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**The Role of Agriculture in Nigeria's Economic Growth:
A General Equilibrium Analysis**

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Abstract

Blessed with abundant land and water resources, Nigeria's agricultural sector has a high potential for growth, but this potential is not being realized. Productivity is low and basically stagnant. Farming systems, which are mostly small in scale, are still predominantly subsistence-based and for the most part depend on the vagaries of the weather. Many agricultural policies have also been ineffective, either because they have been misguided, or because their impacts have been swamped by macro policies affecting inflation, exchange rates, and the cost of capital. Recognizing these challenges, the Federal Government of Nigeria has identified the modernization of the agricultural sector as a major priority. In this paper we have applied the Global Trade Analysis Project (GTAP) framework to estimate the growth potential of agriculture in Nigeria. Our results show that although a 1% percent technological progress in the oil sector gives the largest welfare benefits in dollar terms (\$142.72 million), when we abstract for size several food and agricultural sectors have a value that is higher than that for the oil sector. Some subsectors in the agricultural sectors (e.g. cattle, fruit and vegetables) outperform some of the oil and manufacturing sectors in terms to return to investment. Also our results show technological improvements related to unskilled labor produced the highest returns in agriculture compared to any other sector. In manufacture, the highest returns are obtained from technological improvements related to capital.

This draft is not meant to represent in any way the views of the World Bank or any of its Executive Directors, the U.S. International Trade Commission or any of its individual Commissioners.

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The Role of Agriculture in Nigeria's Economic Growth: A General Equilibrium Analysis

Introduction

Nigeria faces serious poverty challenges. Two out of every three Nigerians live below the poverty line of \$1 per day in income. Poverty in Nigeria is concentrated in rural areas, which are home to more than 70 percent of the nation's poor. Development indicators for rural areas lag behind those for urban areas: incomes are lower, infant mortality rates are higher, life expectancy is shorter, illiteracy is more widespread, malnutrition is more prevalent, and greater proportions of people lack access to clean water and improved sanitation services.

For the foreseeable future, the welfare of rural populations in Nigeria will be tied to agriculture. Agriculture is the backbone of the rural economy, generating about 35 percent of gross domestic product (GDP) and providing by far the largest source of rural employment. Growth in Nigeria's agricultural sector, while better than the growth achieved in many other African countries, has fallen short of expectations. Value added per capita in agriculture has risen by less than 1 percent per year for the past 20 years, and food production gains have not kept pace with population growth, resulting in rising food imports and declining levels of national food self-sufficiency.

Blessed with abundant land and water resources, Nigeria's agricultural sector has a high potential for growth, but this potential is not being realized. Productivity is low and basically stagnant. Farming systems, which are mostly small in scale, are still predominantly subsistence-based and for the most part depend on the vagaries of the weather. The country's vast irrigation potential remains largely unexploited. Most farmers produce mainly food crops using traditional extensive cultivation methods, while commercial agriculture based on modern technologies and purchased inputs remains underdeveloped. The capacity of the agricultural research system has eroded in recent years, as has that of the extension service, so, even when improved technologies are available, often they fail to reach farmers. Farmers' lack of technical knowledge is compounded by deficiencies in input distribution systems, which limit the timely availability of improved seed, fertilizer, crop chemicals, and machinery.

Where inputs are available, farmers' ability to use them is often compromised by a lack of credit, because rural financial institutions are in general poorly developed. Farmers who produce surpluses frequently lack access to reliable markets, and the high cost of transporting produce to distant buying points over bad rural roads reduces their competitiveness. Getting agriculture going in Nigeria will require a coordinated strategy comprising policy reforms, institutional restructuring and well-targeted strategic investments to upgrade degraded rural infrastructure, boost productivity, and stimulate increased competitiveness (World Bank 2005).

Recognizing these challenges, the Federal Government of Nigeria has identified the modernization of the agricultural sector as a major priority. Former President Obasanjo, one of the founding members of the New Economic Partnership for Africa (NEPAD), has repeatedly expressed a commitment to meeting the NEPAD goal of investing at least 10 percent of the national budget in agriculture and related activities. The National Economic Empowerment and Development Strategy (NEEDS) also explicitly recognizes the strategic importance of the agricultural sector and lists a number of special initiatives that the Federal Government intends to pursue in promoting increased food and agricultural production. Current President Yar'Adua also identified food security and agriculture as one of its seven-point agenda. The current government intends to diversify the country's resource base and also to increase the level of export of primary products with some emphasis on adding value to primary products.

While there is interest in modernizing agriculture, there is insufficient knowledge about the growth potential of the agricultural sector in Nigeria. Some still ask if it is appropriate to focus on agriculture and source of growth in Nigeria. In this paper we have applied the most recent version of the GTAP framework to estimate the growth potential of agriculture in Nigeria. Recently the 1999 Nigeria Input-Output statistics was included in the GTAP database.¹

¹ The GTAP framework is fully documented in Chapters 2-5 in T.W. Hertel (ed.), *Global Trade Analysis: Modeling and Applications*, Cambridge, Cambridge University Press, 1997; and in B.V. Dimaranan and R.A. McDougall,

The next section discusses recent findings of the Nigeria Agriculture Public Expenditure Review. An analysis of agricultural public expenditures in Nigeria gives a clear assessment of the low priority the government has given to agriculture over the past several years. Next we discuss the GTAP approach used in this paper. This is followed by the findings and the conclusions.

Public spending on agriculture in Nigeria

The recently completed Public Expenditure Review (World Bank, 2008) for Nigeria reports that agricultural spending averaged only 1.7 percent of total federal spending over the study period (2001-05), lagging behind spending in other key sectors such as education, health, and water. While agricultural spending expressed as a share of total spending is generally low in African countries compared to countries in other developing regions, Nigeria fares unfavorably even within the African context. In 2000, agricultural spending in Nigeria expressed as a share of total public spending was the lowest among all 17 sub-Saharan African countries for which data were available, and in other years it was among the lowest.

Expressed as a proportion of agricultural GDP, agricultural spending in Nigeria has varied considerably since the 1980s, ranging between 1 percent and 10 percent and spiking sharply on two occasions, once in the mid-1980s and then again in 2001. When agricultural spending is normalized by the size of the sector, the level of agricultural spending is again exceptionally low, not only compared to countries in other developing regions, but even within the poorly performing sub-Saharan African countries.

When public spending in agriculture in Nigeria is benchmarked relative to public spending on other sectors, the value of the indicator for agriculture is lower than the values for all the other sectors (i.e., industry, construction, trade, and services). Also careful examination of the pattern of public spending raises questions as to whether the allocation of resources in Nigeria is based on objective empirical criteria. Additional questions about the quality of public spending in agriculture in Nigeria are

raised by the extremely high proportion of funding that supports input subsidies and grain market stabilization. It is certainly fair to ask about the opportunity cost of these investments. At a time when nearly 60 percent of public spending for agriculture was going to pay for input subsidies and output purchases, very little investment was being made in a number of public goods and services that traditionally are viewed as leading candidates for government support, including agricultural research, agricultural extension, and rural infrastructure including transport, energy, and irrigation.

Our approach

We estimate the potential contribution of agriculture to Nigeria's economic growth by running several simulations with a global trade, computable general equilibrium (CGE) model. A global and economy-wide approach is most appropriate for our analysis. If certain agricultural industries in Nigeria gain in productivity, other agricultural sectors would be affected too not only through price changes in intermediate inputs (e.g., cheaper feed grains), but also through price changes in primary factors (e.g., land and labor), which would affect incomes, and consumption of food items. The global markets aspect of our approach is important too. The extent and conditions of international trade would determine the benefits accruing to the Nigerian economy.

In particular we simulate the economic effects of improvements in agricultural production with the GTAP (Global Trade Analysis Project) model (Hertel, 1997). The GTAP model is based on assumptions that are common in the literature: perfect competition, constant returns to scale, and no change in the economy-wide employment of resources. Each regional economy consists of several economic agents: on the final demand side of the model, a utility-maximizing household purchases commodities (for private and government use) and it saves part of its income, which consists of returns to primary factors and net tax collections. On the production side of the model, cost-minimizing producers employ primary factor services and intermediate inputs to supply commodities. Land, labor, and capital are mobile within a region but not internationally. International trade in commodities and services clears world markets under the assumption of product differentiation by country of origin.

This analysis is based on data consisting of 19 regions and 31 sectors/commodities. We have identified Nigeria and twelve other economies in Sub-Saharan Africa to model economic links between these economies. Other economies in our model are North America, the European Union, Japan, Indonesia, Rest of Asia and a Rest-of-the-world. Twelve sectors cover primary agriculture; nine sectors cover processed foods; the rest of natural resource industries, manufactures, and services are covered with 10 sectors.

Findings

We run a series of simulations to assess the impact of selected agricultural productivity improvements on economic growth in Nigeria. In particular, we simulated sector-specific Hicks-neutral technical change (augmenting the productivity of all primary factors equally) as well as factor-biased technological change (e.g. land-specific productivity improvements *vs.* capital-specific productivity improvements).

Table 1 and Figure 1 show the welfare effects in equivalent variation (EV) terms from 1 percent sector-specific Hicks-neutral technological improvements in 4 economies: Nigeria, Uganda, Zimbabwe and Indonesia. Table 1 shows the welfare effects and sector sales. To abstract from the sector-size issue, we divided welfare gains by the value of the sector's output. We have also ranked sectors by the ratio EV/output.

In Nigeria, the oil sector accounts for over a quarter of the economy. Thus, 1 percent technological progress in the oil sector gives large welfare benefits in dollar terms, \$142.72 million. No other sector in Nigeria gives larger welfare gains. The ratio of welfare gains to output, however, is small for the oil sector and the sector ranks 19th (table 1). Wheat and livestock production rank higher than the oil sector in terms of EV/output.

Figure 1 focuses on medium to large sectors in these four economies, i.e., sectors with more than \$100 million in sales. For Nigeria, several food and agricultural sectors have a value that is higher than that for the oil sector: cattle (1.23%), other livestock (1.23%), other grains (1.04%) and fruits, vegetables,

and nuts (1.02%). The effects for Nigeria suggest that comparable investments would yield higher returns in several agricultural sectors than in oil.²

Figure 1 suggests that Nigeria is similar to Indonesia: a few agricultural sectors rank as high as or higher than the gas/oil sectors. In Uganda and Zimbabwe the oil/gas sector is not significant. In Uganda other crops ranks much higher than any other agricultural sector. In Zimbabwe all agricultural sectors obtain similar ranks.

Figure 2 shows the welfare effects from 1 percent factor-biased technological progress in Nigeria.³ There are four primary factors in the model: land, capital, unskilled labor, and skilled labor. In figure 2, however, we focus on land, capital, and unskilled labor because the effects for skilled labor are negligible. Technological improvements related to unskilled labor produced the highest returns in agriculture. In manufacture, the highest returns are obtained from technological improvements related to capital.

Conclusions

Despite being richly endowed with abundant natural resources, Nigeria is among the poorest nations in the world with about 54 percent of its population earning less than 1 dollar per day. Furthermore, social indicators are low. Nigeria is ranked 158 out of 177 countries in the 2007/2008 United Nations Human Development Index. Its history has been marked by economic stagnation with poor welfare indicators and social instability. Although there is evidence for rapid decline in poverty, achieving the MDG on income poverty will require a further acceleration of non-oil growth to about 12-13 percent, hence a significant rise compared to the current rates of growth. Agriculture, which contributes about 35 percent to the GDP, has a critical role to play in alleviating poverty.

Our work shows that agricultural investment can be as profitable as investment in any other sector of the Nigerian economy. We show that (after adjusting for size) some agricultural subsectors (e.g.

² See Ehui and Tsigas for an attempt to prioritize investments in a general equilibrium framework.

³ Welfare effects in figure 2 are measured as a percentage of the sector's output.

cattle, fruit and vegetables) outperform some of the oil and manufacturing sectors in terms of returns to investment. Therefore, the discrimination against agriculture should disappear and significant investment should be channeled to agriculture because it has a very high potential for employing people, providing food security and earning (conserving) foreign exchange.

References

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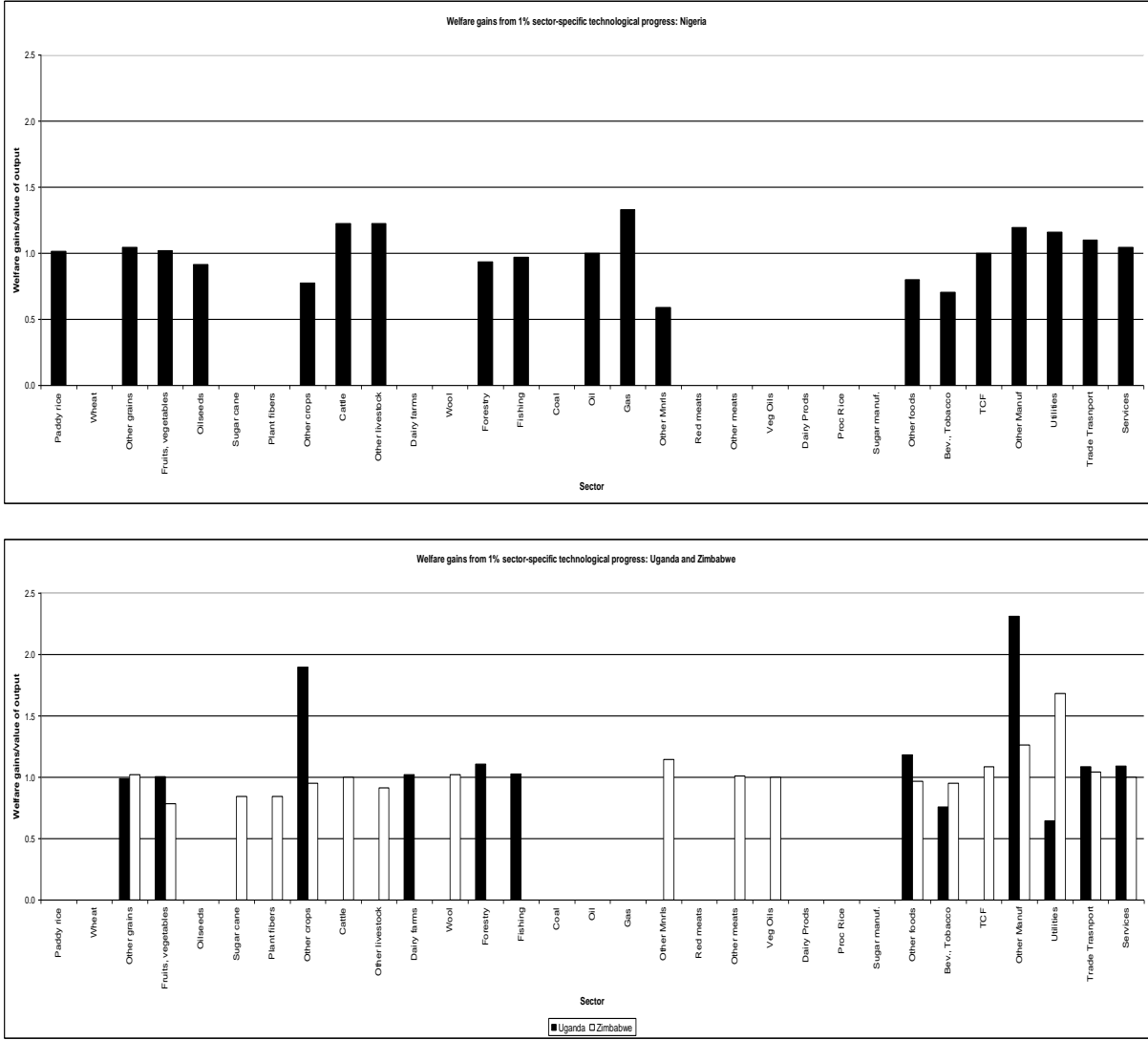
Hertel, T., editor, 1997: *Global Trade Analysis: Modeling and Applications*, Cambridge Univ. Press, January.

Table 1. Welfare gains from 1 percent sector-specific Hicks-neutral technological progress, by sector

Sector	Nigeria				Indonesia				Uganda				Zimbabwe			
	Output	EV	EV/Output	Rank	Output	EV	EV/Output	Rank	Output	EV	EV/Output	Rank	Output	EV	EV/Output	Rank
Paddy rice	335	3.41	1.02	17	5,120	48.47	0.95	12	32	0.40	1.23	13	1	0.02	1.01	13
Wheat	7	0.09	1.23	5	13	0.12	0.96	10	4	0.06	1.42	10	43	0.51	1.18	4
Other grains	919	9.60	1.04	14	824	7.09	0.86	24	322	3.20	0.99	27	189	1.93	1.02	10
Fruits, vegetables, nuts	5,181	52.78	1.02	16	5,210	47.69	0.92	19	1,655	16.65	1.01	26	143	1.12	0.78	28
Oilseeds	151	1.37	0.91	23	1,126	10.07	0.89	21	52	0.59	1.14	17	47	0.42	0.90	25
Sugar crops	7	0.08	1.10	13	843	7.94	0.94	15	86	1.04	1.20	14	117	0.99	0.85	26
Plant fibers	65	0.53	0.81	24	78	0.81	1.03	3	30	0.54	1.81	9	239	2.02	0.84	27
Other crops	201	1.56	0.77	26	4,860	40.93	0.84	25	273	5.18	1.90	8	1,082	10.27	0.95	23
Cattle	293	3.59	1.23	7	603	6.05	1.00	5	86	0.88	1.02	25	379	3.79	1.00	15
Other livestock	833	10.22	1.23	6	2,897	27.39	0.95	14	70	0.74	1.05	21	101	0.92	0.91	24
Dairy farms	53	0.65	1.23	4	174	1.63	0.94	16	235	2.40	1.02	24	9	0.09	0.99	18
Wool	1	0.02	1.28	2	66	0.64	0.98	8	0	0.00	3.30	1	119	1.21	1.02	11
Forestry	183	1.72	0.94	22	3,565	32.91	0.92	18	116	1.28	1.11	18	29	0.27	0.95	21
Fishing	427	4.14	0.97	21	3,040	25.02	0.82	27	128	1.31	1.03	23	19	0.14	0.72	30
Coal	1	0.01	1.22	8	2,995	23.31	0.78	29	10	0.10	1.04	22	56	1.15	2.05	1
Oil	14,263	142.72	1.00	19	8,800	83.25	0.95	13	78	1.50	1.91	7	0	0.00	0.71	31
Gas	1,478	19.62	1.33	1	5,693	62.50	1.10	2	0	0.00	2.21	6	0	0.00	1.03	9
Other minerals	156	0.92	0.59	29	4,786	31.13	0.65	31	19	0.14	0.77	29	481	5.52	1.15	5
Red meats	39	0.43	1.11	11	1,370	13.53	0.99	7	25	0.25	0.97	28	70	0.79	1.13	6
Other meats	48	0.36	0.76	27	2,654	25.67	0.97	9	10	0.23	2.34	3	145	1.47	1.01	12
Vegetable fats and oils	39	0.20	0.51	30	4,537	34.44	0.76	30	1	0.04	2.60	2	153	1.53	1.00	17
Dairy products	9	0.11	1.26	3	418	3.86	0.92	17	15	0.18	1.26	12	9	0.09	0.95	22
Processed rice	20	0.06	0.28	31	6,239	59.33	0.95	11	27	0.35	1.32	11	37	0.37	1.00	16
Sugar manuf.	1	0.01	1.01	18	2,130	18.68	0.88	22	66	0.79	1.18	15	74	0.56	0.75	29
Other foods	328	2.63	0.80	25	10,711	87.31	0.82	28	118	1.40	1.18	16	819	7.91	0.97	19
Beverages and tobacco	156	1.10	0.71	28	5,734	48.21	0.84	26	269	2.03	0.76	30	1,009	9.62	0.95	20
Textiles, clothing and footwear	825	8.23	1.00	20	21,481	185.99	0.87	23	55	1.25	2.28	5	770	8.38	1.09	7
Other manufactures	5,211	62.37	1.20	9	77,082	703.62	0.91	20	344	7.96	2.31	4	2,449	30.94	1.26	3
Utilities	2,359	27.38	1.16	10	25,025	413.36	1.65	1	1,039	6.72	0.65	31	1,133	19.04	1.68	2
Retail and wholesale trade and transportation	8,775	96.60	1.10	12	30,536	308.65	1.01	4	1,391	15.10	1.09	20	2,547	26.61	1.04	8
Other services	10,271	107.23	1.04	15	51,188	509.31	0.99	6	1,628	17.77	1.09	19	4,004	40.11	1.00	14

Notes: Output and equivalent variation (EV) are measured in million US dollars.

Figure 1. Welfare gains from 1 percent sector-specific Hicks-neutral technological progress, by sector



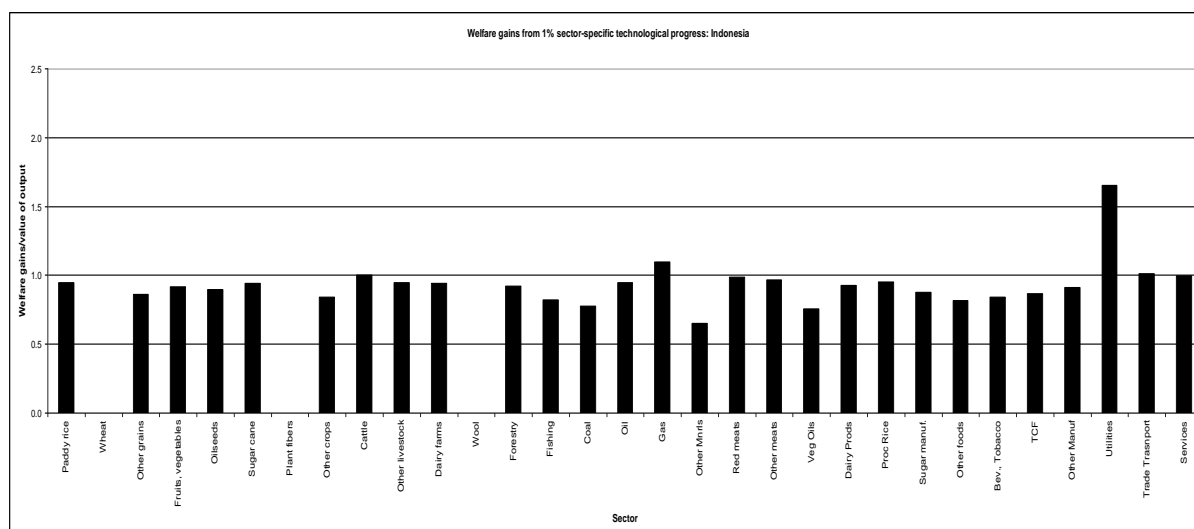


Figure 2. Welfare gains from 1 percent primary factor-biased technological progress, by sector

