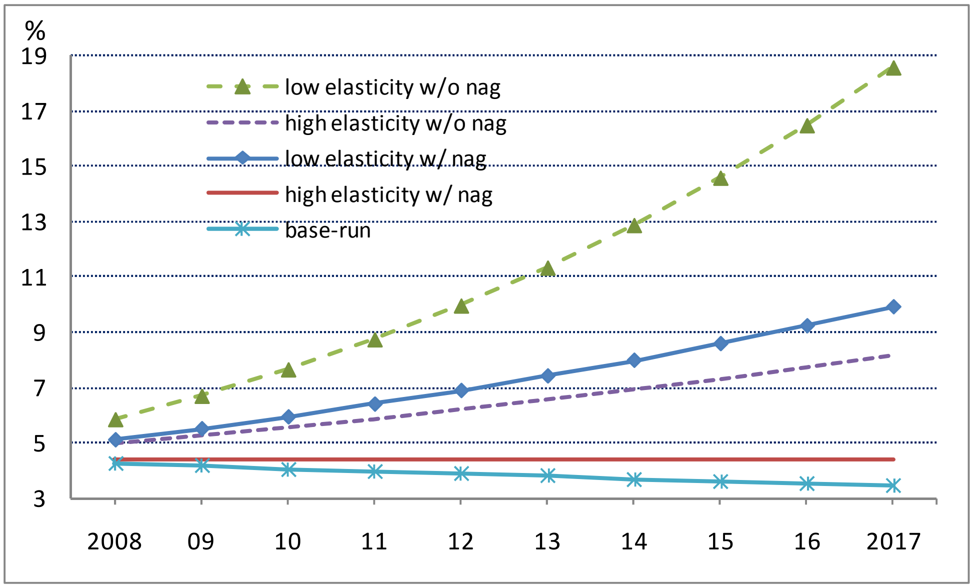
Table 4: Required growth in agricultural and total spending under different scenarios

Indicator	Base-run	CAADP Target			
		Agricultural TFP growth driven by agricultural expenditure only		Accounting for indirect effect of non-agricultural expenditure on agricultural TFP growth	
		low elasticity	high elasticity	low elasticity	high elasticity
Annual growth rates in GDP (%)					
GDP	6.5	8.0	8.0	8.0	8.0
Ag GDP	*5.7*	*9.5*	*9.5*	*9.5*	*9.5*
Non-Ag GDP	6.7	7.5	7.5	7.5	7.5
Annual growth rates in TFP (%)					
Total TFP	2.5	3.8	3.8	3.8	3.8
Ag TFP	2.3	5.6	5.6	5.6	5.6
Non-Ag TFP	2.5	3.0	3.0	3.0	3.0
Annual growth rates in expenditure (%)					
Total spending	7.0	8.6	7.4	9.1	8.5
Ag spending	4.7	23.8	13.6	17.5	8.5
Non-Ag spending	7.1	7.1	7.1	8.5	8.5
Estimated results					
Share of Ag spending in Total spending (%)					
2008	4.2	5.8	4.9	5.1	4.4

2015	3.6	14.6	7.3	8.6	4.4
2017	3.5	18.6	8.1	9.9	4.4
Ratio of Ag spending to Ag GDP (%)					
2008	2.9	3.8	3.2	3.5	2.9
2015	2.7	9.1	4.2	5.7	2.8
2017	2.7	11.7	4.5	6.5	2.7
Ratio of Total spending to GDP (%)					
2008	21.3	21.0	20.8	21.5	21.3
2015	22.1	21.6	19.9	22.8	21.8
2017	22.3	22.2	19.7	23.3	22.0

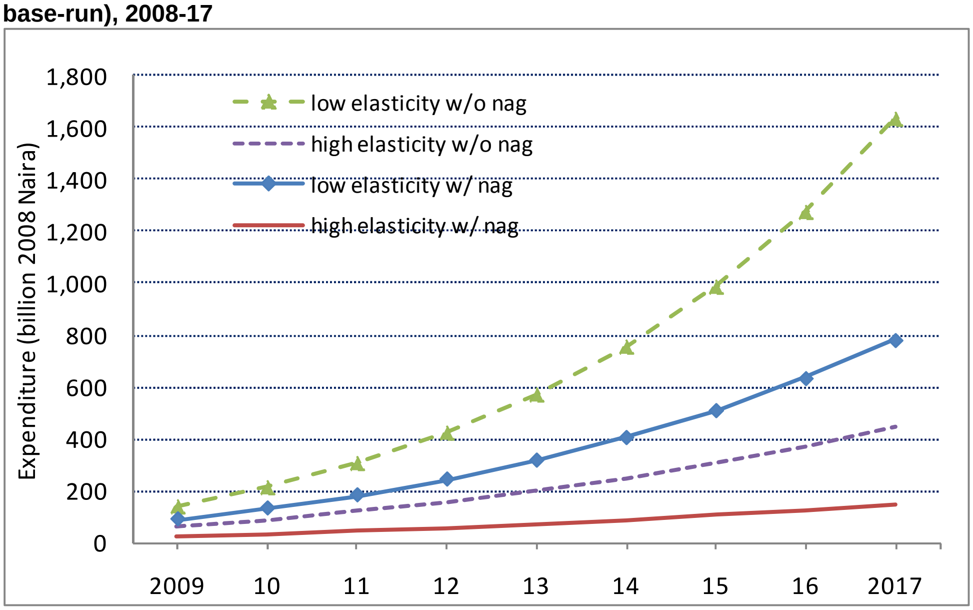
Source: Estimated by authors

Figure 6: Share of agricultural spending in total spending required for accelerated agricultural growth, 2008-17



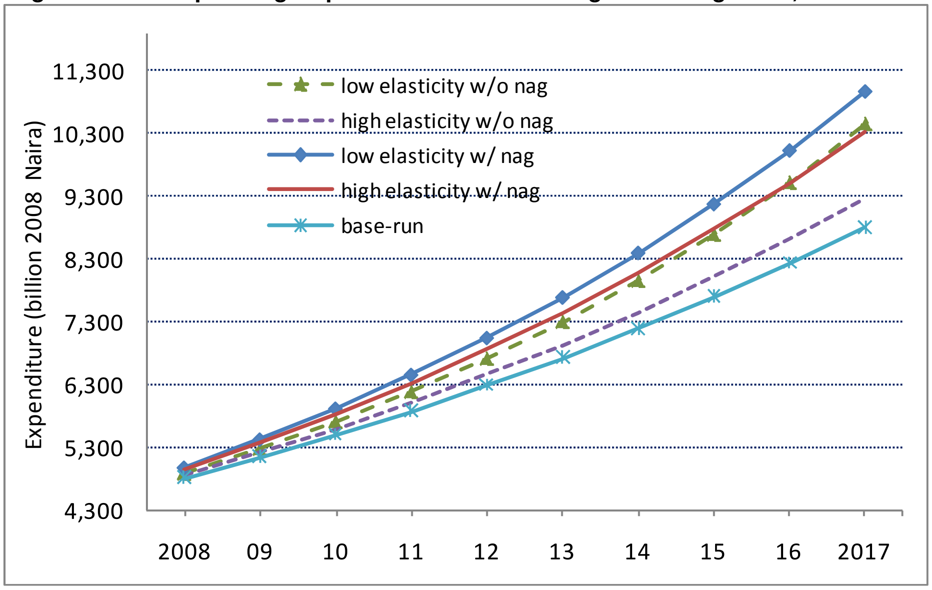
Source: Estimated by authors

Figure 7: Additional agricultural spending required for accelerated agricultural growth (Difference from the base-run), 2008-17



Source: Estimated by authors

Figure 8: Total spending required for accelerated agricultural growth, 2008-17



Source: Estimated by authors

VI. Conclusions

In this study, we assessed the required growth in agricultural spending based on the TFP growth rate drawn from a recent report of Diao et al. (2009) which analyzed the options of agricultural growth for poverty reduction. To do it, we first estimated the elasticities of agricultural TFP growth with respect to the growth in both agricultural and nonagricultural spending. We then conducted four scenario analyses based on these elasticities.

In the first two scenarios, we assumed that growth in agricultural spending is the only driver to support accelerated agricultural growth and assumed non-agricultural spending to remain at its current level. Lower elasticity of agricultural TFP with respect to agriculture spending (low elasticity of 0.24) is used in the first scenario, while the second portrays an improved spending efficiency scenario with (high elasticity of 0.46). In the third and fourth scenarios, we considered the indirect effect on agricultural growth of the additional growth in non-agricultural spending under the low and high elasticity, respectively.

The results show that the required growth in agricultural spending to support accelerated agricultural growth and the share of such spending in government total spending depend critically on two important factors: (i) the efficiency of agricultural investment and (ii) the interaction of agriculture and non-agriculture in both the broad economic activities and government investments. Growth in the agricultural sector and rural economy depends on public investment in both agriculture and non-agriculture, and it is necessary to take into account possible increases in non-agricultural spending (on infrastructure, education, and health) when estimating required agricultural spending. Estimated results of required agricultural spending will be quite different when possible impacts of increased non-agricultural spending on agricultural growth are taken into account.

With the current inefficient agricultural spending patterns, required growth in agricultural spending is extremely high (23.8 and 17.5 percent, respectively, either considering growth in agricultural spending only in the first scenario or growth in both agricultural and nonagricultural spending in the third scenario), and the resources the government has to mobilize to support accelerated agricultural growth will reach 18 percent of total spending by 2017. Looking at its recent spending trends (Table 6), it is obviously unlikely for the Nigerian government to increase agricultural spending at such a high growth pace in the next 10 years. The higher required agricultural spending growth will, in turn, drive rapid growth in total spending.

If we take the indirect effect of non-agricultural spending on agricultural growth into account but do not improve spending efficiency, the required growth in total spending is even faster (9.1 percent in the third scenario versus 8.6 percent in the first scenario), although allocation between agriculture and non-agricultural spending is quite different.

Clearly, improving investment efficiency is the most important challenge for the Nigerian government to effectively support accelerated agricultural growth to help meet MGD1. If agricultural investment efficiency is increased by 70 percent (where the marginal effect of spending on agricultural TFP rises to 0.41 instead of current 0.24), which is similar to what has been estimated in other studies for Sub-Saharan Africa as a whole, required growth in both agricultural spending and total spending is expected to be significantly lower. This becomes more realistic to be achieved by mobilizing additional resources generated from the economic growth.

References

Agenor, P.R., A. Izquierdo, and H. Fofack. 2003. IMMPA: A Quantitative Macroeconomic Framework for the Analysis of Poverty Reduction Strategies. Washington, DC: The World Bank.

Ahmad, E. And E. Mottu. 2002. Oil Revenue Assignments: Country Experiences and Issues. IMF Working Paper 203. Washington, DC: International Monetary Fund.

Ayadi, O.F., E.O. Adegbite, and F.S. Ayadi. 2008. Structural Adjustment, Financial Sector Development, and Economic Prosperity in Nigeria. *International Research Journal of Finance and Economics* 15: 318-331. http://www.eurojournals.com/irjfe%2015%20felix.pdf. Accessed July 2009.

Baunsgaard, T.2003. Fiscal Policy in Nigeria: Any Role for Rules? IMF Working Paper 155. Washington, DC: International Monetary Fund.

Benin, S., S. Fan, and M. Johnson. 2009. Linking Strategic Goals with Public Investment: A Framework for Analyzing Public Agricultural Resource Requirements. Forthcoming.

Budina, N. and S. Wijnbergen. 2008. Managing Oil Revenue Volatility in Nigeria: The Role of Fiscal Policy. In Go and Page, Africa at a Turning Point: Growth, Aid, and External Shocks (Chapter 10: 427-459). Washington, DC: The World Bank. http://siteresources.worldbank.org/INTDEBTDEPT/ Resources/468980-1207588563500/4864698-1207588597197/AFRI427460Ch10.pdf. Accessed July 2009.

Central Bank of Nigeria. 2009. Statistical Bulletin: Volume 18, December 2007, Section B Public Finance Statistics. http://www.cenbank.org/documents/Statbulletin.asp. Accessed July 2009.

Central Bank of Nigeria. 2008. CBN Annual Report and Statement of Accounts for the year ended 31st December 2007, Part 7. http://www.cenbank.org/OUT/PUBLICATIONS/REPORTS/RD/ 2008/ARP-2007-PART%207.PDF. Accessed July 2009.

Central Bank of Nigeria. 2008. CBN Annual Report and Statement of Accounts for the year ended 31st December 2006, Part 4. http://www.cenbank.org/OUT/PUBLICATIONS/REPORTS/RD/ 2008/ARP-2007-PART%207.PDF. Accessed July 2009.

Central Bank of Nigeria/National Bureau of Statistics/Nigerian Communications Commission 2007. Collaborative Survey on Socio-economic Activities in Nigeria 2006.

Diao,X., M. Nwafor, V. Alpuerto, K. Akramov, V. Rhoe, and S. Salau. Agricultural Growth and Investment Options for Poverty Reduction in Nigeria. IFPRI Discussion Paper. Washington, DC: International Food Policy Research Institute. Forthcoming.

Fan, S., B. Omilola, and M. Lambert. 2009. Public Spending for Agriculture in Africa. ReSAKSS Working Paper No. 28. http://www.resakss.org/index.php?pdf=42375. Accessed July 2009.

Fan, S., B. Yu and A. Saurkar. 2008. Public Spending in Developing Countries: Trends, Determination, and Impact. In Fan, S. ed. Public Expenditures, Growth and Poverty: Lessons from Developing Countries. Washington, DC: International Food Policy Research Institute and Baltimore, Md: Johns Hopkins University Press.

Fan, S. and A. Saurkar. 2008. Tracking Agricultural Spending for Agricultural Growth and Poverty Reduction in Africa. ReSAKSS Issue Brief No. 5. Washington, DC.

Fan, S., P. Hazell, and S. Thorat. 2000. Government Spending, Agricultural Growth, and Poverty in Rural India. *American Journal of Agricultural Economics* 82(4): 1038-51.

Federal Republic of Nigeria. 1987. Report of the Political Bureau. Government Press, Lagos, Nigeria.

Mogues, T., M. Morris, L. Freinkman, A. Adubi, S. Ehui, C. Nwoko, O. Taiwo, C. Nege, P. Okonji, and L. Chete. 2008. Agricultural Public Spending in Nigeria. IFPRI Discussion Paper 789. Washington, DC: International Food Policy Research Institute.

National Bureau of Statistics. 2007. National Account of Nigeria (1981-2006). Economic Reform and Government Project (ERGP), Federal Republic of Nigeria.

National Bureau of Statistics. 2006. The Nigerian Statistical Factsheets on Economic and Social Development, Federal Republic of Nigeria.

National Bureau of Statistics. 2005. Poverty Profile for Nigeria. Federal Republic of Nigeria.

Nin Pratt, A., and B. Yu. 2008. An Updated Look at the Recovery of Agricultural Productivity in Sub-Saharan Africa. IFPRI Discussion Paper 787. Washington, DC: International Food Policy Research Institute.

Obinyeluaku, M., and N. Viegi. 2008. Fiscal Policy Rules for Managing Oil Revenues in Nigeria. Paper presented at the 13th African Econometric Society Annual Conference on Econometric Modeling in Africa, University of Pretoria, Pretoria, South Africa, 9-11 July 2008. www.africametrics.org/ documents/conference08/day1season2/obinyeluaku_viegi.pdf. Accessed July 2009.

Regional Strategic Analysis and Knowledge Support System (ReSAKSS). Agriculture expenditure as share of total expenditure. ReSAKSS database. http://www.resakss.org. Accessed July 2009.

Revenue Watch Institute. (n.d.) Transparency Snapshot. http://www.revenuewatch.org/our-work/countries/nigeria-transparency.php. Accessed July 2009.

Uche, C.U., and O.C. Uche. 2004. Oil and the Politics of Revenue Allocation in Nigeria. ASC Working paper 54/2004. Leiden, Netherlands: African Studies Center and Enugu, Nigeria: Department of Banking and Finance University of Nigeria.

United States Agency International Development. 2008. Nigeria Economic Performance Assessment. Washington, DC: Nathan Associates Inc.

Appendix: Estimated elasticity of agricultural TFP with respect to agricultural and non-agricultural spending

We use time-series data on agricultural TFP from Nin Pratt and Yu (2008) as the dependent variable, and agricultural and non-agricultural spending data as the independent variables to estimate the elasticities. Assuming TFP function to be of the Cobb-Douglas type, we perform Ordinary Least Squares (OLS) regression using:

ln (TFP) = β_0 + β_1* ln ($E_{ag\ exp}$) + β_2*ln ($E_{nag\ exp}$) + ε

where β_1 and β_2 are the "agricultural growth-agricultural expenditure elasticity" and "agricultural growth-non-agricultural expenditure elasticity", respectively. ε is the error or disturbance term.

For comparison, we used two sets of spending data: (1) data from Fan et al. (2008) and (2) combination of data from CBN Statistical Bulletin (2009), CBN Annual Report and Statement of Accounts (2007, 2008), and IMF Statistical Index (various years) (Table A.1). We also control for the three sub-periods pre-SAP, SAP, and post-SAP in the estimation by assigning dummy variables (i.e. sub-period =1 if 1984 <= year <=1994; 0 otherwise). In total, we estimate 28 equations (i.e. using data from the both sources to estimate 14 equations corresponding to dummy variables).

The estimated coefficients are shown in Table A.1. Acknowledging the lack of consistent and good quality agricultural spending data for Nigeria, the estimated elasticity under 'data from Fan et al. (2008)' for β_1 (with value of 0.236) seems to be reasonable. However, as explained above in Section 4, the value of 0.462 for β_2 is not consistent with the historical trends of growth in agricultural and nonagricultural spending. A value of 0.14 for β_2 was instead used in the analysis and the calibration method to obtain the value of 0.14 has been discussed in Section 4.

Table 5: Estimated elasticity of agricultural TFP with respect to agricultural and non-agricultural spending, 1980-2007

Dummy variable	Data from combined sources				Data from Fan et al. (2008)			
	β_1	P>|t|	β_2	P>|t|	β_1	P>|t|	β_2	P>|t|
(1) No dummy variable	0.033	0.673	0.546	0.008	0.045	0.530	0.520	0.011**
(2) = 1 if 1984 <= year <=1994; 0 otherwise	0.480	0.625	0.490	0.045	0.168	0.043**	0.214	0.357
(3) = 1 if year >= 1995; 0 otherwise	-0.127	0.029**	0.196	0.169	-0.120	0.117	0.156	0.374
(4) = 1 if 1984 <= year <= 1994 & year >=1995; 0 otherwise	-0.031	0.685	0.057	0.758	-0.069	0.852	0.013	0.972
(5) = 1 if year <= 1984; 0 otherwise	0.067	0.363	0.465	0.026**	-0.036	0.561	0.592	0.006***
(6) = 1 if 1984 <= year <= 1995; 0 otherwise	0.092	0.373	0.564	0.025**	0.193	0.021**	0.295	0.206
(7) = year <= 1984 & 1984 <= year <= 1995; 0 otherwise	0.084	0.209	0.081	0.620	0.022	0.646	0.238	0.096*
(8) = 1 if 1984 <= year <= 1996; 0 otherwise	0.174	0.109	0.721	0.006***	0.236	0.004***	0.462	0.045**
(9) = 1 if year <= 1984 & 1984 <= year <= 1996; 0 otherwise	0.086	0.267	0.070	0.711	0.034	0.529	0.257	0.109
(10)= 1 if 1986 <= year <= 1994; 0 otherwise	0.043	0.651	0.571	0.011**	0.152	0.067*	0.426	0.037**
(11)= 1 if year >= 1995; 0 otherwise	-0.127	0.029**	0.196	0.169	-0.120	0.117	0.156	0.374
(12)= 1 if 1986 <= year <= 1994 & year >= 1995; 0 otherwise	-0.018	0.749	0.084	0.512	-0.063	0.733	0.003	0.989
(13)= 1 if year >= 1994; 0 otherwise	-0.111	0.023**	0.271	0.030**	-0.083	0.216	0.258	0.107
(14)= 1 if year >= 1996; 0 otherwise	-0.158	0.012**	0.135	0.372	-0.168	0.032**	0.070	0.696

Note: ***, **, * denotes significance at the 1%, 5%, and 10% levels of significance, respectively