NIGERIA
Strategy Support Program II

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
IFPRI
Supported by the CGIAR

WORKING PAPER NO. 24 | July 2013

Structural Change in the Economy of Nigeria

Adedeji Adeyinka, Sheu Salau and Dietrich Vollrath

ABSTRACT

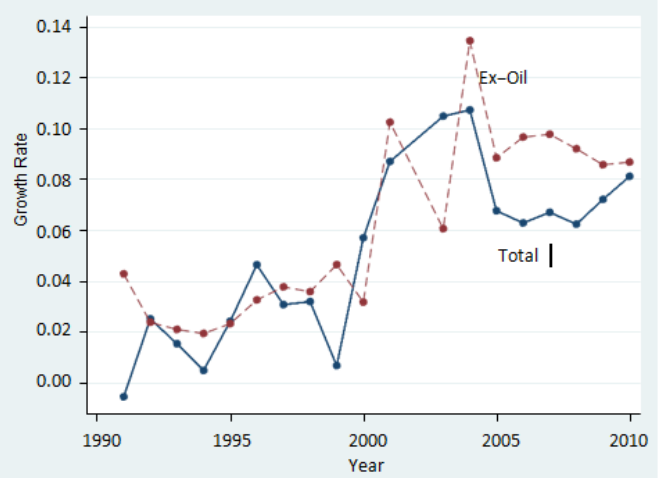
We document that structural change accounts for approximately one-fifth of the total change in labor productivity in Nigeria between 1996 and 2009. Labor moved out of the agricultural and wholesale and retail trade sectors into manufacturing, transportation and communications, business services, and general services. While structural change did occur in this period, significant gains to aggregate labor productivity are still available from further shifts of labor to higher-productivity sectors. We discuss the factors limiting structural change, which include poor agricultural productivity, insufficient infrastructure to support high productivity sectors, and a lack of appropriate skills in the labor force. We calculate that the gains still available to Nigeria from structural change are equivalent to an increase in value-added of 25 percent, given the existing productivity levels of sectors in 2009.

Keywords: Nigeria, Structural change, agricultural productivity, sector composition

1. INTRODUCTION

Aggregate economic growth in Nigeria has been consistently strong ever since the turn of the century. As can be seen in Figure 1, from that time until now aggregate growth averaged around 8 percent per year and is even slightly higher when oil production is excluded from the calculations. This compares to an average growth rate of about 2.25 percent from 1990–2000 (excluding oil). The substantial growth of the Nigerian economy over this period was associated, however, with a relative consistent breakdown of economic activity across major industries.

Figure 1: Growth in Aggregate GDP, 1990–2010



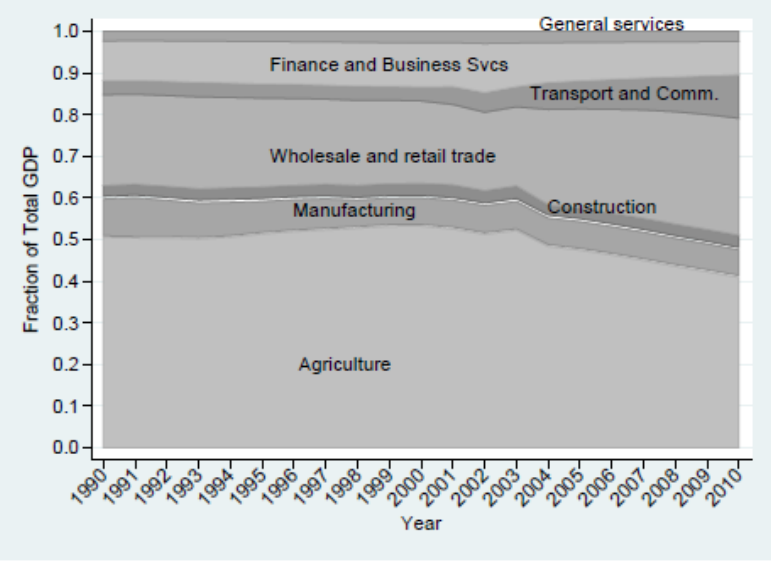
Note: The figure shows the growth rate of aggregate GDP in Nigeria, on a year-by-year basis. 2003 is excluded due to a one-time change in reporting that falsely inflated growth.

Figure 2 shows the composition of GDP from 1990 to 2010. It explicitly excludes the petroleum sector, which would typically account for approximately 20 to 30 percent of GDP.[1] As can be seen in the figure, the remaining dominant sector is agriculture, which accounts for around half of all GDP across this period until the end when it falls closer to 40 percent. Wholesale and retail trade is the next largest, accounting for just over 20 percent of GDP. As will be seen below, the predominance of these two industries will be reflected in the shares of labor that they employ. Manufacturing has maintained a relatively constant share of GDP, roughly 5 percent, while finance and business services have declined from around 10 percent in 1996 to 7 percent in 2009. Some of that loss is made up for by the expansion of transportation and communications from only 4 percent to over 8 percent in the same period.

The extent to which these changes in the composition of GDP are reflected in growth in output per capita depends upon the allocation of labor across sectors. Nigeria over the last fifteen years has exhibited what one might consider the standard pattern of structural change, with labor leaving the agricultural and wholesale and retail trade sectors to join sectors such as manufacturing, communications and transportation, and services. These shifts contributed positively to growth in labor productivity over this period. Specifically, aggregate labor productivity grew by approximately 17 percent from 1996 to 2009 due to the shift of labor to higher productivity sectors. While positive, this is smaller than the growth in labor productivity arising from within-sector improvements, which resulted in aggregate labor productivity growth of approximately 62 percent.

[1] In this figure, and throughout our analysis, we focus on the remaining industries of the Nigerian economy to eliminate distortions caused by a sector with such a large output but small labor force, and to facilitate comparison with other countries.

Figure 2: Composition of GDP in Nigeria, 1990–2010



Note: The figure shows the fractions of GDP coming from seven largest sectors, excluding petroleum. Other excluded sectors are electricity, gas and water, mining and quarry, and undefined activities, due to their negligible size. Breakdown is based on authors' calculations from Nigerian Bureau of Statistics data on the composition of GDP, in constant 1990 prices. Data on crop production and electricity value added are adjusted for discrepancies as described in the text.

While positive for aggregate labor productivity growth, structural change has not proceeded at a pace consistent with the large gaps in labor productivity between sectors. Agriculture, for example, has a labor productivity rate of only 22 percent of that in transport and communications, 46 percent of manufacturing, and 20 percent of that in financial and business services. We discuss several barriers to structural change that exist in Nigeria. These include policies that restrict agricultural productivity, specifically the inadequate supply of fertilizers and the lack of appropriate infrastructure to bring agricultural products to market. In terms of sectors that may absorb labor, again a lack of infrastructure has slowed the expansion of manufacturing and the business services that it demands. Even when there are possibilities for expansion of higher-productivity sectors, education policy has limited the supply of appropriately trained workers. Taken together, the policy environment acts to restrict the possibilities for structural change that would contribute positively to economic growth.

To gain an idea of the scale of the available gains from structural change we employ a simple model and calculate the counter-factual value-added in Nigeria when labor (or human capital) is allowed to flow to its most productive uses unabated. The potential gain to value-added per worker is just over 50 percent, and to value-added per unit of human capital is 25 percent. There is a significant scope for structural change to increase productivity within Nigeria, and the changes that occurred from 1996-2009 did not fully capture the gains available. In the future, removing the barriers that limit agricultural productivity and prevent movement into other sectors would provide a significant boost to aggregate productivity and living standards.

To proceed we discuss the labor force and value-added data that we employ in this study, and then perform the calculations on the role of structural change in overall productivity growth from 1996-2009. Following that, we incorporate information on human capital and hours worked to show that structural change had a robust impact by any measure of labor productivity, and then go on to discuss the barriers that are in place to more broad-based structural change. Finally, we calculate the remaining productivity gains available from structural change.

2. LABOR FORCE DATA

Estimates of the labor share engaged in a sector are based on several General Household Surveys done by the National Bureau of Statistics in Nigeria. Data is available from 1996–1999, and from 2005–2009. Several distinct features of the Nigerian labor force are apparent when looking across all the surveys, as in Table 1.

Table 1: Summary Data from Nigerian GHS, 1996–2009

	1996	1997	1998	1999	2005	2006	2007	2008	2009
Observations	28,168	32,164	34,249	35,567	97,699	83,880	83,700	85,183	107,425
% in Labor Force	33.6	34.0	34.7	36.3	35.1	32.3	32.4	33.4	36.0
Of Labor Force, % with wage work	9.6	9.1	10.7	10.6	10.9	11.1	11.1	13.6	11.4
% women	35.4	33.3	36.4	37.6	40.1	37.0	37.0	41.7	40.9
% with second job	6.3	5.5	7.8	7.6	38.7	12.8	12.7	17.3	17.6
Age 15–25	5,308	6,202	6,542	6,587	20,429	16,549	16,557	16,321	21,207
% in Labor Force	26.2	27.4	28.6	29.2	28.7	24.0	24.0	25.7	29.7
% in School	40.2	39.8	41.7	43.6	49.2	44.3	44.3	43.1	46.3

Notes: Authors calculation using the Nigerian GHS. Definitions of the different percentage breakdowns are described in the text.

To define who is included in the labor force, we use a common question across all the GHS that asks, "What was your main job in the last week?" that has the following possible options:

1. Worked for pay
2. Got job, but did not work
3. Worked for profit
4. On attachment, but did not work
5. Apprenticeship
6. Stayed home
7. Went to school
8. Did nothing

We count anyone under the first five categories as being in the labor force. Haywood and Teal (2010) use a similar definition, but also include those who did nothing but reported themselves as either looking for work or recently laid off. We have excluded those individuals as our interest is ultimately in the sector affiliation of workers, and these job seekers have none listed. In Table 1, one can see that the labor force was approximately one-third of the entire sample over all years.

We can describe several features of the labor force that conform with common findings regarding the Nigerian labor market. First, we identify those individuals involved in wage work as those who answered "Worked for pay" to the question regarding their main job. In addition to these individuals, we count as wage workers those who reported "got job but did not work", "on attachment but did not work", or "apprenticeship" and also reported their employment status on a separate question as "Employee".[2]

As can be seen in table 1, the fraction of the labor force working for wages was extremely low, averaging around 10 percent over all the surveys, and only rising to 13 percent by 2010. The vast majority of workers in Nigeria are engaged in relatively informal arrangements, working either for themselves or within the family. One aspect of structural change that we will address later in this chapter is the movement from informal work into wage work. As will be seen, what little progress that did occur was due exclusively to structural shifts into sectors that have higher percentages of wage workers.

The next aspect of the labor force to note is the fraction of women, which was just over one-third in the 1990's, and then rose slightly to average around 40 percent of the labor force in the 2000's. Haywood and Teal (2010) discuss some of the issues in using the GHS to gauge women's labor force participation, as the questions allow for ambiguity regarding women's activities that take place in the home. They find considerable differences between the GHS and the Nigerian Living Standard Survey, which reports a higher participation rate for women. From our perspective, the one issue raised is that it seems likely that women who are not included in the labor force in our calculations are concentrated in the agricultural sector, which understates the total agricultural labor force.

Turning to the possibility of multiple jobs, we find that the percent of those in the labor force with a secondary job jumps around considerably in the GHS. From fractions around 6-8 percent in the 1990's, there is a distinct outlier in 2005 of 38.7

[2] The other alternatives for this separate question are "Employer", "Own account worker", "Member of cooperative", "Unpaid family worker", and "Other".

percent. After this, there are between 12–18 percent of those in the labor force with a second job, although this drops to under 10 percent in 2010. For several reasons we will not use the secondary job information in our main analysis. First, the obvious fact that the proportions jump around so much would seem to indicate differences in the collection of this data, and second there is not as much information about secondary jobs as about main jobs. To identify secondary jobs, we have taken every individual which contain a meaningful value for their "secondary job status", which indicates whether they were an employee, employer, own account worker, member of a cooperative, or unpaid family worker.

The last section of Table 1 reports specifically on those in the age range 15–25. As can be seen, of this group between 25 and 30 percent are in the labor force. Another 40 to 49 percent report themselves as being in school ("Went to School" was their response for their main job). This leaves between 25 and 30 percent, depending on the year, that are neither in school nor in the labor force. The high degree of youth unemployment, as we will discuss later in the paper, appears to depend partly on a mismatch of skills with the needs of the Nigerian economy. Many of the individuals in this age group have completed secondary and tertiary education, but are not able to obtain employment.

While we have ten different surveys available, there are several irregularities in the data that confine our analysis to a more limited number of years. We will focus specifically on 1996, 1999, 2005, and 2009. This allows us to track changes over the longest possible time period, while still providing some information on intermediate years. The problems are related specifically to the nature of the data on industry of employment. In particular, in 2006 and 2007 there is an aberration in that 17 percent of the labor force is coded as working in coal mining. From the data, it appears that these individuals may have been miscoded service sector workers, but we have no way of identifying the right sector more precisely.

For 2008, the reported industry codes do not correspond directly to the ISIC definitions. In 2010, there is a distinct shift of labor into manufacturing (roughly an additional 6 percent of the labor force) that appears anomalous compared to the movements into manufacturing over the rest of the years. Again, as we have a relatively long time frame by going from 1996 to 2009, dropping the years with suspicious outcomes does not severely limit our ability to measure the role of structural change.

In the years we do focus on, we have information on industry for individuals that report engaging in some economic activity. To stay consistent, these industries are all coded to match the top levels of ISIC revision 2. This gives us nine major sectors, as well as a tenth for "activities not adequately defined". The most important sectors, both in size and in terms of changes over this period, are agriculture, manufacturing, wholesale and retail trade, transportation and communications, finance and business services, and general services.[3] In Table 2 we report the percentage of the labor force in each of these major industries for each of the four years.

Table 2: Share of Labor Force in Major Sectors, 1996–2009, percent

	1996	1999	2005	2009
Agriculture	66.5	62.0	58.4	60.8
Wholesale and Retail Trade	19.4	20.5	17.7	17.4
General Services	9.4	10.4	19.5	10.6
Transport and Communication	2.0	2.4	2.3	2.9
Manufacturing	1.9	3.1	1.1	4.1
Finance and Business Services	0.2	0.5	0.4	2.4

Notes: Authors calculation using the Nigerian GHS. Sectors are defined as in the ISIC Revision 2 classification to facilitate comparison across years. See appendix for specifics on how sectors are assigned in later years.

[3] The other sectors are mining and quarrying, electricity, gas and water, and construction. These three account for very small fractions of the labor force and do not see large changes in those fractions over time.

Table 3: Change in Share of Labor Force in Major Sectors, 1996–2009

	1996-1999	1999-2005	2005-2009	1996-2009
Agriculture	-4.4	-3.6	+2.4	-5.6
Wholesale and Retail Trade	+1.1	-2.8	-0.4	-2.1
General Services	+1.0	+9.1	-9.0	+1.1
Transport and Communication	+0.3	0.0	+0.6	+0.9
Manufacturing	+1.2	-2.0	+3.0	+2.2
Finance and Business Services	+0.3	-0.1	+1.9	+2.2

Notes: Authors calculations using the Nigerian GHS. Changes are percentage point differences between values reported in table 2.

Agriculture is the largest industry in terms of employment over these years. Roughly two-thirds of workers were in agriculture in 1996 and this had fallen to only 60 percent by 2009. The next largest sectors, but still only a fraction of agriculture, are wholesale and retail trade and general services. Trade employed roughly one-fifth of workers in 1996 before falling slightly, to about 17.4 percent by 2009.

General services from 1996 to 2009 averaged about 10 percent of workers. However, there is a distinct spike in this value in 2005 when it rises to 19.5 percent. This represents some of the noise found in the GHS with respect to reported industries. As can be seen this spike in 2005 is quickly eliminated by 2009. This temporary positive deviation in services must be matched by some negative deviation in other sectors. As can be seen, in 2005 agriculture appears to have declined by more than would be expected, given the 2009 value. Additionally, manufacturing falls to only 1.2 percent in 2005, where it had been 3.1 percent in 1999 and 4.1 percent in 2009. The remaining negative deviations appear to be coming from finance and business services and the other unlisted sectors. Overall, this temporary spike in services employment appears to be an anomaly in the data, and while we report results using 2005 as we go forward, we will focus mainly on the longer-term results from 1996 to 2009.

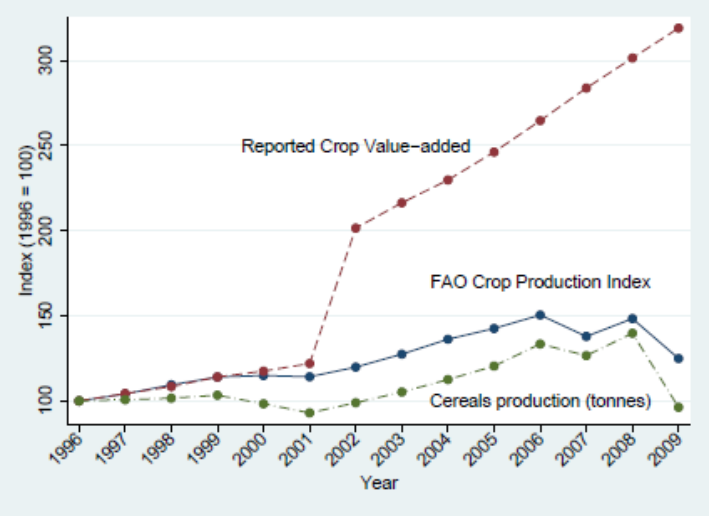
To get some perspective on the re-allocation that was going on over these thirteen years, Table 3 shows the change in the labor shares in each of the major industries across different time periods. The final column shows the change from 1996 to 2009, capturing the broad patterns of sectoral change occurring in Nigeria in this period. Agriculture and wholesale and retail trade were the sectors losing labor share and this translated into larger fractions of labor employed in general services, transportation and communications, manufacturing, and finance and business services. In this sense, the pattern of structural change follows the “typical” pattern one might expect from a developing country.

3. VALUE ADDED BY SECTOR

Data on value added is available from 1990–2010. This data is reported in constant 1990 dollars, calculated using sector-specific deflators applied to sector-specific nominal value added. The specific sectors do not conform directly to the 2-digit ISIC revision 2 categories on which our labor force data is organized. We aggregate the reported sectors from the Nigerian national accounts into the 2-digit ISIC categories ourselves, and the exact mapping can be found in the appendix to this chapter.

There are two anomalies in the reported value added data that require modification. In particular, crop production (a large component of total agricultural value added) experiences an unexplained spike in output in 2002. This will inflate the measure of aggregate labor productivity as well as labor productivity in agriculture. Figure 3 shows a plot of the reported crop production value-added from the national accounts data as well as two measures of real crop production from the FAO. All are scaled to 100 in 1996 to facilitate comparison. The one-time spike in production in the national accounts data can be seen clearly in 2002. Additionally, after 2002 the growth rate of the value-added in crop production is much higher than the apparent growth in real output as evidenced by the other indices.

Figure 3: Measures of Crop Production, 1996–2009

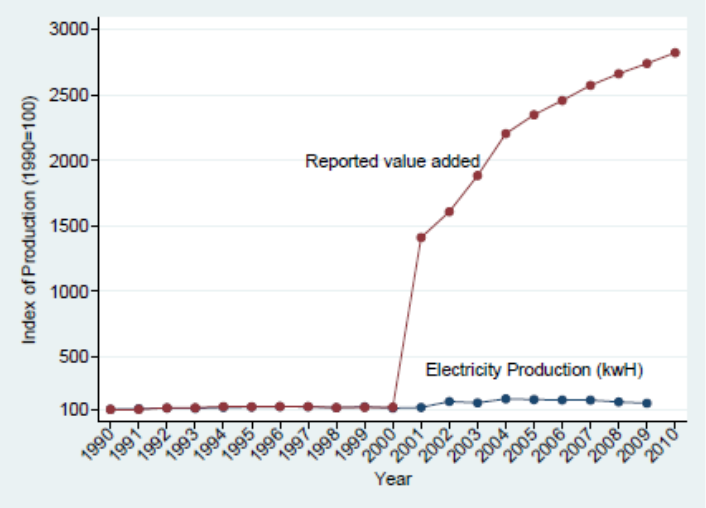


Note: Each series in the figure has been scaled to equal 100 in 1996. "Reported Crop Value-added" is from the Nigerian national accounts, in constant 1990 dollars. "FAO Crop Production Index" and "Cereals production (tonnes)" are both from the FAOSTAT database. The crop production index is a measure created by the FAO to capture production of field crops valued at reference world prices, constant at 2005 international dollars. Cereals production is the tonnes of rice-milled equivalents of major cereal crops produced. Rice-milled equivalents scale crops by nutritional value to be comparable.

We created a new series of value added for crop production based on the FAO data available. In particular, we presume that the growth in value-added of crop production in 2002 is only equal to the average growth rate of value-added in the years 2002–2009 (roughly 6 percent per year). This eliminates the spike in 2002, but retains the generally fast reported growth in value-added in the national accounts data. This means that our alternative measure will still show faster growth in crop production than the FAO, but value-added growth was rapid across all sectors after 2002, and we simply want to remove the anomalous spike in that year.

A similar issue comes up with respect to value added in the electricity sector. Here there is a disjoint in the series in 2001, with value-added rising by roughly 1300 percent in one year. Figure 4 shows how the reported value-added in electricity evolves compared to kilowatt/hours reported in the World Development Indicators. As can be seen, the jump in 2001 is remarkable and there continues to be a distinct upward trend after 2001 that is not matched in the WDI data.

Figure 4: Measures of Electricity Production, 1990–2010



Note: Each series in the figure has been scaled to equal 100 in 1990. "Reported Value-added" is from the Nigerian national accounts, in constant 1990 dollars. "Electricity Production (kwH)" is taken from the World Development Indicators.

We adjust the electricity value added data in a manner similar to the process for crop production. For 2001, we assume that the growth rate of electricity value added is equal to the average growth rate after 2001. This eliminates the one-time spike in value-added in 2001, but retains the pattern of growth in the value-added data subsequently. Given the relatively small size of the electricity sector, this change does not have a material impact on the role of structural change in aggregate growth.

4. THE ROLE OF STRUCTURAL CHANGE

The question now is whether the movement of labor between sectors actually contributed meaningfully to growth in labor productivity. To address this, we decompose the overall percentage change in labor productivity in Nigeria from 1996 to 2009 into a "within" component representing increases in sector-level productivity and a "structural change" component representing the re-allocation of labor between sectors. Algebraically, the decomposition is

$$\Delta P_t \sum_i^N \theta_{i,t-k} \Delta p_{it} + \sum_i^N p_{it} \Delta \theta_{it} \quad (1)$$

where ΔP_t is the change in aggregate labor productivity between period $t-k$ and t. The first term is the "within" component, which is a weighted average of the change in labor productivity in each of the N sectors, with the weight for sector i being the labor share of that sector in period $t-k$, measured by $\theta_{i,t-k}$.

The second term is the "structural change" component, which is a weighted average of the change in labor shares in the N sectors, with the weights captured by the labor productivity of the sector in period t.

Table 4: Structural Components of Productivity Change, 1996–2009

	1996-1999	1999-2005	2005-2009	1996-2009
Panel A: Excluding Oil and Gas % Change labor productivity	2.6	32.6	31.1	78.2
of which: % "within" productivity	-6.0	63.8	11.3	61.5
% "structural change"	8.6	-31.2	19.7	16.7
Panel B: Including Oil and Gas				
% Change labor productivity	-2.4	29.1	15.5	45.7
of which: % "within" productivity	-21.0	41.0	-12.4	10.9
% "structural change"	18.6	-11.9	27.9	34.8

Notes: Authors calculations using equation (1). Data on output by industry is from Nigerian Bureau of Statistics (NBS), and workers engaged in each industry are calculated from Nigerian GHS. See appendix for translation of industries reported by NBS into standard ISIC revision 2 codes. See text for description of labor force data.

Table 4, in panel A, reports the decomposition of the aggregate growth in labor productivity in each of the periods under study. From 1996 to 1999, labor productivity grew by only 2.6 percent over the entire period. Following that, however, from 1999 to 2005 labor productivity grew nearly 64 percent, about 8 percent per year. Between 2005 and 2009, labor productivity grew by 31 percent, roughly 6 percent per year. Over the whole period, labor productivity more than doubled, growing 78 percent, or about 4.5 percent per year.

From 1996 to 1999, structural change was the only thing positively contributing to overall productivity growth. Within-sector productivity actually fell by 6 percent over this time period, but the transfer of labor from low productivity sectors to high productivity sectors was able to turn overall labor productivity positive. Given the shifts shown in table 3, this was mainly through workers leaving agriculture and entering wholesale and retail trade, manufacturing, and to a lesser extent general services and transportation.

In the next two sub-periods, 1999–2005 and 2005–2009, one can see the effect of the spike in services share of employment in 2005. Between 1999 and 2005, the implied contribution of structural change was negative. This reflects the anomalous increase in services, which was a relatively low-productivity throughout the period under study. From 2005–2009, the reversion to the typical level of services employment shows up as a very large contribution of structural change to labor productivity growth. Roughly two-thirds of all labor productivity growth from 2005–2009 is attributed to structural change.

The results of the 1999-2005 and 2005–2009 sub-periods are picking up the odd spike in services employment, and so the decomposition of the full time span from 1996 to 2009 is likely the most informative of all. As mentioned before, there was robust growth in labor productivity over this time span, and this was due primarily to productivity growth within sectors. 16.7 percentage points of the total 78.2 percent increase in labor productivity can be attributed to structural change, roughly 21 percent of the total. On net, labor was moving away from agriculture and wholesale and retail trade, with relatively low productivity, and moving into finance and business services, manufacturing, services, and transport, which as a group had relatively high productivity.

As mentioned in the introduction, our main analysis excludes the oil and gas sector from consideration. For comparison purposes, panel B of Table 4 shows the results if we incorporate this sector into our calculations. Including this keeps several of the patterns in the results intact, but exaggerates the role of structural change. In particular, consider the overall period 1996–2009 in the final column. Including oil and gas, the level of labor productivity in Nigeria is higher, but it grows by only 45 percent, as opposed to 78 percent when oil is excluded. Of this gain, a much larger fraction is due to structural shifts. 34 percentage points of the overall 45 percent growth in labor productivity can be attributed to structural change. This arises because of two things. First, there was a very minute change in the fraction of workers in the mining industry (which includes oil and gas). From 0.03 percent of the workforce in 1996, this industry grows to 0.2 percent of the workforce by 2009. Secondly, labor productivity in the oil and gas sector is so high that this small shift in labor implies an enormous gain in aggregate labor productivity. In 2009, labor productivity in the mining industry was 178 times higher than in agriculture. It is because of these extreme numbers that we have tried to focus on the non-oil portion of the economy. Otherwise, the entire story regarding structural change is driven by a shift of a small number of workers into the oil industry.

Table 5: Sector Productivity Levels and Labor Share Changes, 1996–2009

	Change in Labor Share, %	Relative Labor Productivity, 2009	Change in Labor Productivity, 1996–2009, %
Agriculture	−5.6	1.00	58.6
Wholesale and Retail Trade	−2.1	2.29	164.0
General Services	+1.1	0.34	58.4
Transportation and Communications	+0.9	4.60	236.1
Manufacturing	+2.2	2.17	−30.9
Financial & Business Services	+2.2	4.95	−86.7

Notes: Authors calculations using output data from the Nigerian Bureau of Statistics (NBS) and labor force in each industry from the Nigerian GHS. Labor productivity is reported relative to agriculture for each sector. Changes in labor share are taken from table 3.

The positive impact of structural change in the non-oil economy arises mainly from labor moving into transportation and finance and business services. Table 5 shows the labor productivity, in 2009, of each major sector relative to agriculture, as well as the change in labor share in each sector. As can be seen in the second and third columns, wholesale and retail trade is relatively productive, but lost 2.1 percentage points of the labor force of this period. Labor shifting out of agriculture and trade into general services was actually bad for productivity, as general services had a productivity level only one-third of agriculture's level. Labor moving into manufacturing was positive for productivity so long as the labor was coming from agriculture.

The biggest sources of the positive structural change were the movements of labor into transportation and communications and the finance industries. Each of these sectors has labor productivity over four times larger than agriculture. By adding about 3 percentage points to their share of the labor force, these two sectors added significantly to growth between 1996 and 2009.

It is interesting to examine the distinction between levels of productivity and growth in productivity. Structural change was positive for growth because the levels of productivity in transportation, finance, and manufacturing were generally higher than agriculture and trade. However, growth in productivity in those sectors was not necessarily positive. As can be seen in table 5, productivity growth in manufacturing and finance and business services was actually negative in the 1996 to 2009 period. This would be consistent with declining marginal returns to labor in those sectors. Contrast this to the transportation and communications industry, which not only had higher productivity levels, but in which productivity growth was higher than in any other major sector. The combination of high productivity growth and an inflow of labor provides prima facie evidence of either technological improvements or significant capital accumulation in transportation and communications.

In the declining sectors, agriculture and trade, the level of productivity was relatively low, but grew over this period. These sectors thus contributed in two ways to overall labor productivity growth. First, by passing labor off to more productive uses, and second through their own labor productivity growth. Given its dominant share of the labor force, even in 2009, much of the overall gain in labor productivity in Nigeria in this time period is driven by the 58 percent increase in productivity in agriculture.

5. SPECIFIC SECTORS INVOLVED IN STRUCTURAL CHANGE

Data on the sub-sectors involved in structural change is fragile, given that we are using the General Household Survey, and the absolute numbers of people reporting activity in any given sub-sector can be quite small. With that caveat in mind, we can offer some insight into the sub-sectors that were gaining labor over the period of study.

In 1996, nearly two-thirds of the manufacturing employees in Nigeria were reported to be in the textile, apparel, and leather goods sub-sector. Wood and wood products employed about one-fifth of manufacturing workers, and the other sectors all had shares less than four percent. By 2009, the distribution of manufacturing work had shifted substantially. The textile, apparel and leather goods sub-sector employed less than 30 percent of manufacturing labor, while the wood and wood products sub-sector had fallen to only 12 percent. The main beneficiary of this was the manufacture of food, beverages, and tobacco, which employed 36 percent of manufacturing labor, as opposed to only four percent in 1996.

There were roughly three times as many manufacturing workers in 2009 as in 1996. Thus, the textile sub-sector and wood product sub-sectors have grown in absolute size over this period despite their declining shares of manufacturing labor. However, the food and beverage sub-sector grew by a factor of nearly twenty- seven in absolute terms, absorbing the majority of the additional manufacturing labor in this period.

The finance and business services industry grew by roughly the same number of workers as manufacturing between 1996 and 2009. With the ISIC version 2 classification, there is not much detail on sub-sectors. From that limited basis, though, we can see some tendency for the Nigerian economy to be shifting labor into real estate and business services as opposed to finance and insurance. In 1996, roughly 60 percent of the labor engaged in this industry was in finance and insurance, but this had fallen to only about 11 percent by 2009. The increase of labor engaged in this industry took place almost exclusively through an increase in real estate and business services.

By using the more detailed ISIC version 4 classifications available in 2009, we can see that much of the labor engaged in this industry is in the business services category. The largest sub-sector in 2009, with 36 percent of the labor in the industry, was office administrative and support. The next largest sub-sector was security and investigative activities, with 20 percent. Nearly all of the growth in the industry appears to have come from the expansion of these two activities, as actual real estate services only accounted for about 4.2 percent of industry labor in 2009.

For the transportation and communications industry, employment is dominated by transportation activities. In 2009, 84 percent of the industry worked in the transportation sub-sector, while in 1996 the comparable number was 94 percent. So while being the largest part of the industry, transportation actually lost share to the general communications sub-sector during this period. If we again examine the detailed 2009 data, we can see which areas were likely to have been growing in this period. The three largest non-transportation sub-sectors in 2009 were information services, telecommunications, and computer programming. Together these three accounted for about 14.5 percent of the entire industry employment. It is interesting to note that the prior section found that the structural shift of labor into the transport and communications industry was very positive for productivity growth. Not only was low productivity labor switching into this high productivity industry, but productivity growth within the industry averaged about 9 percent per year. The relatively high-tech sub-sectors of information services, telecommunications and computer programming were a significant contributor to overall labor productivity growth in Nigeria.

The final major industry that added to its labor share between 1996 and 2009 was general services. Unlike the others, this industry has a relatively small labor productivity level, and so the shift of labor into this industry was actually a net drag on aggregate labor productivity. Within this industry, there were several significant shifts in the allocation of labor across sub-sectors. In 1996, about 53 percent of the labor in this industry worked in public administration, another 26 percent in social and community services (e.g. education and health), and a final 20 percent in personal and household service. By 2009 the share engaged in public administration had fallen to only 22 percent, with the drop in this sub-sector picked up by social and community services (rising to 44 percent) and personal and household services (rising to 33 percent).

We can again use the 2009 data to examine in more detail the breakdown of these sub-sectors. 31 percent of the total industry labor is engaged in education, with another 9 percent working in human health activities. The shift into education was significant enough to make that sub-sector the third largest in Nigeria in terms of its share of the labor force in 2009, trailing only agriculture and retail trade.

For personal and household services, the vast majority is made up of what is listed as "other personal services", which likely is a catch-all for domestic service and similar work. This may reflect part of the reason that the general services industry had such low levels of measured labor productivity. It seems plausible that the value added from this kind of service employment is likely to be under-counted in national statistics. Hence, some of the very low measured labor productivity in services may simply reflect a failure of our statistics to account for the output of these individuals.

Regardless, given the measurements we do have, the shift of labor into the services industry was due almost exclusively to the addition of labor in education and "other" personal services. There was measured growth of about 3.3 percent per year in labor productivity in this industry overall, but in terms of structural change the shift into these activities was negative for aggregate productivity growth.

Taking in the results of the first section, what we see in Nigeria from 1996 to 2009 is a broad shift of labor out of agriculture and trade into a few particular sub-sectors: the manufacture of food products, office administration and support, security and investigation, high technology (telecommunications, computer programming, and information services), education, and other personal services. In relationship to the distribution of labor in 1996, this appears to be a general broadening of the types of economic activities engaged in by Nigerians as they move out of the agricultural and trade activities that dominate employment.

Table 6: Sub-sector Labor Shares, 2009

Sub-sector	Percent of Labor Force
Crop and animal production	59.4
Retail trade ex. motor vehicles	13.4
Education	3.3
Other personal services	3.2
Public administration and defense	2.3
Land transport and transport via pipeline	2.3
Food and beverage service activities	1.5
Wholesale, retail, and repair of motor vehicles	1.5
Manufacture of food products	1.4
Construction of buildings	1.0
Human health activities	0.9
Fishing and aquaculture	0.9
Manufacture of wearing apparel	0.9
Office administration, support	0.8
Wholesale trade, ex. motor vehicles	0.8
Security and investigation	0.5
Manufacture of furniture	0.4

Notes: Authors calculations from the Nigerian GHS, 2009. The sub-sectors are ISIC revision 4 categories, as reported in the GHS.

The continued dominance of those two industries can be seen in Table 6, which lists the largest sub-sectors by labor share in 2009. As can be seen, agriculture accounts for close to 60 percent of all labor employed, with retail trade coming in a distant second at 13 percent. Together they account for almost two-thirds of employment. As they are relatively low productivity sub-sectors, the movement of labor to other activities has been a net positive for Nigerian productivity, but as was seen in the prior section a much larger fraction of the gains in this period were due to within-sector productivity growth.

6. ALTERNATIVE MEASURES OF LABOR EFFORT

Labor productivity measures output per worker, excluding consideration of the human capital and time spent working by those workers. From a welfare perspective, measuring productivity per worker or person is the standard we want to use.

However, in understanding the process of structural change and the contribution to productivity growth it is useful to consider more refined measures.

Table 7: Highest Education Level Attained and Hours Worked by Industry, 2009

	Below Primary	Primary	Secondary	Post-secondary	Hours Worked
Agriculture	2.9	64.1	28.0	5.1	40.8
Wholesale and Retail Trade	1.1	50.8	40.4	7.7	43.7
General Services	0.4	20.7	28.5	50.5	41.2
Transport and Communication	0.6	45.6	45.6	8.3	48.5
Manufacturing	0.9	53.9	36.3	8.9	41.5
Finance and Business Services	0.1	17.9	33.7	48.3	44.5

Notes: Authors calculations from Nigerian GHS, 2009. The industry definitions are translated from the reported ISIC revision 4 data in the 2009 GHS to ISIC revision 2 to be consistent with the data across all years. See appendix for details on the translation.

To this end, we perform a similar decomposition to the previous section using different metrics of productivity. The first is output per unit of human capital. There are distinct differences across industries in the human capital levels of workers. As can be seen in Table 7, in agriculture most workers have completed only a primary education, and just about one-third have completed secondary or post-secondary schooling. In the trade, transport, and manufacturing industries, roughly half of workers have primary educations only, with the remainder possessing secondary or post-secondary. It is only in the general services and finance and business services industries that a significant majority of workers have completed at least secondary schooling. In services, roughly half have completed post-secondary education, which includes not only typical bachelor's degrees, but vocational degrees (e.g. nursing certificates, the Higher National Diploma, or National Diploma).

What these differences imply is that while output per worker may be much higher in finance and business services, for example, than in agriculture, output per unit of human capital may not be. To address the role of the reallocation of human capital across sectors, we generate for each individual in our dataset an imputed level of human capital based on the standard Mincerian technique. Specifically, we assume that there is a 10 percent return to each year of schooling, and assign years of schooling to individuals based on their highest level of schooling reported.[4] With that return, each individual is assigned human capital equal to exp(.1 × years). Using an alternative return rate does not produce results that are qualitatively different.

With human capital measured for each individual, we can calculate the share of total human capital engaged in each sector. This results is several distinct differences with the per worker measures. For example, while 61 percent of workers in 2009 worked in agriculture, only 40 percent of human capital is employed in that sector in the same year. On the other hand, while only 11 percent of workers are employed in the general services sector, nearly 23 percent of total human capital is employed there. The gap in human capital productivity between sectors is therefore smaller than the gap in labor productivity between sectors.

We can decompose the change in human capital productivity between 1996 and 2009 into "within" and "structural change" components, as before. Here structural change refers to the shift of units of human capital across industries, as opposed to the shift of physical bodies. That is, one highly educated worker moving from agriculture to finance implies a large structural shift of human capital, even though it may represent a small shift in numbers of workers.

[4] Practically, each person with below primary education is given zero years, those with primary education 6 years, those with secondary 12 years, and those with post-secondary 16 years. While some surveys report specifically the years of education completed, the surveys are not consistent across years in how this is reported. Alternative means of allocating years of schooling do not produce meaningfully different results.

Table 8: Components of Productivity Change Using Different Definitions, 1996-2009

	1996-99	1999-2005	2005-09	1996-2009
Panel A: Productivity per unit of human capital				
% Change productivity	−5.7	7.6	33.1	35.1
of which:				
% "within" productivity	−5.8	26.1	13.7	27.3
% "structural change"	0.1	−18.5	19.4	7.8
Panel B: Productivity per hour				
% Change productivity	19.3	22.9	32.9	94.9
of which:				
% "within" productivity	15.4	46.9	16.7	77.8
% "structural change"	4.0	−24.1	16.2	17.1
Panel C: Productivity per hour of human capital				
% Change productivity	2.5	7.3	36	49.5
of which:				
% "within" productivity	6.5	22.6	19.5	42.1
% "structural change"	−4.0	−15.3	16.5	7.5

Notes: The panels show the decomposition of productivity growth in the noted periods, calculated according to equation (1). The measures of productivity are described in the text more fully.

Table 8, in panel A, shows the decomposition. From 1996 to 1999, human capital productivity actually fell by 5.7 percent, implying that human capital was increasing faster than output. This was all due to falling human capital productivity within sectors, and there was no meaningful shift of human capital across sectors. From 1999 to 2005 and 2005 to 2009, we again have the issue of the anomaly of workers assigned to wholesale and retail trade, which translates to an anomaly in the human capital assigned to that sector. Keeping that in mind, human capital productivity grew in both periods, by 7.6 percent and 33.1 percent, respectively. This was driven exclusively by productivity gains within sectors from 1999 to 2005, and mainly by structural change from 2005 to 2009. However, both of these results are due in part to the anomalous spike in services employment reported in 2005.

Overall, from 1996 to 2009 we can get a clearer picture of the situation. Human capital productivity grew by 35.1 percent in these 13 years, roughly half of what we saw for growth in labor productivity. This implies that human capital per worker roughly doubled in the same period, accounting for a large portion of the labor productivity increase. Of this, the share attributable the structural shift of human capital between industries was about 7.8 percentage points. Proportionally, this is a similar, if slightly higher, share to that seen for labor productivity. Roughly 22 percent of the overall human capital productivity growth was due to shifts of human capital to higher productivity industries, with the remainder due to productivity gains within the industries themselves.

Similar to what we have done with human capital, we can examine productivity per hour of work. Table 7 shows in the final column the average hourly work hours in each industry. An important caveat to these numbers are that they are hours worked while working, and do not capture differences across industries in the number of weeks employed during the year. Agriculture, for instance, has slack periods when workers may not be working as heavily, and so, on a yearly basis, hours may be lower in that sector. We will proceed with these weekly numbers, but keeping in mind that we are likely going to understate the hourly productivity differences across sectors. As can be seen from Table 7, there does not appear to be much variation in hours worked in a week. Transport and communication workers appear to put in about 8 hours more than agriculture or other sectors. This will make workers in that sector appear to have lower hourly productivity.

We can do the structural decomposition again, this time using hourly productivity as our measure. Panel B of Table 8 shows the results of this analysis. If one compares this to the original analysis in table 4, it will be seen that they are very similar. In other words, variation in hours across industries is not very significant and there has not been a significant change in the average hours worked in the whole economy in this period. There is an overall gain in hourly productivity of 95 percent from 1996 to 2009, and of this, 17 percentage points are due to structural shifts from low hourly productivity industries to high productivity industries.

Finally, we can adjust for both hours and human capital, and measure hourly human capital productivity changes. Looking at this combination of effects in panel C of table 8, the overall story remains similar. From 1996 to 2009 structural shifts

into industries with relatively high productivity per human capital hour accounted for about 7.5 percentage points of the overall 49.5 percent increase in productivity.

The structural change in Nigeria over this period was broad based in the sense that individual workers, hours worked, and human capital all shifted similarly out of agriculture and the trade sectors into the rest of the economy. As a fraction of the total change in productivity over this period - regardless of the measure - structural change accounted for about 15 to 20 percent. It was positive for productivity growth, but not the primary source.

7. CHANGES IN TYPE OF EMPLOYMENT

In addition to the changes in productivity associated with shifts between industry, employment terms changed as well. Using the GHS surveys, we can distinguish between those that were engaged in paid work and those that worked for their own account. Perhaps not surprisingly in a nation with a large fraction of labor engaged in agriculture, working on their own account was the dominant form of employment for most Nigerians.

In 1996, only about 9.5 percent of workers did paid work, the remainder working for their own account or engaged in other arrangements (e.g. apprenticeships or part of a co-op). By 2009, this had risen slightly 11.25 percent. Across industries, there are some distinct differences in the type of employment, as can be seen in table 9. In 1996, one can see that both agriculture and wholesale and retail trade have very small proportions of workers in paid work. Compared to those two industries, services, transportation, and finance and business services all have much higher rates of employing paid workers, while manufacturing actually has a relatively small portion of workers in that official capacity.

By 2009, the general pattern is similar, with there being a tendency for paid work to actually shrink, though, in both services and transportation. In manufacturing and finance and business services, however, paid work makes up a larger fraction of their workforce. In both agriculture and the wholesale and retail trade industry, the fraction of workers employed as paid labor remained very low over the whole 13-year period.

We do not have distinct information on the formality of labor ties by workers. That is, paid workers could well be informal in the sense of working for unregistered companies and firms. Workers on their own account may well be formal in the legal sense. Without a distinct way of identifying informal workers, however, we will focus on the distinction between paid work and own account work in examining the change in terms of employment between 1996 and 2009.

Table 9: Percent Employment Type by Industry, 1996 and 2009

Employment Type, 1996:		
	Paid Work	**Own Account or Other**
Agriculture	1.2	98.8
Wholesale and Retail Trade	1.1	98.9
General Services	76.5	23.5
Transport and Communication	44.2	55.8
Manufacturing	8.6	91.4
Finance and Business Services	38.1	61.9
Employment Type, 2009:		
	Paid Work	**Own Account or Other**
Agriculture	1.0	99.0
Wholesale and Retail Trade	2.2	97.8
General Services	62.8	37.2
Transport and Communication	21.5	78.5
Manufacturing	10.7	89.3
Finance and Business Services	80.1	19.9

Notes: Authors calculations using data from the Nigerian GHS.

To decompose the change in terms of employment between 1996 and 2009, we use the following expression

$$\Delta I_t = \sum_i^N \theta_j \, \Delta i_{jt} + \sum_j^N i_{jt} \Delta \theta_{jt} \quad (2)$$

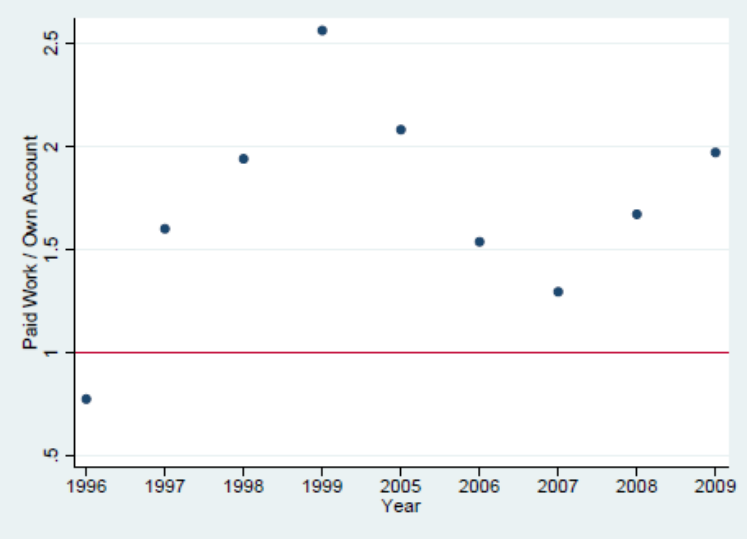
where ΔI_t is the change in the fraction of own account workers from time $t-k$ to time t. $\Delta\theta_{jt}$ again refers to the change in employment share of industry *j* over the same period. θ_j is the average employment share of industry j in the two periods, $\theta_j = 0.5(\theta_{j,t-k} + \theta_{jt})$. The term Δi_{jt} refers to the change in the fraction of own account workers in industry *j* from $t-k$ to t. Similar to the employment share, the term ij is the average fraction of own account workers, *ij* = .5($i_{j,t-k}$ + i_{ij}). Using this breakdown, the first summation term captures the change in own account work within industries, and the second summation captures the change in own account work across industries.

Overall, ΔI_t = −0.025, capturing the decline in own account work from 90.5 percent to 88.75 percent. This comes exclusively from the shift between industries. By itself, the shift between industries would have lowered own account work by 3.5 percentage points. Working counter to this, the proportion of own account work within sectors raised the fraction of own account work by 1.0 percent. This can be seen in Table 9, where own account and other work tended to increase in the largest sector, agriculture, as well as in general services and transportation.

Drilling down into sub-sectors in 2009, the patterns of paid employment are perhaps not terribly surprising. Education, public administration, and office administration and support all have over 93 percent of their workers reporting paid work. Similarly, financial activities, insurance, and other auxiliary financial services work have the proportion of paid work over 88 percent. For “other personal services”, however, the proportion of paid workers is only 14 percent, likely reflecting the informal nature of this sub-sector.

Within the manufacturing sector, the proportion of paid workers appears very low, but it is useful to recall that the main sub-sectors here are the manufacture of food products, the manufacture of wearing apparel, and the manufacture of furniture. In all of these sub-sectors, paid workers make up less than 7 percent of workers. We do not have information on firms, but this would be consistent with a multitude of informal or small family-based businesses producing for local markets.

Figure 5: Relative Income of Paid Work and Own Account Work, 1996–2009



Note: The figure shows the ratio of average income of paid workers to the average income of other types of workers (primarily own account) in each year. The data are from the Nigerian GHS, and reflect total income reported.

The main sub-sectors involving paid workers are those tied to government employment (education, public administration) and finance. In every other sector of the economy, the dominant form of employment for Nigerians is working on their own account. Again, this does not necessarily imply that these are informal workers, but it does indicate a relatively small amount of labor engaged in straightforward labor relationships with employers at firms.

We cannot break down labor productivity by type of employment, as the Nigerian national accounts are not organized in this manner. However, we can get a general idea of the shift towards paid work in raising incomes for Nigerians. The GHS provide data on income for each individual, and, in general, paid workers have higher overall incomes than those reporting own account work or other types of employment. Figure 5 plots the relative income of paid workers to own account workers

for each year of data we have available. Other than 1996, paid workers earn a substantial amount more than those engaged in own account work (which includes all other types as well).

This tendency echoes the work of Malik and Teal (2006) and Eberhardt and Teal (2010), who emphasize the importance of wage work in raising incomes in Nigeria. These authors emphasize that the lack of job growth in large-scale firms (with more than 50 employees) has held back growth in average wages despite relatively high economic growth over the last ten years. Firms of that size and larger, which also tend to employ individuals as formal wage workers, pay wages with a roughly 50 percent premium over smaller firms.

While we do not have firm-level information, the general pattern of paid work earning a premium over own account work is present across almost all of the major sectors of the Nigerian economy. Table 10 gives the ratio of paid work income to own account income for 2009. While in agriculture the premium is only about 15 percent, for manufacturing it is 89 percent and for services 76 percent. Trade and transportation have smaller premiums, while in finance and business services the own account workers actually earn more than their paid worker peers. This may reflect the fact that this category encompasses a number of professional activities (e.g. law) in which own account work is the norm.

Table 10: Paid Work Income as a Proportion of Own-account Income, 2009

Sub-sector	Ratio
Agriculture	1.15
Manufacturing	1.89
Wholesale and Retail Trade	1.26
Transport, Storage, and Communications	1.29
Finance and Business Services	0.77
General Services	1.76

Notes: The table shows the ratio of the average income of individuals reporting "Paid Work" to the average income of those reporting any other type (consisting mainly of those with "Own Account") of work, for each sector. From the Nigerian GHS and author's calculations.

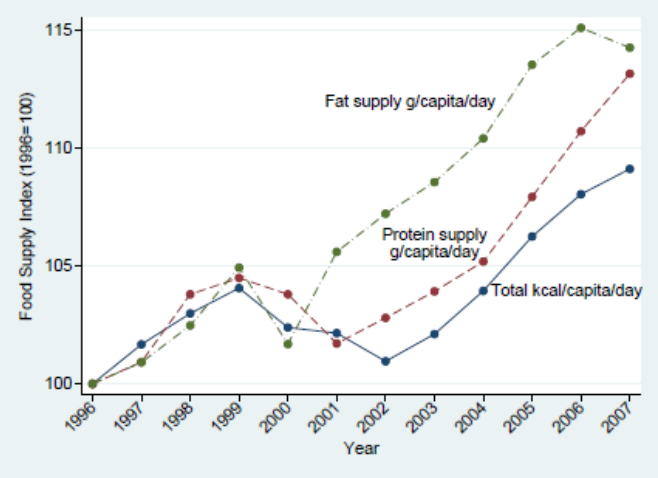
Regardless, for the vast majority of Nigeria, paid work is more lucrative than working on own account. The small shift towards paid work we observe (from 9.5 to 11.25 percent of workers) would have contributed to higher average wages in the period under study, and appears consistent with the movement out of sectors with a large own account populations like agriculture and trade.

8. LEVERS OF STRUCTURAL CHANGE

Agricultural Production

The agricultural sector is the largest non-oil component of the Nigerian economy, and as was seen above it contributed to aggregate growth in part by releasing labor into other sectors with higher labor productivity. In this sense, Nigeria exhibited a pattern of structural change similar to that experienced by many, if not all, developing countries. The source of this is often traced to the "food problem", as described by Schultz (1953) and explored more recently by Gollin, Parente, and Rogerson (2007). With low labor productivity in agriculture, it takes a large proportion of the labor force to provide sufficient food for the population. Only when labor productivity rises in agriculture is labor able to move to other sectors of the economy. We consider the experience of Nigeria from the perspective of this "labor-push" type of structural change, as well as considering "labor-pull" from the rest of the economy on the agricultural sector.

Figure 6: Food Supply Indices, Nigeria, 1996–2007

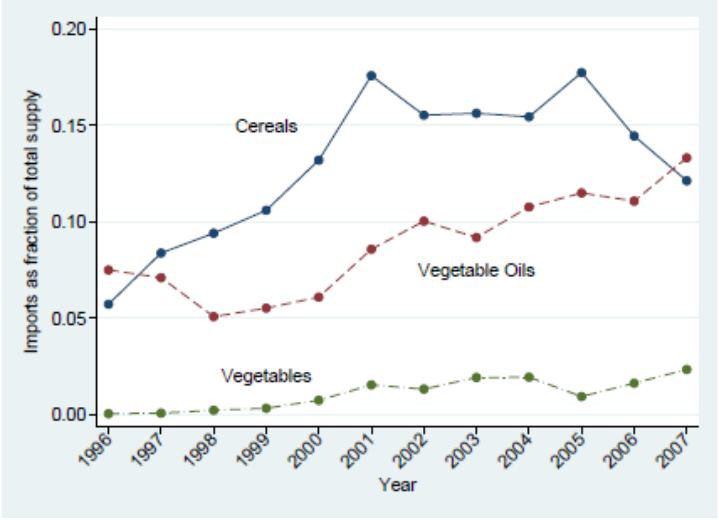


Note: Authors calculations on data from the FAOSTAT database. Food supply is the total amount available for consumption in Nigeria, roughly equal to production plus imports minus exports, with modifications for use as feed and seed in agricultural production. Fat supply and protein supply are both in grams per capita per day.

Figure 6 shows the evolution of the food supply in Nigeria from 1996 to 2007. Over this period, total kilocalories available per capita per day rose by about 10 percent, while the amount of fat and protein available per day each increased by about 13 percent. The food supply is constructed by the FAO to present the amounts available within the country, including imports and subtracting amounts exported, so it will be a more accurate measure of food availability than production numbers. These indices show that in general, the food supply was growing, although we cannot speak to issues related to the distribution of this food across the population.

This increased availability of food appears to be due, in part, to increased imports. Figure 7 plots for three major components of the food supply, the share that was provided from outside of Nigeria. For cereals, one can see that from importing roughly 5 percent of the supply in 1996, the country now imports around 15 percent. The other categories - vegetable oils and vegetables - are imported in smaller proportions but show a tendency for imports to rise in importance of the period 1996–2007.[5]

Figure 7: Imports as Percent of Total Food Supply, Nigeria, 1996–2007



Note: Authors calculations on data from the FAOSTAT database. Food supply is the total amount available for consumption in Nigeria, roughly equal to production plus imports minus exports, with modifications for use as feed and seed in agricultural production. Both the supply and imports are originally measured in metric tonnes.

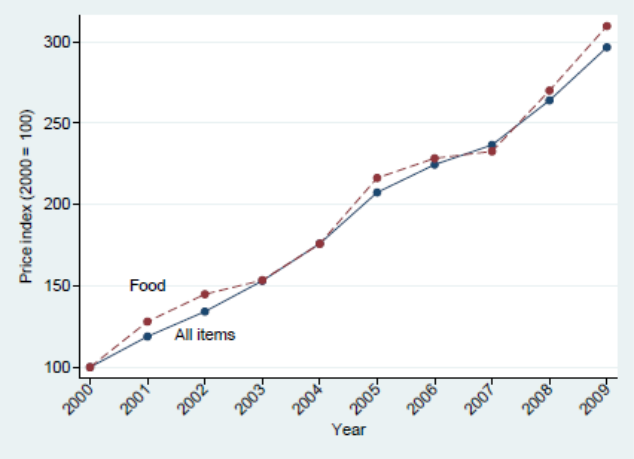
[5] Other components of the food supply do have some imports, but in no case do these rise above one percent of the total supply.

The distinct rise in the share of cereals and vegetable oils imported is capable of explaining much of the increase in food supply per capita seen in Figure 6. This is despite the fact that the absolute amount of domestic agricultural production was rising over this same period. Recall Figure 3, which showed that aggregate crop production rose by about 30 percent between 1996 and 2007. This was not sufficient by itself, and the additional imports were necessary to generate the increase in food supply.

There has been a distinct inflation in food prices over this same period, although this appears to mirror the general trend in prices across the economy. In other words, there did not appear to be a tendency for the relative price of food to rise in the aggregate data. Figure 8 shows price indices from the FAO for both food and all items from 2000 to 2009. Both series essentially triple in this period.

As described by Alvarez-Cuadrado and Poschke (2011), the change in the relative price of agricultural goods contains information on whether labor was being "pushed" out of agriculture by higher productivity in that sector or "pulled" out by higher productivity in the rest of the economy. The indices in figure 8 show no distinct movement in the relative price of food. This indicates no distinct movement in the relative productivity of the agricultural sector over this period as well. We have some evidence from table 5 that labor productivity grew in agriculture, but not at a pace that fundamentally changed its position as a relatively low-productivity sector. The fact that the increased food supply in Nigeria in this period was based mainly on increased imports supports the idea of there being no distinct leap in agricultural productivity.

Figure 8: Price Indices, Nigeria, 2000–2009



Note: Authors calculations from FAOSTAT.

While the drop in the fraction of workers in agriculture contributed positively to aggregate growth, the absence of significant productivity improvements in agriculture was likely responsible for there not being an even larger release of labor to higher productivity sectors. That is, the structural change that took place could have been more dramatic, and may be in the future if agricultural productivity were to increase.

There are a series of constraints on agriculture in Nigeria that prevent it from being a larger contributor to the process of structural change than it is already. One of the most important is the limited use of fertilizer and improved varieties of crops. Nigeria uses approximately 10-15 kilograms per hectare of fertilizer, compared to rates between 100-200 kg/ha in most developed nations. One element of this low fertilizer usage is the lack of any appreciable domestic production. In the early 2000's the national producer (NAFCON) was shuttered, and ever since all the fertilizer used in Nigeria has been imported.[6] Increases in international fertilizer prices have kept imports low, despite the presence of subsidies of 25 percent since 2001 (Phillips et al, 2009).

An additional issue is that the fertilizer that is imported often fails to make it to the smallholders that dominate the agricultural sector. Phillips et al (2009) find that several barriers prevent an efficient distribution to those who might benefit most. Poor transportation links from ports to inland destinations and a lack of any meaningful distribution network leave most farmers in Nigeria unable to access necessary amounts of fertilizer. According to the World Bank (2007), the density of roads in the rural areas is extremely low, with only 0.06 kilometers of road per 10 hectares of cultivable land, compared to rates of 0.18 in Tanzania and 0.19 in India. This leaves 30 million rural inhabitants more than 2 kilometers from the nearest road.

[6] A company named Notore acquired many of the assets of NAFCON in 2009 and is now beginning to produce again for the domestic market.

Studies corroborate that it is actually constraints on the supply of necessary inputs that limit the reach of improved farming techniques, rather than an unwillingness of farmers to try them. In cases where extension services have introduced improved varieties of crops, adoption rates are often above 75 percent, and normally well above 50 percent of treated farmers. However, packages of improvements (which include improved techniques and use of larger quantities of fertilizer) have a much lower adoption rate (see World Bank, 2008, Annex 6 and Taiwo, 2007).

The inability of the domestic market to provide the inputs necessary for adoption of higher productivity techniques is a common theme. From a report by the Federal Agricultural Coordinating Unit (1999), several of the prominent constraints to adoption named by farmers were scarcity of improved seeds, the high cost of fertilizer, high transportation costs to markets, and a scarcity of agricultural credit. The limited infrastructure to deliver needed inputs to agriculture was mirrored in a lack of infrastructure to get agricultural products to market. The road system is poor and transportation costs are between one-third and one-half of the cost of bringing agricultural crops to market (Fade-Aluko, 2007). Additionally, limited storage and processing facilities mean that crops may spoil while waiting, reducing the net value added that is provided. In short, agricultural productivity is held back in part by an inability to actually get agricultural products to markets.

Financing productivity-improving investments is difficult. Very few smallholders can produce the necessary collateral to obtain loans. Phillips and Adetimirin (2001) report that none of the farmers in their sample in Oyo and Ogun states was able to access conventional bank loans to finance projects, relying instead on cooperatives or friends and family. Two thirds cited collateral requirements and high interest rates as the reason for not using bank credit. At a national level, the Central Bank of Nigeria reports the fraction of commercial loans made by sector. In 1993, 16.4 percent of all loans were made to the agricultural sector, while by 2009 that percentage was down to 1.5 percent. Relative to total value added from agriculture, loans were equal to 12 percent in 1993 and only 3 percent by 2009. The availability of credit to the agricultural sector appears to have fallen dramatically over the period under review, restricting the ability to invest.

Three parastatal entities are supposed to deliver credit services to the agricultural sector. The Nigerian Agricultural, Cooperative, and Rural Development Bank (NACRDB) was created in 2000 to provide credit directly as well as loan guarantees. The Agricultural Credit Guarantee Scheme Fund (ACGSF) has existed for over thirty years, and guarantees credit on behalf of farmers. The Agricultural Credit Support Scheme (ACSS), established in 2006, subsidizes commercial bank loans to the agricultural sector. While making credit more available to the agricultural sector, the extent to which these institutions have penetrated the rural market is limited. NACRDB, for instance, had only about 45,000 loan clients in 2005 (World Bank, 2008). The ACGSF had resources of 4.7 billion naira available in 2005, however it has been held back by extremely long delays in processing claims. The World Bank (2008) reports that it had a backlog of 4,064 claims in 2005, some of which were 25 years old. The last entity, the ACSS, has a 50 billion naira fund to work with. It functions primarily by subsidizing loans. Commercial banks review loan applications under their normal standards, and apply their standard interest rate. For borrowers who make timely repayments, ACSS reduces the effective interest rate on those loans, taking on the liability for the difference with the contracted rate. We have no direct information on the nature of the loans subsidized by ACSS. However, even if all 50 billion naira were loaned out in the relatively small amount of 50,000 naira per loan, this would reach only one million of the estimated 30 million farmers in Nigeria.

There have been several major policy initiatives involving agriculture that have been implemented over the last ten years. The Presidential Initiative on Cassava (PIOC) began in 2002 with a goal of increasing the industrial production of starch, chips, and flour. The original program had a goal of raising exports of cassava products by $5 billion by 2007. Most cassava production is done for own consumption, and the infrastructure for processing cassava crops for industrial use was not in place. However, of the 65.6 billion naira budgeted, very little has actually been released for use – only 131 million naira in 2004 and 2005 according to the FAO. A study by the FDA/FMARD (2006) found that the major constraints to the exportation of cassava were a lack of adequate storage facilities, a lack of railway systems for moving large volumes of cassava from inland production areas to processing plants, and a lack of port facilities for agricultural exports. The limited resources released under PIOC have not addressed any of these constraints.

Similar issues plague the Presidential Initiative of Rice (PIOR) and the Presidential Initiative on Vegetable Oil Development (VODEP). Promised funds have not been released, and output and the ability to process that output have not grown appreciably. Phillips et al (2009) document that neither rice nor cassava production has grown any faster than maize, a crop that was not subject to any specific initiative. The National Special Programme on Food Security (FSPFS) is another program aimed at food security and poverty reduction, but there has not been a rigorous attempt to evaluate the outcome of this effort.

Overall, labor productivity in Nigerian agriculture has not increased sufficiently to effect a significant release of labor to other sectors of the economy. While the reported value added data used earlier indicated that labor productivity grew by about 58 percent between 1996 and 2009, this does not match up with the reported indices of crop production from the FAO. Referring back to figure 3, one can see that not only was there a one-time spike in reported output in 2002, but that the reported growth rate of crop value added was much higher in that national accounts than in the FAO data. If we take the FAO numbers seriously, then there was essentially zero growth in labor productivity in agriculture from 1996 to 2009, despite the numerous initiatives and tariff protections afforded the sector (discussed more below).

As seen earlier in this chapter, the shifts of labor out of agriculture are a positive contributor to aggregate labor productivity growth. These shifts occurred in spite of a lack of meaningful gains to agricultural productivity in this period. If better practices such as increased fertilizer use and better infrastructure for bringing crops to market were adopted, the gains to agricultural labor productivity could be very large, and accelerate the structural changes that are now proceeding only very slowly.

Trade Policies

The specific patterns of tariff protection within certain sub-sectors are closely correlated with the pattern of sectoral changes. This shows up most clearly within manufacturing. Overall, manufacturing raised its share of total workers from 1.9 percent to 4.1 percent between 1996 and 2009. Within that sector, tariffs on intermediate and final goods vary depending on the sub-sector considered.

For food and beverages, textiles, wood products, and paper and printing, there is a distinct degree of tariff escalation across stages of production (WTO, 2005). Escalation refers to a pattern of low tariffs on imports involved in the initial stage of production (i.e. raw materials) combined with high tariffs on imports of the final goods. Therefore, for these four sub-sectors, raw materials and necessary inputs can be purchased relatively cheaply, while their output is competitive because of the high end-product tariffs. The difference in tariff rates between the final stage and initial stages are quite large. In 2003, for food and beverages the difference was about 20 percentage points; for textiles the difference was about 25 percentage points; for wood products 30 percentage points; and for paper and printing the gap was 15 percentage points.

The protection accorded these industries shows up in the sectoral allocations. As seen in table 6, the sub-sectors of manufacturing with the largest share of workers were food products (1.38 percent), wearing apparel (0.89 percent), and furniture (0.36 percent). While none of these are particularly large relative to the economy as a whole, they form the dominant proportion of all manufacturing work. Together, these three sub-sectors account for two-thirds of all manufacturing workers in Nigeria.

Textiles are a particularly interesting case, as they not only face a favorable tariff structure, but 70 percent of tariff lines in the textile product group are subject to outright import bans. Despite this degree of protection, as noted earlier the share of labor working in textile manufacturing has been falling over time. The continued existence of these import bans holds despite Nigeria adopting the ECOWAS common external tariff in October 2005, and despite the fact that the NEEDS calls for a reduction in tariff protection. The ostensible goal of the continued import bans and restrictive tariffs - fostering the domestic industry - has failed to materialize. Instead, it appears that these measures have instead diverted resources into smuggling (see Raballand and Mjekiqi, 2010).

Tariff structures for the remaining areas of manufacturing do not have a similar escalation across stages of production. For non-metallic mineral products, tariffs on initial stage products are higher by nearly 10 percentage points compared to final stage tariffs, meaning that producers face high costs for inputs and have limited protection for their output. In the “other” manufacturing sub-sector, this de-escalation shows up as a difference in tariff rates of 30 percentage points. Within the manufacturing industry as a whole, then, tariff patterns appear to be closely correlated with the type of work done. This pattern favors food, textiles, and furniture production relative to the remaining sub-sectors. However, while the protection ensures that these sectors do not face international competition, it has not engendered any sustained expansion of these sectors.

In general, agricultural end-products face very high tariffs. From that late 1990’s until 2002, the average tariff rate on the output of the agricultural industry was 27 percent, rising to 42 percent after that. This compares to an average tariff on the output of the manufacturing industry of 24 percent prior to 2002 and 28 percent afterwards. Within agriculture, fruits and vegetables carry import tariffs of 98 percent, tobacco 90 percent, and non-water beverages 75 percent.

Additionally, there are a number of agricultural products that are simply prohibited from being imported. Wheat flour, sorghum, cassava, and frozen poultry are all banned. This obviously implies that any demand for those products must be

met by domestic production. Similar prohibitions on several processed food items are also in place, helping to explain the significance of manufacturing of food products. Biscuits, noodles, fruit juice in retail packaging, sugar confectioneries, and beer are all prohibited from being imported. In general, the tariff structure contributes to the prevalence of agriculture and food processing within Nigeria. While in October 2008 a large number of products were removed from the banned list, the remaining bans cover many goods of with significant trade possibilities.

Similarly, imports of major construction goods such as cement, steel, and wood are restricted. Cement imports have quantitative restrictions, duties on finished steel are around 50 percent, and timber imports for carpentry are banned. In each case, this leads to shortages and higher prices for construction projects. In the case of timber, builders are forced to use local hardwood, which is more expensive and could otherwise be exported.

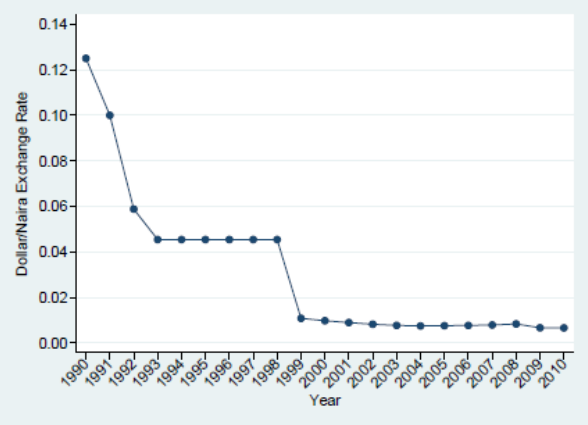
On the export side, several programs were set up to explicitly foster growth in exports. The Export Expansion Grant (EEG) program makes grants of 15 to 30 percent of export value. There are several requirements for participating in this program, including evidence of production of Nigerian products and a history of repatriating export profits. The EEG also allows for a duty drawback on imports used in the production of exported final goods.

A similar Manufacture-in-Bond (MIB) program involves the importation of raw materials duty-free for use in the production of exportable products. The firm posts a bond against the value of the raw materials, which is cleared once there is evidence of the export of the end products. The MIB, as indicated in its name, is available only to manufacturing firms. There is also the Pioneer Tax Program, which provides tax holidays to exporters who export at least half of their total production. A firm has to be named a Pioneer firm by the Nigerian Investment Promotion Commission (NIPC), although that has not always been sufficient to allow firms to get the tax holiday applied from the Inland Revenue Service.

Aside from these direct export-promotion programs, several Free Trade Zones (FTZ) have been established with the purpose of expanding trade with the rest of the world. These were instituted in 1992 in the Nigeria Export Processing Zones (NEPZA) Authority Decree. Seventeen special zones were established, the first in Calabar. Some were targeted to specific industries (oil and gas) but others were meant to be general areas for trade promotion. The FTZ generally have a separate customs procedures, meant to simplify and speed up the clearance process. Mousley (2010) reviews the success of the EEG, MIB, and Pioneer programs, as well as that of the FTZ's. Overall, he finds a very limited impact. One of the problems is the very low uptake of the programs. Only 94 firms accessed the Pioneer program from 2006 to 2010. For the FTZ's, almost all are related to oil and gas, and the exception of Calabar only has 36 firms in operation within it. He finds very few jobs associated with firms that utilize the EEG and MIB programs, which very few firms are able to access due to daunting documentation requirements.

More broadly, policy and practice act to limit trade. Nigeria ranks 144th out of 181 countries in the Doing Business Indicators, 2009. Ten different documents are required for export, compared to six in Ghana or four in Singapore. The cost per container to export from Nigeria is $1,179, as opposed to roughly half that amount for the most efficient operators in the world. Importing a container costs roughly $1,306, between two and three times higher than the most efficient countries, and requires nine separate documents to clear, taking nearly 42 days. In Kenya, the time to clear an import container is only 26 days, in Ghana 29, and in Singapore only 3. Protection of specific industries is irrelevant if the cost of actually exporting goods is prohibitive.

Figure 9: Dollar/Naira Exchange Rate, 1990–2010



Note: Authors calculations from World Development Indicators

From the perspective of the exchange rate, the depreciation of the naira after 1999 would have made exporting more lucrative, and raised the prices of imports. Figure 9 shows the path of the dollar/naira exchange rate over time and the distinct depreciation can be readily seen. As part of the package of financial reforms that have taken place since the return to democracy in 1999, the more transparent foreign exchange management system has led to a much less volatile exchange rate.

Despite the favorable exchange rate regime, the sectors that may be expected to benefit through exports (textiles, for example) have not expanded appreciably. Again, the costs of exporting are so high that the low value of the naira cannot overcome them. On the other hand, the depreciated naira has increased the cost of imports, which has had direct effects on consumer prices of food and vegetable oils, as well as on imports that may be useful in raising productivity. Fertilizer is the main example. As discussed above, one of the primary limits to Nigerian agricultural productivity is the limited use of fertilizer, and as the entire supply of this product must be imported presently, the depreciated naira effectively raises its costs.

The naira has maintained a stable exchange rate with the dollar over the last twelve years, and this has allowed for more stability in the flow of oil revenues. However, the dollar itself has been slowly depreciating over most of this time period versus other major currencies, in particular the euro and pound sterling. As the U.K. and Europe are major trading partners with Nigeria, this means that imports from those countries have been getting more expensive over time, limiting further the ability to import necessary inputs.

In the end, the restrictive tariff policies and import bans have acted to freeze the sectoral structure of Nigeria. The pattern of protection is set up to insulate the existing structure from competition, and so reduces the incentives to improve productivity which would allow for either an expansion of output or a shift of resources away from the protected sectors. Import bans have not provided any incentive for domestic industries to expand, but simply have shifted trade into unofficial channels. The costs of necessary inputs that would contribute to productivity growth (e.g. fertilizer, cement) are made more expensive by an exchange rate policy that favors a stable but devalued naira.

Infrastructure

A commonly cited reason for low productivity in Nigerian industry is the lack of reliable power. Access to, and the reliability of, the electrical system are poor. Nigeria produces around 4,000 MW of power, compared to 39,000 MW in South Africa with only one-third of the population (World Bank, 2007). Firms are forced to rely on self-generation to ensure electricity supplies, which requires substantial resources that could otherwise be used to invest in the firm's productivity or for expansion and the creation of new wage positions.

94 percent of firms in the World Bank RPED survey (2002) reported power as being their number one problem, more than twice the percentage of any other individual constraint on growth. Over 90 percent of the firms in the survey have some facility to generate their own power. Similarly, a survey of firms in Abia and Anambra states (2003) found that 90 percent of firms named infrastructure, in general, as a constraint on their business, and 85 percent named the high cost of utilities.

The World Bank (2007) cites evidence that up to 15 percent of total payrolls at industrial firms in Nigeria goes towards maintenance of self-generation facilities. More broadly, they also note that around one-fifth of the costs of new investment projects are for infrastructure investments (e.g. power, water, and telecoms). There is also evidence that 22 percent of the value of equipment and machinery in business is used for electricity generation. The World Bank RPED survey also finds that 30 percent of finished product is lost due to power outages.

It seems safe to assert that disruptions and limitations due to the sporadic power supply are a significant constraint on Nigerian manufacturing and industry. This leads to a constriction of the non-agricultural sectors, in particular, along both extensive and intensive margins. There are fewer firms entering the manufacturing sector due to the high costs of start-up associated with providing one's own power, and firms are operating below capacity due to the lack of reliable power supplies. The failure to ensure a regular power system is one of the main reasons that the manufacturing industry has not grown faster in Nigeria over this period.

Similarly, infrastructure related to transportation, mentioned above in reference to agriculture, is poor for industry. While there are roads that are relatively well maintained (e.g. Lagos-Kano), overall the state of roads is such that 46 percent are classified as being in poor condition. Over half of the local roads, in particular, which constitute two-thirds of the total kilometers in the system, are in poor condition (World Bank, 2007). The railway system also has major problems that make reliability low and limit its usefulness to industry. Locomotives availability at the Nigerian Railway Corporation (NRC) is only 6 percent, compared to an average of 75 in Africa. Wagons and passenger coaches both have availability of less than 30 percent (World Bank, 2007). This has led nearly all cargo to be transported by road.

One notable contrast to these infrastructure areas is telecommunications. Following liberalization in 1999, this specific sector has grown demonstrably, with four mobile operators and over 20 fixed-line operators. The density of telephone subscriptions reached 16 percent by 2005 from a rate of less than one percent in 2000. We noted before the rapid growth of the telecommunications sub-sector as a part of the overall growth in the transportation and communications industry. It is worth recalling that this industry also showed the most notable growth in labor productivity over the period of study.

The policy differences between telecommunications and the other infrastructure sectors are worth exploring. The government enacted a competitive and transparent legal framework for the industry. There is a regulator (the Nigeria Communications Commission) overseeing the sector that is independent of the national telecommunications company NITEL. Additionally, the Nigerian government is pursuing the sale of a large stake in NITEL.

In other areas of infrastructure, the Infrastructure Concession Regulatory Act of 2005 allows for public- private partnerships in delivering electricity, water, and other basic utilities. The act allows the government to contract with private companies to either build, operate, and transfer new infrastructure projects, or take on the repair, maintenance, and operation of existing facilities. An Infrastructure Concession Regulatory Commission (ICRC) was established to regulate and monitor the contracts. To the extent that these new regulations will generate an expansion in infrastructure services similar to telecommunications they can foster positive structural change, however there is not sufficient information available on projects organized by the ICRC to evaluate the effect at this point.

Human Capital

One of the frictions that hold up structural change in Nigeria appears to be the lack of suitable human capital for formal sector, technical jobs. Billetoft (2010) states that "...there are mismatches between skills being developed by present public policies and those required to support structural change and employment in the labor market."

The first source of this mismatch can be traced to general education. As was seen earlier, even in 2009 a large portion of the workforce consists of individuals with only a primary education. Two-thirds of agricultural workers only complete school to this level, and this likely forms an impassable barrier to their transition to sectors involving high technology and formal employment. In 2009, about 37 percent of all individuals over the age of 20 had only completed primary school or less. 34 percent had actually completed senior secondary school, with another 6 percent completing junior secondary school. In comparison, 8 percent had the equivalent of a baccalaureate degree (which includes the Higher National Diploma), and 2.1 percent a post-baccalaureate degree. Another 10 percent obtains the National Diploma (ND), the Nigerian Certificate in Education (NCE), or nursing degrees. This last group comprises a set of technical or vocational tertiary degrees. Fewer than 1 percent of those over the age 20 had completed a degree at a vocational/technical college that serves as an alternative to senior secondary school.

The lack of graduates from this last group seems particularly relevant to the process of structural change. These programs involve teaching skills such as electrical installation, welding and fabrication, bookkeeping, plumbing, and carpentry. While higher education is generally valuable, the supply of graduates with baccalaureate degrees appears to be out of proportion to the supply of graduates with the skills appropriate to a developing manufacturing and construction sector. In our previous analysis, we generally ignored the construction industry specifically because there were so few workers engaged in this area. This is perhaps not surprising given the supply of workers with these skills is so scant.

A reason for the limited supply of workers that may be likely to move into growing sectors such as manufacturing and construction is that the National Board of Technical Education (NBTE) has not been able to provide sufficient resources to the production of these students. The African Development Fund (2005) found that technical colleges are unable to respond to labor market needs because their capital and methods are outdated. These providers are not capable of servicing a larger body of students to prepare them for jobs in the formal sector.

Two types of new institutions were introduced in 2007 as part of a reform initiative at the Federal Ministry of Education. The Vocational Enterprise Institutions (VEI) and Innovation Enterprise Institutions (IEI) are privately run organizations that serve secondary school leavers (VEI) and those with some post-secondary education (IEI). They were designed to equip the students with the technical skills demanded by industry in Nigeria, allowing them to take on formal sector jobs that otherwise they would not be qualified for even if they held baccalaureate degrees.

The NBTE reports that in 2008 there were a total of 138 program areas being offered in 2 VEIs and 22 IEIs. It is too early to evaluate whether these will have a material impact on structural change within Nigeria, as their first graduates will only have entered the job market in 2010. However, as a means of equipping workers in Nigeria with specific technical skills these programs would appear to be moving in the right direction.

Recall from the introduction that the labor force participation rate of young people aged 15-25 in Nigeria is quite low, around 28 percent. The participation rate for those aged 25-35, after most will have completed schooling, was 63 percent in 2009. A significant amount of structural change could result in Nigeria by moving those not in the labor force into positions in the higher productivity sectors: manufacturing, transportation and communications, construction, and business services. However, the human capital of many of these individuals appears to be mismatched with the needs of these sectors, leaving them out of the labor force completely. The programs aimed at imparting usable skills, such as the VEI and IEI, could be effective levers for structural change if they were able to service larger numbers of students.

There are a large number of tertiary institutions, including the polytechnics and monotechnics that ostensibly already provide some of this kind of training. However, these tend to graduate a relatively small number of students in technical fields compared to fields such as mass communication, marketing, and business studies. Altogether, the polytechnics and monotechnics enroll only about one-fifth of the students that the universities do (NTBE). Again, the implication is that there are relatively few students graduating with the skills demanded by industry, and hence they struggle to find employment, leading to a low labor force participation rate and limiting the amount of structural change that is occurring. Billetoft (2010) cites the poor funding and low status of the polytechnics and monotechnics as roadblocks to increasing their enrollment.

The Ministry of Education formulated a Master Plan for Technical and Vocational Development in 2000, offering actions to take of the following decade. The main points of this plan were to be more responsive to the demands of the labor market and produce a workforce capable of handling state-of-the-art technology in various vocations. One of the main tools called for was the establishment of a National Vocational Qualifications Framework (NVQF) that would standardize the certification of programs, allowing the private sector to step in and take on a more active role in providing skills training. However, the NVQF has not been fully realized at this point, and hence there has not been the impetus to vocational training desired.

9. THE GAINS FROM STRUCTURAL CHANGE

A variety of policies has combined to keep structural change in Nigeria from occurring at a faster pace. However, how big of a loss does this represent to aggregate labor productivity? Phrasing the question in a different way: how much of a gain in aggregate value-added is available to Nigeria through continued structural change? If labor (or human capital) were able to flow into the sectors where it was most productive, how much higher would be value-added per worker (or unit of human capital)?

To answer these questions we employ a very simple theoretical setting that describes how value-added per worker is related to the number of workers in a sector. It is quite similar to the setting used by other studies on the role of misallocations between sectors, such as Chanda and Dalgaard (2008), Vollrath (2009), and Cordoba and Ripoll (2009). One difference is that we will be accounting for movements of labor between all nine of the main sectors of the Nigerian economy, while those prior papers only consider two sectors (agriculture and non-agriculture).

To begin, each sector i's value added is described by the following production function

$$VA_i = X_i L_i^{1-\alpha} \tag{3}$$

where X_i is a fixed productivity term specific to sector i. In terms of more traditional Cobb-Douglas production functions, the X_i combines the role of physical capital and total factor productivity. For our purposes, those quantities are held constant, and so combined into a single term.[7]

Li is the labor employed in a sector, and $1-\alpha$ is the elasticity of value-added with respect to labor. This value will be important in that it determines how much labor productivity will fall (rise) as labor is added (subtracted) to a sector. Value-added per worker, our measure of labor productivity, is

$$\frac{VA_i}{L_i} = \frac{X_i}{L_i^{\alpha}} \tag{4}$$

As seen earlier in Table 5, there are large differences in value added per worker across sectors in Nigeria. To assess the potential gains from structural change, we will ask how large aggregate value-added would be if value-added per worker were equalized across all the sectors. This will entail moving labor out of low productivity sectors (e.g. agriculture) and into high productivity sectors (e.g. manufacturing). Labor is moved until the value added per worker in agriculture has risen, and that in manufacturing has fallen, to the same level. At that point, there are no more gains to be exploited.

[7] If we explicitly modeled the role of capital and capital accumulation, then the potential gains would be even larger, as the increased productivity from structural change would induce more investment and a higher capital stock overall.

With n sectors, it can be shown that the allocation of labor that equalizes value-added per worker is equal to

$$\frac{L_i}{L} = \frac{X_i^{1/\alpha}}{\sum_j^n X_j^{1/\alpha}} \tag{5}$$

in sector i. Essentially, the higher is X_i for a given sector, the more labor it should be allocated. Given these allocations, this potential aggregate value added can be expressed as

$$VA^* = \left(\sum_j^n X_j^{1/\alpha}\right)^{\alpha} L^{1-\alpha} \tag{6}$$

where L is the total of all labor available.[8] We are interested in the ratio of potential value-added to actual value-added. This ratio M, which represents the maximum possible gains available from structural change, is written as

$$M = \frac{VA^*}{\sum_j^n VA_j} = \frac{\left(\sum_j^n X_j^{1/\alpha}\right)^{\alpha} L^{1-\alpha}}{\sum_j^n X_j L_j^{1-\alpha}} = \frac{\left(\sum_j^n X_j^{1/\alpha}\right)^{\alpha}}{\sum_j^n X_j \left(\frac{L_j}{L}\right)^{1-\alpha}} \tag{7}$$

To calculate M we require information on X_i as well as on the fraction of labor currently employed in each sector. We can back out X_i from equation (3) for each sector given our data on value-added per worker and labor allocations, as well as an assumption regarding α. For our purposes here we will assume that α = 0.3, matching the typical assumption made in the literature.[9] The data on the labor shares in each sector are available from our existing data.

We find a value of M = 1.54, meaning that value-added per worker in Nigeria could potentially be 54 percent higher if labor was moved until value-added per worker was equalized across sectors. This gain comes primarily from moving workers out of agriculture. The fraction of workers that remain in agriculture in our counter-factual distribution is only 4.24 percent, while the proportion in transportation and communications would be 33 percent and that in finance and business services 34 percent. Unsurprisingly, the allocation that maximizes value-added per worker is heavily skewed towards those sectors with the highest actual value-added per worker in the data.

These are dramatic shifts of labor, due in part to assuming that each individual worker is identical. However, as we noted in section 5 human capital differs quite dramatically across sectors. So while there are large gaps in value-added per worker between sectors, the gaps in value-added per unit of human capital are not as stark.

We can do our analysis of the potential gains from structural change again, this time changing from using the number of workers, L_i, to the units of human capital, Hi. Now we will be asking what is the potential gain in value-added per unit of human capital if we reallocate human capital across sectors efficiently.

In this analysis the ratio we find is M = 1.25, meaning value-added could be 25 percent higher if human capital were rearranged among sectors to equalize the value-added per unit of human capital. In this counter- factual situation, 22 percent of the human capital in Nigeria would remain in agriculture (down from a share of 40 percent currently), while roughly 27 percent would be allocated to transportation and communications (up from 4 percent), 30 percent to wholesale and retail trade (up from 20 percent), and about 6 percent to manufacturing (up from 4 percent). Finance and business services would be allocated only about 10 percent (up from its current 5 percent). The other major donor of human capital is the general services sector, which goes to close to zero percent of human capital from its current allocation of around 23 percent. The very low productivity of human capital in the agricultural and general services sectors result in the large movements out of those occupations.

This scenario paints a somewhat more realistic picture of the possible gains from structural change in Nigeria. There would be a shift of human capital out of agriculture and general services into transport, communications, trade, manufacturing and business services. In that sense, the predicted reallocations of human capital are what one might expect during a process of industrialization and development. The potential gain to value-added from such a shift is substantial, raising it by 25 percent above current levels. From table 8 we know that from 1996-2009 value-added per unit of human capital grew by

[8] We have not explicitly accounted for the change in relative prices that would occur following shifts of labor between sectors. In practice, allowing for such changes does not prove to be significant in such calculations - see Vollrath (2009).

[9] If the value of α were sector-specific, that would complicate the calculations but not change the general idea behind our exercise. As it stands, there is little evidence that labor shares - 1 − α - differ across sectors substantially, see Gollin, Lagakos, and Waugh (2012). Additionally, by using α = 0.3 we match estimates of the own-price elasticity of labor demand found in Hamermesh (1993).

35 percent total. The potential gains from structural change still available to Nigeria are equivalent to nearly three-quarters of this actual change. There suggest that there is great scope for structural change to enhance the productivity of Nigeria in the future. If the barriers discussed previously were to be removed and structural change was able to run its course, there would be a significant gain to productivity.

10. CONCLUSION

Structural change is occurring in Nigeria, with a general tendency for labor to shift from agriculture and trade activities into manufacturing, transportation, and services. This transition fits within a typical “labor-push” model of structural transition, with higher productivity in agriculture and trade allowing labor to move to higher productivity activities. Overall, the shift of labor between 1996 and 2009 was positive for labor productivity growth in Nigeria, contributing about 17 percentage points of the total 78 percent increase in this period. Looking more closely, the main beneficiaries of this shift were the food product, textile, and wood product sub-sectors of manufacturing, as well as education, office services, security services, and tele-communications.

The push out of agriculture has occurred despite the lack of appreciable gains in total agricultural output in this period. There are a number of constraints on productivity in the agricultural sector, including a lack of fertilizer and poor infrastructure. Without those constraints, the transition out of agriculture to higher productivity sectors may well have been higher, and the removal of those constraints could induce a larger structural shift in the future.

In general, the lack of sufficient infrastructure to support high productivity manufacturing activities has likely led to the relatively slow growth of that sector. This includes not only utility provision but also the availability of efficient transport and port facilities that lower the cost of trade. Sectors that have grown quickly, such as telecommunications, have done so in an environment explicitly free of many of the regulatory barriers in other sectors.

An additional issue has been an apparent mismatch of the skill development of the Nigerian workforce and the needs of high productivity sectors. The trade and vocational skills that are demanded by many sectors are not supplied in great amount by the technical education system and this manifests itself in a relatively low labor force participation rate for the younger generations of Nigerian workers.

We estimate that removing those barriers and allowing the economy to efficiently allocate human capital between sectors would raise value-added in Nigeria by about 25 percent. Thus, the barriers we have mentioned are holding back a potentially significant source of growth in productivity in Nigeria.

APPENDIX

TRANSLATION OF ISIC REVISION 4 TO ISIC REVISION 2

Data from later years of the Nigerian GHS (2006 through 2009) uses ISIC revision 4, while the earlier data uses revision 2. To make data comparable, we translated the revision 4 codes into revision 2, following the standard concordance provided by the United Nations Statistical Division. The following shows the two-digit ISIC revision 4 codes that were included under each one-digit ISIC revision 2 category.

1. (Agriculture, Forestry and Farming): 01, 02, 03
2. (Mining and Quarrying): 05, 06, 07, 08, 09
3. (Manufacturing): 10 through 33, inclusive
4. (Electricity, Gas, and Water): 35, 36
5. (Construction): 41, 42, 43
6. (Wholesale and Retail Trade and Restaurants and Hotels): 45, 46, 47, 55, 56
7. (Transport, Storage, and Communications): 49, 50, 51, 52, 53, 58–63 inclusive
8. (Finance, Insurance, Real Estate and Business Services): 64, 65, 66, 68, 69–82 inclusive
9. (Community, Social and Personal Services): 84–96 inclusive, 99
10. (Activities not adequately defined): 97, 98, 99

ASSIGNING NATIONAL ACCOUNTS DATA TO INDUSTRIES

The breakdown of Nigerian GDP into economic activities does not conform directly to the ISIC revision 2 categories of activities. The following lists the one-digit ISIC codes and the economic activities from the national accounts that were aggregated into them.

1. (Agriculture, Forestry and Farming): crop production, livestock, forestry, fishing
2. (Mining and Quarrying): coal mining, metal ores, and other quarrying
3. (Manufacturing): oil refining, cement, and other manufacturing
4. (Electricity, Gas, and Water): water
5. (Construction): construction
6. (Wholesale and Retail Trade and Restaurants and Hotels): whole and retail trade, hotel and restaurants
7. (Transport, Storage, and Communications): road transportation, rail transportation, pipelines, water transportation, air transportation, post office, telecommunications, and broadcasting
8. (Finance, Insurance, Real Estate and Business Services): financial institutions, insurance, real estate, business services
9. (Community, Social and Personal Services): public administration, education, health, private nonprofits, and other services

There were two economic activities listed in the Nigerian national accounts data that are not included in our calculations. The first is oil and gas, which is excluded due to its large size and relatively small local labor force. The second is the electricity sector, which in the national accounts data experiences an unexplained increase in GDP of approximately 1000 percent in 2003.

REFERENCES

African Development Fund. 2005. “Appraisal Report,” Nigeria Skills Training and Vocational Education Project.

Alvarez-Cuadrado, Francisco and Markus Poschke. 2011. “Structural Change out of Agriculture: Labor Push versus Labor Pull,” American Economic Journal: Macroeconomics, 3(July): 127-158.

Billetoft, Jorgen. 2010. “Labor Market Trends and Skills Development,” in Putting Nigeria to Work, ed. Vo¨lker Treichel. Washington D.C.: The World Bank.

Central Bank of Nigeria. 2010. Statistical Bulletin, 2010.

Chanda, Areendam and Carl-Johan Dalgaard. 2008. “Dual Economies and International Total Factor Productivity Differences: Channeling the Impact from Institutions, Trade, and Geography,” Economica, 75:629-661.

Cordoba, Juan-Carlos and Marla Ripoll. 2009. “Agriculture and Aggregation,” Economics Letters, 105(1):110-112.

Eberhardt, Markus and Francis Teal. 2010. “Growth, Employment, and Industry in Nigeria,” in Putting Nigeria to Work, ed. Vo¨lker Treichel. Washington D.C.: The World Bank.

Fade-Aluko, T.O. 2007. “Marketing of Ofada Rice in Abeokuta Metropolis of Ogun State,” Department of Agricultural Economics and Farm Management, University of Agriculture, Abeokuta.

Federal Agricultural Coordinating Unit (FACU). 1999. Evaluation of Crop-Livestock Integration at the Small-scale Level in Nigeria, final report.

Federal Department of Agriculture (FDA) and Federal Ministry of Agriculture and Rural Development (FMARD). 2006. “Progress in Implementation of Presidential Initiative on Rice, Cassava, and Vegetable Oil Development Programme,” www.mistowa.org/files/CASTON/presidentialInitiative-FDA.pdf

Food and Agriculture Organization (FAO). 2012. FAOSTAT Database, http://faostat.fao.org/default.aspx.

Gollin, Douglas, David Lagakos and Michael Waugh. 2012. “The Agricultural Productivity Gap in Developing Countries,” working paper.

Gollin, Douglas, Stephen Parente and Richard Rogerson. 2007. “The Food Problem and the Evolution of International Income Levels,” Journal of Monetary Economics 54(4): 1230-55.

Hamermesh, Daniel. 1993. Labor Demand. Princeton University Press: Princeton, NJ.

Malik, A. and F. Teal. 2006. “Policy Lessons from Nigerian Firm Survey,” in Economic Policy Options for a Prosperous Nigeria, ed. P. Collier, C. Pattillo, and C. C. Soludo. London: Palgrave Macmillan.

Mousley, Peter. 2010. “Building the Enterprise Sector for Employment and Growth: Some Policy Options,” in Putting Nigeria to Work, ed. Vo¨lker Treichel. Washington D.C.: The World Bank.

Phillips, D. and V. O. Adetimirin. 2001. “Enhancing the transfer and Commercialization of Agricultural Technologies in Nigeria,” PRA Survey Report on the South West Zone of Nigeria, prepared for OAU/SAFGRAD-STRC.

Phillips, Dayo, Ephraim Nkonya, John Pender, and Omobowale Ayoola Oni. 2009. Constraints to Increasing Agricultural Productivity in Nigeria: A Review. Nigeria Strategy Support Program, Background Paper NSSP 006. IFPRI.

Raballand, G. and E. Mjekiqi. 2010. “Nigeria’s Trade Policy Facilitates Unofficial Trade but Not Manufacturing,” in Putting Nigeria to Work, ed. Völker Treichel. Washington D.C.: The World Bank.

Schultz, Theodore. 1953. The Economic Organization of Agriculture. New York: McGraw-Hill.

Taiwo, O. I. 2007. “A Literature Review on the Impact of Agricultural Public Investment in Nigeria,” background paper for Nigeria Agriculture Expenditure Review.

Vollrath, Dietrich. 2009. “How Important are Dual Economy Effects for Aggregate Productivity?” Journal of Development Economics, 11(3):187-228.

World Bank, RPED. 2002. An Assessment of the Private Sector in Nigeria.

World Bank. 2007. Nigeria: Competitiveness and Growth Country Economic Memorandum. Report No. 36483-NG.

World Bank. 2008. Nigeria: Agriculture Public Expenditure Review. Report No. 44000-NG [26] World Trade Organization (WTO). 2005. Trade Policy Review, Nigeria. WT/TPR/S/147.

About the Authors

Adedeji Adeyinka is Senior Statistician at the National Bureau of Statistics, **Sheu Salau is** Rural Development Specialist (ETC) at World Bank Nigeria Country Office, and **Dietrich Vollrath** is Associate Professor of Economics at the University of Houston.

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

2033 K Street, NW | Washington, DC 20006-1002 USA | T+1.202.862.5600 | F+1.202.457.4439 | Skype: ifprihomeoffice | ifpri@cgiar.org | www.ifpri.org

IFPRI-ABUJA

c/o International Fertilizer Development Center | No.6 Ogbagi Street | Off Oro-Ago Crescent | Garki II, Abuja | Nigeria

ifpri-nigeria@cgiar.org | http://nssp.ifpri.info/

This Working Paper has been prepared as an output for the Nigeria Strategy Support Program, funded by USAID, and has not been peer reviewed. Any opinions stated herein are those of the author(s) and do not necessarily reflect the policies or opinions of IFPRI.